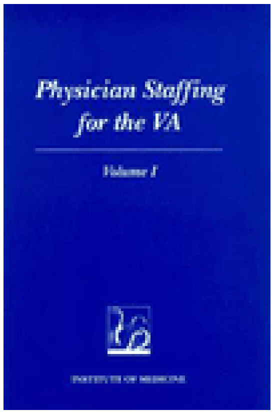

Physician Staffing for the VA: Volume I

Joseph Lipscomb, Editor; Committee to Develop Methods Useful to the Department of Veteran Affairs in Estimating Its Physician Requirements, Institute of Medicine

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Physician Staffing for the VA

Volume I

Committee To Develop Methods Useful To the Department of Veterans Affairs in Estimating Its Physician Requirements
INSTITUTE OF MEDICINE

Joseph Lipscomb, Editor

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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The serpent has been a symbol of long life, healing, and knowledge among almost all cultures and religions since the beginning of recorded history. The image adopted as a logotype by the Institute of Medicine is based on a relief carving from ancient Greece, now held by the staatlichemuseen in Berlin.

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Preface

Unlike most Institute of Medicine (IOM) studies, which deal purely with policy choice, this project's task was to develop a *method* by which the Department of Veterans Affairs (VA) could determine its physician manpower requirements. The implications of this difference are significant. To construct a new state-of-the-art tool for calculating physician staffing requirements, by specialty and at the facility level, calls for an element of *creativity* in the development and use of quantitative analytic methods, data bases, and professional judgment. While these efforts taxed both committee and staff, they responded admirably and have broken new ground.

The VA manages this country's largest and, arguably, one of the world's most important health care systems. It is critical for the VA's future that it have a sound plan for determining the number of physicians required for its three mission-connected responsibilities of patient care, education, and research. We believe we have created a tool for determining physician requirements that will be of great utility to VA decision makers in their policy roles.

The committee's background varied from "quantniks" to bedside physicians of many specialties. It took a significant effort to marshall this expertise to produce an approach that is methodologically innovative, capable of being applied systemwide in a relatively efficient fashion, *and* sufficiently detailed and concrete to be relevant to the realities of the clinical environment. Here also the members of the committee enriched each others' experience and understanding. No one could have asked more of a committee and its panels.

My thanks go to Sam Thief who was supportive over a longer-than-usual IOM project and who understood the uniqueness and complexities of our task. Division director Karl Yordy personally added his considerable experience to our effort, and the committee is grateful. However, to Joe Lipscomb, the staff director, go the committee's and my own personal thanks, admiration, and even awe. His prodigious efforts made this complex project run smoothly. More important, he was a nidus of creativity around which the committee's efforts crystallized. He was vigorously seconded by Bobbie Alexander and the rest of the staff. In all my years of involvement in IOM endeavors, I have never seen such a hard-working group.

Now we pass the baton back to the VA.

DAVID R. CHALLONER, CHAIR

COMMITTEE TO DEVELOP METHODS USEFUL TO THE DEPARTMENT OF VERTERANS AFFAIRS IN ESTIMATING ITS PHYSICIAN REQUIREMENTS

Acknowledgments

This study could not have been accomplished without the assistance of numerous individuals in VA Central Office and VA medical centers around the country.

The committee is especially indebted to the leadership and staff of the VA's Boston Development Center (Braintree, Massachusetts) for their unfailing diligence in providing the data and interpretive expertise that enabled the committee to produce the empirically based physician staffing models. Deserving of special praise are the contributions of Frank Holden, the center's director, and of Stephen Kendall and Michael Doyle.

The committee is grateful to the administrative and clinical officials at the four VA medical centers (labeled in the report as VAMCs I, II, III, and IV) whose locally generated data were crucial to the development of accurate depictions of these facilities in the expert judgment staffing exercises.

Over the course of the study, committee and panel members and staff conducted site visits at 16 different VA medical centers across the country. To the VA professionals who participated in the organization and conduct of these visits, the committee owes special thanks. The committee also expresses its appreciation to the administrative and clinical professionals in the 60 VAMCs that participated in surveys conducted by the affiliations and nonphysician practitioners panels.

The VA Liaison Committee, chaired by Elizabeth Rogers, offered the committee thoughtful commentary, and encouragement, throughout the study. This group of VA clinicians, administrators, and health services researchers improved the committee's understanding of the rapidly changing VA health care system and the role that a physician staffing methodology might play in it.

From the project's beginning to its conclusion, the committee has greatly benefited from the advice and support of its VA project officer, Gabriel Manasse. No one has had a better understanding of the subtle complexities—both administrative and clinical—that have characterized this complicated and lengthy endeavor. He, of course, does not shoulder the responsibility for what the committee produced, but he has most certainly enhanced the quality of the product.

Finally, the committee expresses its deep appreciation to the members of the 11 panels appointed to advise this study. For their diligence and intellectual leadership, the chairs of these panels deserve special recognition: Robert M. Donati (other physician specialties); Daniel W. Foster (medicine); Ernest W. Johnson (rehabilitation medicine); Robert J. Joynt (neurology); Kerry E. Kilpatrick (data and methodology); W. Eugene Mayberry (affiliations); Harold M. Visotsky (nonphysician practitioners); Harold M. Visotsky and co-chair Robert L. Leon (psychiatry); David C. Sabiston, Jr. (surgery); Sankey V. Williams (ambulatory care); and Cheryl E. Woodson (long-term care).

For excellent editorial assistance, the committee thanks Julie Phillips, consulting editor; Leah Mazade, IOM staff editor; and Wallace K. Waterfall, director of the IOM Office of Communications.

Contents

Executive Summary

OVERVIEW OF THE STUDY

Purpose and Scope

To accomplish its mission-related responsibilities of patient care, education, and research, how many physicians does the VA require?

The purpose of this study has been to develop a methodology to assist the Department of Veterans Affairs (VA) in answering this basic, but extraordinarily complex question.

Specifically, the VA asked the Institute of Medicine (IOM) to develop "a sound methodology for estimating the number of physicians, by specialty groupings, required for the efficient delivery of high quality physician services" in all programs and facilities operated by the Veterans Health Administration (VHA), which has responsibility for all VA physician-related activities.

The overall methodology should be capable of assessing:

- The number of physicians required to meet current patient-care workload at VA medical centers (VAMCs). These assessments would be conditional on the scope and case acuity of patient workload; the number and type of residents; the availability of nonphysician personnel, such as nurses, allied health professionals, and other support staff; and other productivity-influencing factors.
- Future VA physician requirements, taking into account possible changes in the volume, mix, and case acuity of patient workload resulting from the aging of the veteran population and other demographic and administrative factors.
- The net effect on VA physician requirements of possible changes in the number, type, and intensity of VA-medical school affiliation relationships. In addition, there should be analyses of the potential effects of such changes on the VA's ability to accomplish the physician education component of its mission now as well as in future years.

Organization and Conduct of the Study

The IOM committee conducting this study consisted of 19 members, including experts in the physician specialties relevant to the VA, nursing, allied health manpower, statistics, economics, operations research, and health services research. Many members had, at some point, provided either patient care, clinical instruction, or research expertise at VAMCs. But, by design, no committee member was on the clinical or research staff of a VAMC during the period of the study.

The committee was advised by 11 panels: data and methodology (working on all components of the study, but focusing especially on statistical analyses), affiliations (examining VAMC-medical school affiliation relationships), nonphysician practitioners (focusing on a selected set of providers, including physician assistants and nurse practitioners), and six specialty and two clinical program panels (each concerned with physician requirements from the perspective of its own discipline or program).

The six specialty panels were medicine, surgery (which also included anesthesiology), psychiatry, neurology, rehabilitation medicine (which also included spinal cord injury), and other physician specialties (which included laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology). The two clinical program panels, both multidisciplinary in composition, were ambulatory care and long-term care.

Each panel consisted of a mix of VA-staff and non-VA members, with the former never constituting a voting majority. Each panel chair was also a member of the committee.

Throughout the study, the committee was advised also by a VA liaison committee, appointed by the VA chief medical director. Its 22 members, all VA professionals, included experts in the clinical specialties, administration, and health services research. The liaison committee's role was strictly advisory, and the study committee benefited considerably from this group's thoughtful counsel.

Some Undergirding Assumptions

The following assumptions were adopted by the committee in the course of the study:

- **The Methodology Focuses on Physician Full-Time-Equivalent Employees (FREE) Required to Meet the VA's Mission in the Field**. The IOM was not asked to compute the budgetary cost of the physician FTEE levels recommended by the methodology, or to analyze practical difficulties that might arise in acquiring these physicians. The methodology also does not examine how to determine the physician FTEE required for full-time administration at VA Central Office and other sites (including the VAMC). However, these are important issues that should be addressed squarely by the VA.
- **This Is Not a Needs-Based Approach**. The VA requested a methodology for deriving physician requirements to meet current and future "workload demands." Not addressed directly is the issue of physician staffing required for the amounts and kinds of health care that veterans may "need,"

however that term is defined. Nonetheless, the methodology could be readily adapted for this purpose.

- **The Methodology Should Promote the Quality of Care**. To develop a methodology that consciously promotes the delivery of high-quality medical care—perhaps the greatest challenge in the study—the committee has proposed a strategy in which expert clinical judgment plays a prominent role. Expert judgment is formally involved in the evaluation of statistical models for staffing, the independent derivation of physician staffing requirements, and in efforts to reconcile the estimates from these alternative approaches. The committee also advocates continued empirical investigation of the relationship between the intensity of physician care and patient outcomes. It demonstrates, by example, that as such linkages are established, it becomes possible to derive physician FTEE levels that are consistent with achieving certain designated quality-of-care standards.
- **The Methodology Must Be Relevant to the Present, Flexible for the Future**. The committee has assumed that health resource allocation in the VA will be centrally directed and locally executed—but it urges a strong, two-way dialogue between VA Central Office and the VAMCs. It is also assumed that, for the foreseeable future, the VA will continue to provide health care directly to veterans, on a large scale, primarily through its own network of hospitals, clinics, and nursing homes.

The committee did not analyze, however, the issue of determining the additional requirements for VA physicians in the event of a war or other national emergency. The data available to the committee, based on current VA patient care delivery, did not permit a sound empirical investigation. Nonetheless, the committee believes that a methodology structurally similar to the one proposed here could be applied successfully to a wartime caseload, though additional empirical analyses would be required to achieve this adjustment.

One assumption the committee did *not* make was that the VA health care system of the future would necessarily exhibit the same configuration of inpatient, ambulatory, and long-term care programs and services as presently seen. For the non-VA sector, there have been dramatic shifts from inpatient to alternative forms of care, particularly ambulatory and long-term care; primary care and prevention are being emphasized. The committee notes that similar pressures exist in the VA.

This is the major reason the methodology emphasizes that physician workload relationships should be analyzed (where feasible) at what is termed the patient care area (PCA) level, as well as at the facility level.[1]

[1] A PCA is an administratively defined locus of care, whose patients share certain clinical characteristics; examples of PCAs include the inpatient medicine bed section, the psychiatry clinics within the ambulatory care program, and the nursing home.

It is crucial that the methodology possess this degree of flexibility. With the size and age structure of the veteran population changing significantly, the VA health care system of the future may look quite different than the present one.

In designing a physician requirements methodology, however, it was not the committee's intent either to defend and preserve the status quo or to overturn it in favor of a newly configured VA system. Rather, the methodology should be seen as a vehicle for calculating physician requirements for whatever programs and services the VA determines to be appropriate. That is, the methodology is not a substitute for fundamental policy choice—it is a means for helping implement those choices once management has determined the needs of the system.

DEFINING, BUILDING, AND RECONCILING ALTERNATIVE APPROACHES TO PHYSICIAN STAFFING

The VA physician requirements methodology involves statistical formulas that use existing VA data. It involves methods for using expert judgment to derive appropriate physician staffing. It can accommodate physician staffing guidelines emerging from outside the VA health care system (external norms). Overall, however, the methodology is best characterized as a *decision-making process*—a process for using these approaches, in concert, to establish physician staffing recommendations that are defensible by definable criteria.

Three General Approaches to Determining Physician Requirements

The analyses in chapter 4 of the report demonstrate how physician requirements can be derived from statistical models estimated from existing VA data. Specifically, the committee developed *Empirically Based Physician Staffing Models* (EBPSM) with two, complementary variants: the production function (PF) model and the inverse production function (IPF) model. In chapter 5, two alternative *expert judgment models* for physician staffing were introduced—one based on the Detailed Staffing Exercise (DSE) and the other, on the Staffing Algorithm Development Instrument (SADI). A third general approach also discussed in that chapter would involve using non-VA physician staffing criteria, or *external norms*, for guiding the decision about physician requirements in the VA.

The Empirically Based Physician Staffing Models

A PF is estimated statistically for each PCA at the VAMC.[2] Each model relates (PCA-specific) workload to a number of variables thought to influence productivity, including physician FTEE for direct care, by specialty. To derive the total physician FTEE in a given specialty (e.g., neurology) or clinical program (e.g., ambulatory care) required for patient care at a given VAMC, one must solve for the FTEE required to meet patient workload on each relevant PCA, then sum across PCAs.

In the IPF variant of the EBPSM, specialty-specific rather than PCA-specific models are estimated. Each model directly relates (specialty-specific) physician FTEE for patient care and resident education to a number of variables thought to influence physician requirements, including workload.[3]

Under either the PF or IPF variant, total FTEE required at the facility is the sum of the model-derived estimate plus separate estimates for those FTEE components, such as research and continuing education, not incorporated in the model.

Expert Judgment Models

A DSE and (subsequently) a SADI was developed for each specialty (e.g., medicine) or VA program area (e.g., ambulatory care) analyzed by the six specialty and two clinical program panels. Each DSE and SADI has two major sections. The first (section A) focuses on physician requirements for direct care and resident education in the PCAs of a VAMC. For each ward, clinic, and procedure, the expert is asked to assess the amount of physician time—in hours—required per day, per visit, or per unit, respectively, to produce good-quality care.

The second section (B) of each DSE and SADI contains questions about the amount of physician time required for night and weekend coverage in the PCAs,

[2] Each VAMC is divided into 14 or fewer (depending on the scope of services offered) PCAs: inpatient care—medicine, surgery, psychiatry, neurology, rehabilitation medicine, and spinal cord injury; ambulatory care—medicine, surgery, psychiatry, neurology, rehabilitation medicine, and other physician services (including emergency care and admitting & screening); and long-term care—nursing home and intermediate care.

[3] There are separate facility-level IPFs for each of the following 11 specialty groups: medicine, surgery, psychiatry, neurology, rehabilitation medicine, anesthesiology, laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and spinal cord injury. (Included in this latter group are physicians in any specialty assigned to the spinal cord injury "cost center" in the VA's Cost Distribution Report.)

education activities not occurring in the PCAs, research, administration, other facility-related activities, and leaves of absence.

Time estimates for all patient care and non-patient-care activities are summed and converted to FTEE—assuming one FTEE translates into a 40-hour/ week commitment.

Reconciling the Approaches

As an overall framework for determining VA physician requirements (given workload and other factors), the committee endorses a *Reconciliation Strategy* in which the major components of physician FTEE are analyzed separately, then combined to produce the total FTEE required, by specialty or program, at the VAMC.

The three major components of physician FTEE are: (1) a large category (labeled simply "X" in the report) that includes all patient care, resident education, administration, and leaves of absence; (2) research; and (3) continuing education. Together, these components are intended to represent a mutually exclusive and exhaustive categorization of how a physician's time is allocated at a VAMC. To execute the Reconciliation Strategy, for a given specialty or program at a VAMC, is to determine for each physician FTEE component:

- the most appropriate empirically based estimate of FTEE,
- the most appropriate expert judgment-based (or, alternatively, external norm-based) estimate of FTEE, and
- the most appropriate relative weight accorded to each in a simple formula [see Equation 6.1 of the report] for deriving a recommended FTEE level for this component.

The calculations are repeated for each of the three FTEE components, the results are summed, and what emerges is total physician FTEE requirements for the specialty or program.

The specific configuration of the Reconciliation Strategy recommended by the committee conveys a particular policy perspective:

In determining physician requirements for each specialty or program area, the first step is to derive a "baseline" FTEE estimate from a variant of the EBPSM, either the IPF or the PF. The second step is to investigate whether this baseline should be modified by expert judgment in light of factors threatening the validity of the empirically based model.

It sometimes would not be practical for a VAMC to realize instantaneously the new "target" level of physician staffing in a given specialty or program that emerges from application of the Reconciliation Strategy. The committee recommends that when this is the case, the VA consider phasing in the target by establishing an intermediate target. These increments (or decrements) in staffing would provide natural experiments for analyzing prospectively and rigorously whether the new physician FTEE levels lead to the hypothesized changes in access to care, indicators of the quality of care, and other measures of system performance.

Using the Reconciliation Strategy to Calculate Physician FTEE

Within the "umbrella" of the Reconciliation Strategy, how exactly should VA physician FTEE levels be calculated, by specialty and program area?

1. *Physician FTEE for direct care, resident education, administration, and leaves—Based* on the analyses summarized in chapters 4 through 7, the committee reached the following conclusions regarding approaches to analyzing this major component of physician FTEE:

- The PF and IPF are potentially complementary variants of the EBPSM, and either is a viable candidate for helping generate the empirically based estimates for this component of physician FTEE.
- To derive expert judgment FTEE estimates for use in the Reconciliation Strategy, the most promising approach is a methodology built around the SADI. The SADI permits physician requirements to be assessed in almost as much detail as the DSE, but with much greater efficiency; because the SADI is specialty-or program-specific, rather than VAMC-specific (like the DSE), it could be applied periodically across the VA system much more economically than the DSE.

  Hence, the committee recommends the following: the VA, without delay, should apply the SADIs either across the board or to a representative sample of VAMCs; analyze the results; revise the instruments on the basis of what is learned; reapply the SADIs to VAMCs across the system; and, finally, integrate the resulting FTEE estimates into a Reconciliation Strategy-based assessment of physician requirements.
- The relative weight accorded to empirically based versus expert judgment approaches in the Reconciliation Strategy should be determined on a facility-specific or facility-group basis.

2. *Physician FTEE for research*—The amount of research FTEE built into overall physician requirements should be related to measurable indicators of research productivity and excellence. Possible indicators include the amount of VA and non-VA research funding, the quantity of peer-reviewed publications, or (most simply) the amount of FTEE currently allocated by each specialty to

"research" in the VA's Cost Distribution Report. In principle, the committee's preferred indicator is research funding.

3. *Physician FTEE for continuing education*—Continuing education for staff physicians should be an important component of any VA quality assurance program. The committee recommends that a certain minimum amount of continuing education FTEE be expected for all specialties at all VAMCs.

External Norms

Without exception, the specialty and clinical program panels concluded that the non-VA staffing criteria developed in the study were of limited usefulness in determining VA physician requirements. After reviewing these external norm analyses, the committee concurs.

Nonetheless, the committee believes that useful external norms can be developed. To accomplish this, a detailed examination of physician staffing levels in relationship to workload and other factors affecting physician productivity would need to be undertaken at each non-VA facility selected for analysis. The committee recommends that the VA pursue these more detailed external norm analyses.

OVERALL ADEQUACY OF PHYSICIAN STAFFING IN THE VA: COMMITTEE PERSPECTIVE

The primary purpose of the study has been to develop a physician staffing methodology. Physician requirements were computed selectively for specific specialties and sites, but this was always for demonstrating or testing a method or model. Hence, the committee concludes that:

- Relying solely on analyses performed in this study, it is not possible to reach sound *quantitative* conclusions on whether current VA physician staffing levels are adequate *in the aggregate*. Though an important question, it is not one the committee was asked to address.
- A close reading of the panels' final reports (see Volume II, *Supplementary Papers*) and their meeting transcripts (unpublished) reveals a recurring theme, enunciated in qualitative terms: in most specialties and program areas, the VA currently has too few physicians in the aggregate; in no case does it have too many.

In keeping with the report's focus on methodology rather than the adequacy of specific staffing levels, the committee acknowledges the panels' views but takes no formal position on their specific conclusions about the adequacy of current staffing. But these panel conclusions, emerging after months of careful deliberation, bear sufficient policy significance to warrant immediate investigation by the VA.

The proposed physician requirements methodology provides the means to do this.

VA CENTRAL OFFICE AND THE VAMC: PROMOTING A DIALOGUE

By its very structure and logic, the Reconciliation Strategy implies that the allocation of physician FTEE across the system would be more centrally directed than is currently the case. Within each specialty or program area, all facilities would be judged by the same criteria. There is the presumption that facilities with similar mission-related demands would be prescribed similar physician FTEE levels.

For the Reconciliation Strategy to be implemented successfully and to be improved over time, there must be strong channels of communication between Central Office and each VAMC. And the dialogue must be an active, two-way interchange. The committee does believe that the physician staffing methodology would be more likely to influence VA physician staffing if the methodology were made an integral part of the budget process at the facility level. Therefore, the committee recommends that the VA undertake this integration concurrently with the implementation of the methodology. These analyses would be facilitated if the physician requirements methodology were a component part of a larger VA "decision support system" that promotes a comprehensive integration of resource planning and budgeting.

AFFILIATIONS WITH MEDICAL SCHOOLS

The committee's views about VA-medical school affiliation relationships, presented at length in chapter 9, can be summarized as follows:

- The overall impact of affiliations on the VA health care system is strongly positive. These benefits include an improved ability to attract and retain well-qualified physicians and other health professionals; a wide spectrum of services provided by a pool of highly qualified physicians, both those on the VA staff and those whose services are made available to the VA through other relationships with the medical schools; access to state-of-the-art tertiary care; participation in the education of physicians, a mandated part of the VA's mission which cannot realistically take place currently in the absence of affiliations; and participation in medical and health services research, which benefits the general population as well as veterans.

- The VA should explore strategies for developing and expanding affiliations to include facilities that currently are not affiliated.
- The VA should work to develop innovative models of affiliation targeted specifically to the chronically ill, including those requiring psychiatric care and rehabilitation services. These innovative models would, in general, be oriented around and give emphasis to ambulatory and long-term care.

NONPHYSICIAN PRACTITIONERS

Early in the study the committee hypothesized that VA physician requirements may be influenced by the availability of certain nonphysician practitioners (NPPs). In chapter 10 the committee presents recommendations on the present and future role of four types of NPPs: physician assistants, nurse practitioners, certified registered nurse anesthetists, and clinical nurse specialists.

- Both the procedures for collecting data at the VAMC and the format of the SADI should be revised so that the impact of NPPs on physician requirements can be determined with greater specificity than at present, using either the empirically based models or this expert judgment approach.
- Continuing education on the use of NPPs should be provided to VA physicians, and NPPs should receive continuing education to enhance their clinical skills. Wherever possible, the VA should establish academic affiliation relationships with NPP training programs to augment these education efforts.
- National guidelines on the use of NPPs should be strengthened where they exist, established where they do not, and updated on a regular basis over time. They should allow the VAMC adequate flexibility for innovation and quality control.
- To promote the development and diffusion of new information about the appropriate use of NPPs, the VA should support research projects that examine the range of activities now performed by these practitioners across the system.

FURTHER DEVELOPMENT OF THE METHODOLOGY

In chapter 11 the committee presents a number of recommendations for testing, refining, and extending its proposed methodology:

- Improve the EBPSM by increasing the accuracy of the data from the VA's Cost Distribution Report, developing new variables for the models, and periodically reestimating the models as factors influencing physician productivity—or its measurement—change over time.

- Evaluate and refine the SADI by applying the present instruments to all VAMCs, or at least a representative sample, and then revising each instrument accordingly.
- Pursue more detailed analyses of external physician staffing norms by studying in depth a selected number of non-VA clinical sites. The resulting (non-VA) physician task times could then be applied to workload data from a given VAMC to derive an *implied* total quantity of physician FTEE required.
- Extend current workload projection procedures to incorporate patient demand models, in which the veteran's predicted utilization of the VAMC becomes a function of income, health insurance coverage, and other factors affecting the propensity to select the VA system. The workload projection procedures used in the present study, adapted directly from existing VA models, produced facility-and PCA-specific utilization estimates adjusted only for the projected change in the age distribution of the veteran population.
- Pursue these improvements through a two-phase strategy; Phase I would involve an intensive two-year effort to accomplish the tasks just summarized, while Phase II represents an ongoing effort to reevaluate and possibly revise components of the methodology.

CONCLUDING REMARKS

The committee's recommended methodology is multifaceted because no one approach to determining physician requirements is without its flaws. But when the approaches are considered in concert, the opportunity is created to bring the full range of relevant information to bear on the problem.

A useful by-product of the methodology is that it is possible to compare the actual and model-predicted performance of individual VAMCs in terms of physician staffing intensity and workload productivity.

If the VA adopts, and adapts as needed, the proposed methodology, the quality of its physician staffing decisions should improve over time—and so should the quality of VA health care.

1

Overview of the Study

PURPOSE AND SCOPE

To accomplish its principal mission-related responsibilities of patient care, education, and research, how many physicians does the VA require?

The purpose of this study has been to develop a methodology to assist the Department of Veterans Affairs (VA) in answering this basic, but extraordinarily complex, question.

Specifically, the VA asked the Institute of Medicine (IOM) to develop "a sound methodology for estimating the number of physicians, by specialty groupings, required for the efficient delivery of high-quality physician services" (Institute of Medicine, 1987) in all programs and facilities operated by the Veterans Health Administration (VHA), which has responsibility for all VA physician-related activities.[1]

The VHA, headed by the chief medical director, operates the largest federal medical care delivery system in the United States, with about 1.1 million inpatient admissions and 22 million outpatient visits in Fiscal Year (FY) 1990. About 97 percent of its $11.6 billion budget in FY 1990 was devoted to medical care (U.S. Department of Veterans Affairs, 1991), and the great majority of medical care expenditures are for programs and services directly involving physicians; the scope of this study extends across these physician-related activities.

[1] Specifically, the mission of VHA is to provide the following:

- Complete health care delivery service for the ambulatory and hospital care of eligible veterans;
- Program of education and training of health care personnel;
- Program of medical research; and
- Health care services to members of the Armed Forces during a war or national emergency.

In the statement of work agreed to by the VA and the IOM (Institute of Medicine, 1987), the designated primary study objective was the development of a "mathematical/statistical methodology, incorporating both empirically-derived and expert-judgment-based values in the methodology's algorithms, which translates quantitative measures of ... mission-related workload demands . . . into numerical estimates of physician staffing requirements." Data for these analyses would be derived from three sources:

- The VA's own information systems, yielding empirical observations on physician-patient workload relationships across the system (and thus reflecting what may be characterized as "internal" performance norms);
- "External" (to the VA) physician performance norms, as obtained directly or else inferred from other health care organizations in the public and private sectors; and
- Expert panels, which would evaluate the statistical models, the data used in them, and external staffing norms—and, in light of these assessments, recommend modifications to either the models or the staffing recommendations derived from them.

The committee interpreted as its charge the development of a methodology capable of assessing:

- The number of physicians required to meet the current patient-care workload at VA medical centers (VAMCs). These assessments would be conditional on the scope and case acuity of patient workload; the number and type of residents; the availability of nonphysician personnel, such as nurses, allied health professionals, and other support staff; and other productivity-influencing factors, such as the presence of certain capital equipment.
- Future VA physician requirements, taking into account possible changes in the volume, mix, and case acuity of patient workload resulting from the aging of the veteran population. Likewise, the methodology should be flexible enough to incorporate projected changes in other factors influencing VAMC utilization, such as the distribution of veterans across eligibility-for-care categories and the proportion of females in the eligible population.
- The net effect on VA physician requirements if there were changes in the number, type, and intensity of VA-medical school affiliation relationships. In addition, there should be analyses of the potential effects of such changes on the VA's ability to accomplish the physician education component of its mission now and in future years.

Over the years, the VA has published staffing guidelines for most health care provider categories, except physicians. This underscores the genuine complexities—clinical, economic, statistical, administrative, and political—that abound in attempting to estimate the number of physicians required to meet the VA's mission.

In the majority of VAMCs, mission-related responsibilities are threefold: patient care, education, and research. In most of these activities, the VA staff physician does not function alone, but rather as a critical member of a team that may include residents, non-VA consulting physicians, nurses, nonphysician practitioners (e.g., physician assistants), and a variety of support staff. Hence, the number of physicians required in any specific VA setting will be a function of the availability and productivity of these other providers, who may function as either substitutes for or complements to the staff physician. Nonpersonnel factors (e.g., capital, floor space, the VAMC's proximity to the nearest medical school) may also be important determinants of physician productivity.

The amounts of time to be allocated to research, classroom instruction of residents and others, continuing education, administration, and professional development all should figure directly into the computation of VA physician requirements.

The approaches to VA physician staffing set forth in this report do attempt to account for the influence of these factors (subject to data limitations). Overall, however, the committee would characterize its product as a "first-generation methodology" (consistent, in fact, with language in the statement of work describing the anticipated outcome of the study). At the moment, the proposed methodology is capable of yielding defensible estimates of VA physician requirements, in the committee's judgment. But whether this methodology would lead over time to significant improvements in the efficiency and quality of VA health care can be determined only after it is implemented, then rigorously evaluated.

ORGANIZATION AND CONDUCT OF THE STUDY

Studies undertaken by the IOM (and the National Academy of Sciences, in general) are conducted by expert committees. These committees consist of individuals selected for their expertise on one or more topics germane to the study; collectively, all disciplines, research areas, and social perspectives important to a study are to be represented on the committee conducting it.

The IOM committee conducting this study was organized in the spring of 1988; after all appointments had been made, it consisted of 19 members, including experts in the physician specialties relevant to the VA, nursing, allied health manpower, statistics, economics, operations research, and health services research. The committee had a broad representation by age, gender, and geographic location. Most members had, at some point, provided either patient care, clinical instruction, or research expertise at VAMCs. But, by design, no committee member was on the clinical or research staff of a VAMC during the period of the study. The committee roster appears in the front of this report.

The study was developed partly on the basis of an analytical plan formulated by an earlier IOM committee, which had been appointed in response to a request from the VA. This earlier study, completed in 1985, laid the broad intellectual groundwork for the current effort (Institute of Medicine, 1985).

In its conduct of the study, the committee was advised by 11 panels: data and methodology (working on all components of the study, but focusing especially on statistical analyses), affiliations (examining VAMC-medical school affiliation relationships), nonphysician practitioners (focusing on a selected set of providers, including physician assistants and nurse practitioners), and six specialty and two clinical program panels (each concerned with physician requirements from the perspective of its own designated discipline or program).

The six specialty panels were medicine, which encompassed all medical subspecialties; surgery, which encompassed all surgical subspecialties, plus anesthesiology; psychiatry; neurology; rehabilitation medicine, whose purview also included spinal cord injury; and other physician specialties, defined by the committee to include the specialties of laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology. The two clinical program panels, both multidisciplinary in composition, were ambulatory care and long-term care.

Of the 11 panels, eight were defined at the study's inception; the neurology, ambulatory care, and nonphysician practitioners panels were instituted by the committee during the course of the study.

Each panel consisted of a mix of VA-staff and non-VA members, with the former never constituting a voting majority. Each panel chair was also a member of the committee.

Throughout the study, the committee also was advised by a VA liaison committee, appointed by the VA chief medical director. It consisted of 22 VA staff members, including experts in the clinical specialties, administration, and health services research; the VA's project officer for the study was an *ex officio* member of this committee. The liaison committee's recommendations were, by design, nonbinding, and the study committee welcomed and benefited considerably from this group's thoughtful counsel.

The rosters for all 11 panels and the VA liaison committee are found in Appendix A of this report.

The complex nature of the topic, coupled with the charge that the committee produce a well-researched product suitable for policy application in the VA, led to there being an unusually large number of committee and panel meetings.

From June 1988 through December 1990, the study committee met eight times and its panels met as follows: data and methodology, 11; affiliations, 5; nonphysician practitioners, 3; and the eight specialty and clinical program panels, twice each for a total of 16. Over this period, the VA liaison committee met with either the study committee or its staff on four occasions. In sum, there were 47 meetings, each of 1 to 2 days' duration.

From November 1989 through December 1990—an intensely active period during which all components of the methodology were being brought to fruition and tested—a total of 32 committee and panel meetings were conducted.

THE COMMITTEE PERSPECTIVE

After considerable analysis and much deliberation through many meetings, the committee recommends a new methodology for determining VA physician requirements. It calls for estimates of physician requirements to be derived simultaneously through competing analytical approaches, principally involving statistical modeling and expert judgment processes. These alternative estimates form the boundaries within which *specific physician staffing targets* are derived through an open process of evaluation and discussion, termed the Reconciliation Strategy. The methodology is multifaceted because no one approach to determining physician requirements is without its flaws. But when the approaches are considered in concert, the opportunity is created to bring the full range of relevant information to bear on the problem.

The committee's principal charge was to produce a methodology, not implement it. Consequently, this report does not contain specific estimates of how many physicians the VA requires systemwide (though it reports physician requirements in detail for a small set of VAMCs analyzed experimentally during the study). What the report does contain are precise recommendations for how the methodology, after further empirical refinements, could be used to determine physician staffing, by specialty, at any facility in the VA system. Moreover, physician requirements can be calculated for any desired grouping of facilities by directly aggregating the corresponding facility-specific estimates.

A useful by-product of the methodology is that at any point in time, it is possible to compare the actual and model-predicted performance of individual VAMCs in terms of physician staffing intensity and workload productivity.

As the study proceeded, it became clear to the committee that this resource allocation problem should be attacked in an "evolutionary" fashion, with the methodology presented here as the vehicle to launch the evolution. In its current form, the methodology provides a better framework than exists presently for determining VA physician requirements, in the committee's view. On the basis of the many experimental analyses reported in this study, the committee concludes that the methodology is capable, at the moment, of yielding defensible staffing recommendations. But it can, and should, be improved over time.

In the course of this report, the committee presents a number of proposals for testing and refining the methodology. No meaningful testing and refining is possible, however, unless the staffing models are first put to use. In subsequent chapters, the committee recommends, in quite specific terms, the analyses that should be performed, and why.

If the VA adopts, and adapts as needed, the proposed methodology, the quality of its physician staffing decisions should improve over time—and so should the quality of VA health care.

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2

Background

This chapter briefly addresses two categories of issues that bear on the committee's understanding and conduct of the study.

First, as a prelude to investigating how many physicians the VA should have, the number that it does have is examined by specialty and allocation across the major mission-related activities of patient care, education, and research. The data are for Fiscal Year (FY) 1989, the year used for most of the empirical analyses in the study. In addition, factors thought to influence the number of physicians in a given specialty at a given VA medical center (VAMC) at any point in time are discussed. It is into this VAMC decision-making environment that the committee's proposed physician requirements methodology would be introduced.

Second, among the working assumptions invoked by the committee in the conduct of the study, several undergirding ones should be noted at the outset and therefore are discussed below.

CURRENT ALLOCATION OF PHYSICIANS IN THE VA

Total Physicians, By Specialty

For each of 11 specialty categories, data on the total quantity of VA staff physicians nationwide for FY 1989 are summarized in Table 2.1. For each specialty, the absolute and the percentage allocation of physicians to direct patient care (and miscellaneous other activities), education, and research are shown. The three dominant physician specialties, in size, are medicine, psychiatry, and surgery; in every specialty, the great majority of manpower is devoted to patient care (miscellaneous activities account for less than 5 percent of the total).

Included in the table are all physicians on the VA payroll who are based in one (or more) of the system's 172 medical centers, 63 independent or satellite outpatient facilities, or 122 nursing homes.

Excluded from the table are VA physicians in administrative positions not based at one of these sites (e.g., a position in VA Central Office in Washington, D.C.) and non-VA physicians who periodically perform consultations at VAMCs either for a set fee or free of charge. As discussed in chapters 4 and 9, there are no nationwide data measuring either the quantity or the clinical contributions of these non-VA physicians. Although data on VA physicians in central administration are available, the proposed methodology will not deal with this arena of activity, as discussed momentarily. (Also excluded from Table 2.1 are physicians at the VAMC who are not assigned formally to one of the 11 specialty categories in the VA's personnel accounting system, e.g., physicians assigned, instead, to the spinal cord injury or ambulatory care cost centers.)

All VA personnel, including physicians, are measured in terms of Full-Time-Equivalent Employees (FTEE). In general, one FTEE translates into a 40-hour-per-week commitment; for example, someone working 20 hours per week would represent 0.5 FTEE, whereas five people who each work 12 hours per week contribute a total of 1.5 FTEE.

For staff physicians, the meaning of FTEE is somewhat more complicated than this in practice. The VA payroll system essentially divides the 40-hour week into eight parts, so that a full-time physician is termed an "8/8ths" employee, a half-time physician is a "4/8ths" employee, and so on.

For physicians who are not full time, the "eighths" assignment is supposed to be an accurate statement of the average hourly commitment per week. A physician classified as "5/8ths" is assumed to spend about 25 hours per week at the VAMC.

On the other hand, it is well understood that a full-time physician's time commitment is not strictly limited to 40 hours per week; it may exceed this, on occasion or frequently, as required to meet the VAMC's missions of patient care, education, and research. There are no available data on the average hours per week worked by full-time VA physicians, and hence no way presently to derive an "adjusted" FTEE count that accurately reflects the total number of hours worked. This caveat must be kept firmly in mind when interpreting physician staffing data throughout the report.

How Physician FTEE Levels Currently Are Determined

At present, the VA has no national, centrally directed policy for determining how many physicians it needs. The number of physician FTEE, by specialty, at each VA medical site in FY 1989 (as reflected, ultimately, in Table 2.1) emerged from a decision process that is local in nature and influenced by historical staffing patterns, perceived workload burdens, opportunities for productivity enhancement, national program initiatives, and local market forces.

Each fiscal year, a VAMC is assigned a total operating budget and a ceiling on total personnel—but no specific directives or guidelines on how many physician FTEE, overall or by specialty, it should have. The latter decision is at the facility's discretion.

The committee could find no formal documentation describing how physician FTEE are assigned, but it has concluded from various commentaries during the study that the following factors are important:

1. *Historical Considerations*. Within a given specialty service at a VAMC in a given fiscal year, there will be a certain number of designated physician FTEE—a type of "historical base" that is the product of myriad previous staffing decisions by administrators at the facility. There are a number of practical limitations on the ability of that service chief to alter physician staffing significantly. With VA budgets growing slowly, at best, it is often the case that the chief can acquire additional physicians only if the VAMC is willing to reduce staffing, or other resource commitments elsewhere in the facility. Not surprising, few fellow service chiefs are willing to surrender *their* physician slots. Further, the ability of a chief of staff or facility director to downsize a service is hampered by the fact that all full-time VA physicians have what amounts to "tenure"; to attempt to remove or transfer these physicians over their objections can be an arduous and costly endeavor. The result, in sum, is that each year's physician FTEE total is likely to be similar to the previous year's.
2. *Perception That Workload Is Changing*. When there is a perception, empirically based or not, that a given specialty will be unable to meet patient workload demands, that specialty is sometimes able to argue successfully for additional physician FTEE.
3. *A Reward for Good Performance*. When a specialty at the VAMC can demonstrate that it has used existing physician FTEE efficiently, it may bid successfully for additional physicians to expand its scope of operation.
4. *Pursuing New Programs*. Periodically, VA Central Office will invite facilities to compete for funds supporting the development of new, targeted programs, for example, Geriatric Research, Education and Clinical Centers, and Post-Traumatic Stress Disorder initiatives. In most cases, successful applicants will receive funding for a designated additional number of physician FTEE to carry out the initiative. These new physicians are "add-ons," requiring no reduction in existing physician FTEE levels.
5. *Marketplace Considerations*. In some cases, a given specialty will have clearance from its VAMC to hire additional physicians but simply cannot attract them, given the facility's geographic location in combination with existing VA salary levels. This problem of "absolute" shortages appears to arise more

frequently in VAMCs lacking academic affiliations, particularly in rural areas and particularly for highly specialized physicians.

In other cases, a VAMC may find that it can acquire the additional physicians it requires—but only at salaries well beyond those established by the VA. When this occurs, there are several options. The VAMC may negotiate a contract to obtain targeted amounts of physician FTEE in certain specialties (perhaps from a group practice or medical center). If the VAMC is affiliated with a medical school, it may attempt to acquire assistance from "consulting & attending" or "without-compensation" physicians—and, in the process operate at well below market rates. Finally, a VAMC may respond by hiring nonphysician practitioners. For example, a VAMC unable to find, or afford, an additional psychiatrist may acquire some combination of psychologist and social worker FTEE to handle a portion of the psychiatry workload.

SOME UNDERGIRDING ASSUMPTIONS

There are at least four topics that should be discussed in advance of the methodology's presentation.

The Methodology Focuses on Physician FTEE for VAMCs

The proposed methodology is intended to help the VA determine the quantity of physicians, measured in FTEE, required to meet the mission-related demands of the VAMC. Two important points must be addressed.

First, the committee recognizes that staff physicians serving in administrative positions in VA Central Office and other sites external to the VAMC have contributed significantly to the VA's mission-related activities of patient care, education, and research. However, the committee regards the determination of FTEE for this purpose as traditionally a matter of administrative discretion and, in any event, beyond its technical competence.

Second, the Institute of Medicine was not asked to analyze the associated budgetary cost of alternative physician staffing levels. Nor was it asked to consider the practical difficulties that might arise in implementing staffing recommendations, given current VA salary ceilings and variations in the geographic concentration of physicians.

The committee did take note of the following administrative point advocated by some members of the specialty and clinical program panels. In certain specialties (e.g., anesthesiology), the VA physician salary ceiling is sufficiently below the market rate of compensation that a facility may have difficulty acquiring the quantity of FTEE authorized in its budget. These panel members contended that, in such cases, a VAMC therefore should be assigned more physician FTEE than formally recommended in the methodology in order to compensate for the adverse effect of VA salary ceilings.[1]

In reality, this problem is apparently overcome in some cases by compensating the part-time VA physician from a combination of VA and non-VA sources, a tactic facilitated if the VAMC has an affiliation agreement with a neighboring medical school. It is also ameliorated by the use of non-VA consulting physicians who, through these affiliation agreements, render care at the facility at nominal rates or without compensation.

The committee believes that such issues are important and must be squarely addressed by the VA. However, the methodology has been focused steadfastly on one primary issue: the physician *FTEE* required, in fact, to meet the VA's patient care, education, and research commitments in the field.

Nonetheless, the committee does consider (in chapter 7) the advisability of tying the methodology to the VA budgetary process. Because this step would serve to enhance the effectiveness and validity of the methodology itself, the committee recommends that this linkage be achieved.

This Is Not a Needs-Based Approach

As noted in chapter 1, the VA requested a methodology for deriving physician requirements to meet current and future "workload demands," that is, current and future veteran utilization of the system. Not addressed in this study, by the VA's own design, is the issue of physician staffing required for the amounts and kinds of health care that veterans may "need," however that term is defined. (Need may be defined biologically or clinically, or in terms of the access to care required for equity or social justice.)

Thus, the scope of this analysis, and the approaches taken, differ in some significant ways from those adopted by the Graduate Medical Education National Advisory Committee (GMENAC) (Department of Health and Human Services, 1981), and the Council on Graduate Medical Education (COGME) (Buerhaus and

[1] For example, suppose the salary ceiling in specialty s is $80,000 (per FREE) and the market rate is $100,000. The facility would simply not be able to hire one full-time physician in s, unless the advantages of working in the VA (e.g., possibly reduced hours, professional stimulation, public service) were sufficient to compensate for the $20,000 salary differential. To acquire one FTEE in s through the addition of part-time physicians (working various "8ths"), a similar situation arises. The facility would need to have 1.25 budgeted slots in s to afford the manpower equivalent of one FTEE—unless the nonpecuniary aspects of VA service were attractive enough to induce specialists to sign up at below-market rates.

These panel members knew, of course, that current VA personnel policies could not formally accommodate such a proposal. Their contention, simply, was that the total package of VA inducements is often not adequate to allow the facility to hire the staff physician FTEE for which it has nominally budgeted.

Zuidema, 1990). In both the GMENAC and COGME studies, the focus was (and is) on developing a "needs-adjusted" estimate of physician requirements.

However, the methodology presented in chapters 4 through 7 could readily be adapted to accommodate a needs-based approach if the VA were subsequently to develop an operational definition of "need" along with guidelines for translating needs into expected patient workload. This is because those parts of the methodology for determining physician requirements to handle a *given* workload operate quite distinctly from the part (presented in chapter 8) for estimating what the workload will be. A variety of alternative demand-based and needs-based workload estimation approaches could be incorporated into the overall methodology at a later date. In particular, a needs-based approach that emphasizes both primary care and prevention could be well accommodated.

Assuring the Quality of Care

In developing a physician requirements methodology, perhaps the biggest challenge facing the committee was determining how to derive physician FTEE in a way that promotes high-quality medical care. The problems here are numerous and substantial. There is little consensus, either within or outside the VA, on how "quality" should be defined and measured. For any selected quality indicator (e.g., mortality), there is considerable uncertainty about the effects of particular medical interventions. There are virtually no studies in the clinical literature linking outcome-oriented quality measures to the intensity of physician staffing.

In response, the committee's physician requirements methodology has the following features:

- Clinical judgment plays a critical quality assurance role. The expert judgment-based approach to physician staffing presented in chapter 5 complements—and frequently serves as a counterpoint to—staffing approaches based on the statistical analysis of existing VA data relating current physician staffing to current workload production.
- Physician requirements derived from these statistical models (see chapter 4) do reflect, in sum, the nature and the quality of current clinical decision making in the VA. During this study, the committee frequently heard from members of its specialty and clinical program panels that quality is sometimes compromised in the VA because of resource inadequacies. Hence, the argument goes, to base staffing decisions on statistical models estimated from current data will not promote quality care. Although the committee conducted no formal analyses to confirm or refute these statements, it is vitally concerned that physician FTEE levels derived from the methodology be consistent with high-quality care.

In response, the committee has established an overall framework for the methodology—termed the Reconciliation Strategy (see chapter 6)—that allows for a balanced use of statistically based and expert judgment models in the calculation of physician requirements.

In addition, the committee has demonstrated that if the VA can develop models linking quality indicators to physician staffing levels, physician FTEE can be derived *from the statistical models* in ways that meet designated quality standards (see chapter 7). In this regard, the committee applauds work recently begun by the VA Office of Quality Management to develop such indicators and explore their relationship to measures of resource intensity.

Finally, the committee's proposed strategy for implementing the methodology emphasizes the importance of analyzing, prospectively and rigorously, the effects of physician staffing levels on outcome measures of quality. These results would be incorporated directly into the methodology's component models so that subsequent physician staffing recommendations are consistent with quality-of-care criteria.

The Methodology Must Be Relevant to the Present, Flexible for the Future

In the physician requirements methodology proposed here, it is assumed that health resource allocation in the VA of the future will be centrally directed and locally executed. However, the committee advocates a strong, two-way dialogue between VA Central Office and the individual VAMCs as essential to improving both the local acceptability and the empirical validity of the methodology over time (see chapter 7).

In its analyses, the committee has assumed that, for the foreseeable future, the VA will continue to provide health care directly to veterans, on a large scale, through a network of its own hospitals, clinics, and nursing homes. Hence, the committee did not investigate how physician requirements might be determined under radically different scenarios, for example, that veterans might simply be issued vouchers for the purchase of medical insurance or health care from any provider. The committee strongly suspects that the methodology presented in chapters 4 through 8 could be suitably modified to accommodate such new scenarios. The most substantial modifications would likely be required in the workload projection models (chapter 8) rather than in the core pieces of the methodology (chapters 4 through 7). Such speculative issues will not be pursued further in this report.

In developing and testing the methodology, the committee did not specifically analyze the additional requirements for VA physicians in the event of a war or other national emergency. This issue is relevant in that the VA must provide medical contingency backup to the Department of Defense under such emergency conditions (see note 1 in chapter 1). In fact, during the recent Persian Gulf War, the VA established specific contingency plans for treating the expected military casualties.

There are two basic difficulties in examining this staffing question empirically. First, the case mix and severity of military casualties, characterized by a high incidence of acute trauma cases, would likely differ significantly from that of the current VA population. The statistically based and expert judgment staffing models developed in this study are both empirically grounded in the current practice of medicine in the VA. The extent to which the resulting workload-to-physician relationships apply to a wartime caseload requires careful investigation; adjustments to the models would likely be required.

Second, the models for estimating future patient workload (see chapter 8) are based similarly on recent VA patient utilization experience and simply do not address the issue of emergency demands on the system.

Nonetheless, the committee believes that a methodology, similar in principle to the one proposed here, could be applied successfully to determine physician staffing for a wartime caseload. However, a considerable amount of additional empirical analyses would be required to achieve the necessary empirical adjustments.

One assumption the committee did *not* make was that the VA health care system of the future would necessarily exhibit the same configuration of inpatient, ambulatory, and long-term care programs and services as presently seen. For the non-VA sector, there have been relatively dramatic shifts in recent years from inpatient to alternative forms of care, especially ambulatory and long-term care. The committee notes that similar pressures exist in the VA. This increased emphasis on primary care for the eligible veteran could indeed imply a very different deployment of manpower than seen in the present VA system, with its generally strong orientation toward hospital-based tertiary care. This is a major reason the methodology emphasizes that physician workload relationships be analyzed at what will be termed the "patient care area" (PCA) level, as well as at the facility level.

A PCA is an administratively defined locus-of-care site whose patients share certain clinical characteristics; PCAs include, for example, the inpatient medicine bed section, the nursing home, and the psychiatric clinics within the ambulatory care program. The committee's underlying precept is that PCAs are useful not only in the analysis of current physician requirements, but can serve as the building blocks for models to determine physician requirements for types of VAMCs not presently seen in the system.

For example, to estimate FTEE requirements for a VAMC of the future offering primarily psychiatric, intermediate, ambulatory, and nursing home care, the analyses would focus on the physicians required for these four categories of PCAs. Currently, there may be few, or no, VAMCs configured just this way. But the physician requirements methodology can still yield FTEE estimates for such a facility—through either a statistically based approach, an expert judgment approach, or some amalgam of the two.

The committee feels that it is crucial that the methodology possess this degree of flexibility. With the size and age structure of the veteran population changing significantly, the VA health care system of the future may look quite different than the present one.

In designing a physician requirements methodology, however, it was not the committee's intent either to defend and preserve the status quo or to overturn it in favor of a newly configured VA system. Rather, the methodology should be seen as a vehicle for calculating physician requirements for whatever programs and services the VA determines to be appropriate. That is, the methodology is not a substitute for fundamental policy choice—it is a means for helping implement those choices once management has determined the needs of the system.

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Table 2.1 Total Staff Physicians by Selected Specialties at VAMCs, in FY 1989, with FTEE Allocated Across Major Activity Categories

	Physician FTEE[1]			
Physician Specialties	Direct Care & Miscellaneous Activities	Education[2]	Research	Total
Medicine	2,360.1 (71.6)	482.6 (14.6)	451.5 (13.7)	3,294.2
Surgery	985.0 (71.5)	265.7 (19.3)	127.4 (9.2)	1,378.1
Psychiatry	1,240.3 (79.5)	189.0 (12.1)	130.0 (8.3)	1,599.3
Neurology	197.0 (69.4)	42.1 (14.8)	44.8 (15.8)	283.9
Rehabilitation Medicine	238.6 (88.3)	23.8 (8.8)	7.9 (2.9)	270.3
Spinal Cord Injury	94.1 (93.2)	3.3 (3.3)	3.6 (3.6)	101.0
Anesthesiology	204.1 (79.6)	39.6 (15.4)	12.8 (5.0)	256.5
Laboratory Medicine	436.4 (85.5)	39.5 (7.7)	34.6 (6.8)	510.5
Diagnostic Radiology	475.4 (87.8)	44.7 (8.3)	21.3 (3.9)	541.4
Nuclear Medicine	114.7 (79.4)	15.6 (10.8)	14.2 (9.8)	144.5
Radiation Oncology	33.4 (85.0)	4.4 (11.2)	1.5 (3.8)	39.3

[1] Percentage of total FTEE for the specialty is shown in parentheses.
[2] Includes FTEE allocated to the training of residents and other staff, to the administration of education programs, and to continuing education for the VA physician.
SOURCE: VA internal accounting data, with subsequent analyses performed by the VA's Boston Development Center, Braintree, Massachusetts.

3

Overview of the Analysis

The tasks of defining, presenting, and evaluating the committee's proposed VA physician staffing methodology begin in this chapter.

In what follows, major questions that must be resolved in constructing such a methodology are previewed. These questions include:

- Which existing types of models or algorithms for assessing manpower requirements, in general, can be adapted to determine the number of VA physicians required, by specialty grouping? Will these prove adequate, or will new modeling approaches be needed?
- For each approach, what are the appropriate sources of data and appropriate analytical procedures—both for statistical inference and decision making—for deriving physician staffing levels that would be consistent with high-quality care?
- Should physician requirements be determined on the basis of a single dominant approach, a menu of approaches, or a strategy that synthesizes several approaches?
- If the latter, how should such a synthesis be achieved analytically? Can the strategy for synthesis be sensitive to the concerns of each specialty, while allowing all specialties to be treated in a coherent, internally consistent fashion?
- Given a choice of strategy for calculating physician requirements, what management policies will enhance the likelihood of successful implementation as well as refinement of the methodology over time?

In the remaining chapters, these questions are examined in some detail as the components of the methodology are developed piece by piece. The core elements of the methodology are presented in chapters 4 through 8; some important questions relating to VA physician requirements are examined in chapters 9 and 10; and the committee's main conclusions, including recommendations for additional analysis, are summarized in chapter 11.

Before these questions are introduced and the suggestions for their resolution in the chapters ahead are discussed, the main product that is to emerge from this study is commented upon briefly. The VA physician requirements methodology involves statistical formulas that use existing VA data. It involves the use of expert judgment approaches to derive appropriate physician staffing. It can accommodate physician staffing guidelines emerging from outside the VA health care system (external norms).

However, the overall methodology will not consist simply of statistical formulas, or expert judgment procedures, or external norm-based staffing ratios. Rather, it is best characterized as a *decision-making process* —a process for using these approaches, in concert, to establish physician staffing recommendations that are defensible by definable criteria.

In what follows and in chapters 4 through 7, the choice among alternative analytical approaches, and of desirable physician Full-Time-Equivalent Employee (FTEE) levels, is assumed to rest in the hands of a stylized actor called the VA decision maker. It is recognized that decisions within a system as complex and diverse as the VA require the interaction and consultation of multiple individuals with a variety of perspectives at various sites throughout the system. In many cases there is no one individual either in the field or in the VA Central Office that can be identified as *the* decision maker on a particular issue. Recognizing that interactions among multiple actors are typical of decision making in large organizations, it is nonetheless a useful shorthand (which simplifies exposition) to personify this set of relationships and processes in a single "VA decision maker."

The VA decision maker will alternatively appear to reside in Central Office or at a particular VAMC. In no case should this characterization suggest that the locus of decision making is assumed to reside exclusively in either site or that the decision maker is a pure type. Particularly in chapter 7, the importance of a strong, two-way communication link between the individual VAMCs and Central Office is emphasized. For the physician requirements methodology to function properly, and improve over time, certain kinds of information must flow freely between Central Office and the VAMCs.

With this as background, the major methodological questions facing the committee are discussed below.

A CENTRAL PROBLEM: DETERMINING PHYSICIAN FTEE REQUIRED FOR PATIENT CARE AND RESIDENT EDUCATION

By far the most important and difficult question (within this study's purview) facing the VA decision maker is how to determine the number of physicians, by specialty, required to meet a VAMC's commitment to high-quality patient care and resident education.

In the terminology of the study, this question can be stated more precisely as follows: What quantity of VA physician FTEE, by specialty, is required for rendering patient care and training residents at a given VAMC, given the availability and relative productivity of these residents (who interact with staff physicians in patient care and training), nurses, nonphysician practitioners, support staff, and other productivity-influencing factors? (The phrasing of the question acknowledges that the VA physician's roles as caregiver and educator are frequently intertwined and not always easy to disentangle empirically.)

Three general approaches for determining physician requirements for patient care and resident education are analyzed in chapters 4 and 5. First, it is possible to construct statistical models relating physician FTEE to workload production rates, while controlling for factors that affect physician productivity. Once the models are estimated (by multivariate regression techniques), using existing VA data, one can derive the quantity of staff physician FTEE required to meet a given workload, conditional on assumptions about these factors—including the *net* effect of residents on workload productivity.

Two complementary variants of these statistically oriented, "Empirically Based Physician Staffing Models" (EBPSM) are studied in depth in chapter 4: the production function (PF) and the inverse production function (IPF). There is a PF for each of 14 specified locus-of-care sites termed patient care areas (PCAs) in the VAMC; there is an IPF for each of 11 major VA physician specialty categories. Both variants allow physician FTEE requirements for patient care and resident education to be estimated on a specialty-specific basis at the VAMC level, and the PF permits this also at the PCA level.

Second, physician requirements can be derived through an expert judgment approach, in which panels with clinical and staffing expertise are asked to determine the quantity of physician FTEE required to meet a specified workload, again conditional on resident availability and other factors. In chapter 5, two variants of this expert judgment approach are studied in depth, one based on the Detailed Staffing Exercise (DSE) and the other on the Staffing Algorithm Development Instrument (SADI). Both variants permit physician FTEE requirements to be calculated, by specialty, at the VAMC level and specific to PCA within the facility.

A third approach is to develop physician staffing criteria based on standards, either explicit or implicit, established by selected non-VA providers of care. Such "external norms" can be used to derive point estimates of the physician FTEE required to meet VA workload or, alternatively, to establish the FTEE boundaries (ceilings and floors) for a range of acceptable staffing levels.

In the course of its deliberations, the committee concluded that there are distinct organizational, economic, and methodological advantages in building a physician requirements methodology around the EBPSM—to the extent that the models' underlying clinical and statistical assumptions can be met. To the extent that these assumptions are not met, the EBPSM (or at least the FTEE recommendations emerging from them) should be modified, either by independently derived expert judgment assessments of physician requirements or by external norms, adapted to the case at hand.

The EBPSM variants, relating physician FTEE to workload production, are grounded solidly in the reality of the practice of medicine—and of medical and administrative record-keeping—within the VA system. The data analyzed in chapter 4 collectively reflect the considered clinical judgment and resource allocation decisions of myriad VA health care providers, administrators, strategic planners, and budget managers.

The assumptions underlying the validity of the EBPSM are noted in chapters 4 through 6. The standard statistical requirements for such multivariate regression models are summarized in chapter 4. Violation of these assumptions is cause for concern, of course. In addition, there are at least three other potential threats to the validity of the EBPSM.

First, because of resource constraints, perverse incentives, less-than-ideal management, or other factors affecting the quality of care, historically observed FTEE-workload relationships at VAMCs across the system might be skewed from what they would be under less strained arrangements. If this were the case, the key input-output data used to estimate the PF and the IPF equations may not reflect high-quality medical care; hence, the prescriptions derived from those equations might not either.

Second, the data relating FTEE to workload may be sufficiently poor (regardless of the quality of care itself) that serious biases are imparted to the statistical analyses.

Third, physicians may be required for new programs or activities for which there are no existing, or appropriate surrogate, data.

The presence of any of these problems (discussed in chapters 4 through 6) boosts the case for a physician requirements methodology that gives substantial emphasis to an expert judgment or external norm approach.

Moreover, during the course of the study's many specialty and clinical program panel meetings, critics of the empirically based approach sometimes asserted that, at best, the EBPSM can indicate how to achieve a more efficient rearrangement of the current aggregate supply of VA physician FTEE. Thus, the question of whether additional physician FTEE would be required in aggregate is left unaddressed.

In line with this intuitively reasonable claim is the following statistical fact, underscored in chapter 4: At a given slice in time, with a given distribution of workload to meet (and a given distribution of nonphysician resources and other factors) across the VA system, application of the IPF to a given physician specialty results only in a prescribed reallocation across the system of its current aggregate quantity of FTEE (for patient care and resident education, the FTEE components analyzed within the IPF). Put differently, if the IPF's prescribed FTEE reallocations were made, the net change in VA salary costs for physicians in that specialty would be close to zero. The zero-sum aspect of this result is literally built into the operating logic of the statistical technique (least-squares regression) used to estimate the IPF.

Although this result does not strictly apply to the PF variant, it can be inferred (see chapter 4) that application of the PF across the system would likely lead to little aggregate change in total FTEE—given the current volume and distribution of workload.

However, it does *not* follow that application of the empirically based approaches to derive *future* physician requirements for patient care and resident education implies a zero-sum, budget-neutral result. As vividly demonstrated in chapter 4, the level of projected workload plays an independent and potentially strong role in driving the physician requirements calculations. If workload for some future year is projected to rise from the present level, the prescribed quantity of physician FTEE will virtually always be higher than at present, all else equal, under either empirically based approach (or, for that matter, either expert judgment approach). If workload is projected to fall, so typically will physician requirements, all else equal.

Hence, the argument that the VA decision maker should eschew the EBPSM because it automatically locks each specialty into its status quo position is misdirected. Rather, the decision maker's attitude about the EBPSM should be guided by whether the models' underlying assumptions are being met. It is worthwhile to rephrase the important ones now from a more positive perspective.

Does the VAMC—in response to budgetary, manpower, and other constraints—attempt to maintain a balance between workload and physician FTEE so that staffing ratios are consistent with high-quality care? Are the PF and IPF equations properly specified, in terms of the explanatory variables included and their assumed mathematical relationship? Are the data, even if sometimes measured with error, sufficiently accurate on balance that statistically strong, clinically meaningful equations can be estimated? Can physician requirements for new programs or activities be inferred from PF or IPF equations estimated from existing data?

To the extent that these questions are answered in the affirmative, the case is strengthened for a VA physician staffing methodology giving substantial weight to the EBPSM.

As indicated in chapter 5, the committee's interaction with the study's eight specialty and clinical program panels has afforded ample opportunity to assess the merits of alternative orchestrations of an expert judgment approach. In sum, this study has generated compelling evidence that such panels can function effectively, even under significant time and information constraints. Using first the DSE and then the SADI variant, each panel was able to establish what it regarded as a reasonable range of physician staffing (in its specialty or program domain) in several actual VAMCs for which detailed data had been provided by staff.

However, the committee's enthusiasm for a physician staffing methodology based solely on expert panels is tempered by several considerations. Compared with empirically based modeling, panels are administratively cumbersome and relatively expensive to operate. There is the challenge of defining a "representative" panel membership, then successfully appointing a group with the desired mix of clinical expertise, analytical sophistication, experience with the VA, and professional perspective. Some of the data required for the panel's staffing assessments are not collected centrally (at the moment) or are not stored in an automated fashion; in response, additional data would have to be gathered from each VAMC (see chapter 5).

All of this leads the committee to the general policy position enunciated earlier. To determine physician requirements for patient care and resident education, the VA decision maker should rely on the EBPSM to the extent that the modeling assumptions are met; otherwise, substantial weight should be accorded to approaches based on expert judgment or external norms.

DETERMINING PHYSICIAN REQUIREMENTS FOR OTHER MISSION-RELATED ACTIVITIES

For each of these activities (and any residual miscellaneous ones), the principal methodological question that arose with respect to patient care and resident education resurfaces. Should physician FTEE requirements be determined through an empirically based approach, or expert judgment, or external (to the VA) norms, or some admixture of these?

As the discussions in chapters 4, 5, and 6 (especially the latter) indicate, the choice in each case is typically between some form of data-driven FTEE allocation that may or may not be related to current staffing levels, and an expert judgment-derived FTEE allocation that need have no connection to the current level.

To be specific, consider research. One empirically based approach is to "allocate" research FTEE to VAMCs in the future on the basis of current allocations—a type of pass-through arrangement. Another empirically based approach is to allocate these FTEE to VAMCs on the basis of their demonstrated research productivity, perhaps tying the allocations to the volume of research dollars generated in recent years. An alternative, expert judgment approach would distribute these FTEE on the basis of the percentage of time that VA physicians *should* be devoting to research, as appraised by the panels.

A similar problem arises with continuing education. Future FTEE allocations could be based on current FTEE devoted to continuing education. Or, these allocations could be based on the time commitment required to qualify for specialty recertification or other credentials established by the profession—hence, an application of external norms to determining required

FTEE. A third approach would rely on expert judgment to determine the amount of physician FTEE that *ought* to be devoted to continuing education.

RECONCILING THE APPROACHES

As discussed at length in chapter 6, the committee examined four alternative decision strategies for using these staffing approaches, singly or in combination, to derive total physician FTEE, by specialty, required for a given VAMC.

To summarize, the strategies are as follows:

A. For each specialty (e.g., medicine) or program area (e.g., ambulatory care), adopt one dominant approach (e.g., the PF variant of the EBPSM or an expert judgment approach using the SADI).
B. Use two or more approaches in conjunction to derive a range of physician staffing estimates.
C. Use two or more approaches in conjunction to derive a range of physician staffing estimates, whose budgetary and management implications are then examined through various sensitivity analyses.
D. Through some integrative process (e.g., mathematical weighting scheme), combine physician staffing results from two or more approaches to produce either a single FTEE estimate or a range of estimates. The sensitivity analyses proposed in (C) would be pursued as well.

As an overall framework for determining VA physician requirements (given workload and other factors), the committee endorses a variant of (D) in which the major components of physician FTEE are analyzed separately, then combined to produce the total FTEE required, by specialty or program, at the VAMC. This variant of (D) is termed the *Reconciliation Strategy*.

The three components of physician FTEE consist of a major category (labeled simply "X" in chapter 6) that includes all patient care, resident education, administration, and leaves of absence; research; and continuing education. Together, these components are intended to represent a mutually exclusive and exhaustive categorization of how a physician's time is allocated at a VAMC. To execute the Reconciliation Strategy, for a given specialty or program at a VAMC, is to determine for each physician FTEE component:

1. The most appropriate empirically based estimate of FTEE;
2. The most appropriate expert judgment-based (or, alternatively, external norm-based) estimate of FTEE; and
3. The most appropriate relative weight accorded to each in a simple formula (see Equation 6.1) for deriving a recommended FTEE level (or range of levels) for this component.

The calculations are repeated for each of the three FTEE components, the results are summed, and what emerges is total physician FTEE requirements for the specialty or program.

As envisioned, all of these choices, which effectively determine the outcome of the Reconciliation Strategy, rest with the VA decision maker. Put differently, the strategy is basically a framework, or shell, for organizing and analyzing data in a way that facilities policy analysis and decision making.

In the committee's proposed physician requirements methodology, the formulas guide—they do not govern. However, it should be emphasized that they guide in very specific ways. The empirically based and expert judgment-based estimates establish the boundaries of the FTEE range within which the VA decision maker is supposed to choose. The Reconciliation Strategy is intended to be flexible, but it does impose restrictions on the range of FTEE that ought to be recommended.

Regardless of exactly how the Reconciliation Strategy is executed, the resulting FTEE recommendations can be regarded as fair, or equitable, in the following sense: Suppose there were two VAMCs that were similar in all significant respects and suppose the projected workload for each was identical. Then, the Reconciliation Strategy would almost certainly lead to an identical set of physician FTEE recommendations for the two VAMCs. If the projected workloads differed, all else equal, the physician FTEE recommendations would now differ (in the same direction as workload). If, on the other hand, the projected workloads were identical but the two facilities were now assumed to differ in important ways (e.g., resident availability, support staff, affiliation status), the recommended physician FTEE levels would likely differ, also.

In other words, the methodology attempts to treat VAMCs that are equally situated in an equal fashion, while according differential treatment to those that are differently situated. These anticipated outcomes are consistent with the principles of "horizontal" and "vertical" equity, cornerstone concepts in discussions about fairness in economics (Musgrave and Musgrave, 1989).

MANAGEMENT USES OF PHYSICIAN STAFFING MODELS

If the proposed methodology were adopted, the allocation of physician FTEE across the VA system would become more centrally directed. At present, each VAMC determines its own physician staffing levels, both overall and by specialty, subject to constraints established by its centrally assigned budget and ceiling on total personnel.

The committee believes that the methodology has a much greater chance of influencing physician allocation decisions if it is integrated directly into the VA budgeting process, and it recommends (in chapter 7) that this be done.

However, for the methodology to be implemented successfully, and to improve over time, there must be strong channels of communication between VA Central Office and the individual VAMCs, as noted earlier. If facilities have the opportunity, if not mandate, to respond to the methodology's recommendations (before they are implemented), several positive results will follow. More information relevant to physician requirements will be brought to bear than can (or should) be accommodated in any formal model. Better staffing decisions will result than if the methodology were applied mechanistically. Acceptance "in the field" will be greater than if allocations are obviously imposed.

This proposed dialogue is oriented around the interpretation and evaluation of formal models. Such models allow all parties to the decision process to pose important "what if" questions that lead to better policy applications of the models—and to improvements in the models themselves. In chapter 7, the committee discusses how these analyses would be facilitated if the methodology were a part of a larger VA "decision support system" that integrated resource planning and budgeting.

PROJECTING FUTURE VA PATIENT WORKLOAD

Estimates of future physician requirements hinge crucially on estimates of future patient workload. The derivation of these workload estimates is the subject of chapter 8.

The models adopted by the committee for projecting inpatient, ambulatory, and long-term care workload have several noteworthy features:

- In their structure and logic, all three represent adaptations of existing workload projection models used presently in VA strategic planning. The major difference in each case is that workload is expressed here in the form of a "weighted work unit" index (see chapter 4) rather than in terms of patient days or visits, as in the VA models.
- The models presented in chapter 8 explicitly adjust projected workload for anticipated changes in the age structure of the veteran population over time. They could be adapted readily to adjust also for changes in the distribution of the veteran population by gender or eligibility-for-care categories.
- The workload projections derived from these models can be input directly into both the PF and IPF variants of the EBPSM to derive future physician requirements, by VAMC and PCA within each VAMC. Although these workload projections are not *directly* applicable to the expert judgment staffing models, the committee demonstrates how they can be used to obtain indirect estimates of workload at the level of specificity required by the SADI and the DSE.

The precision, specificity, and statistical validity of workload estimates could be improved if they were derived from patient demand functions that allowed the VA to predict system utilization as a function of such factors as veteran income and insurance status, as well as age and gender.

THE VAMC-MEDICAL SCHOOL AFFILIATION RELATIONSHIP

The committee's views on the present and future role of affiliations between VAMCs and non-VA medical institutions are presented in chapter 9.

The committee concludes that the present affiliations "model," which links the VAMC to a medical school in a set of sharing agreements oriented heavily toward tertiary care, continues to bring very positive benefits to veterans. Such relationships appear to improve the recruitment and retention of high-quality physicians and to increase the veteran's access to state-of-the-art tertiary care. These affiliations are also integral to the VA's accomplishing two aspects of its mission—education and research.

At present, 134 of the system's 172 VAMCs are affiliated. Because the committee is convinced that these benefits are substantial, it urges the VA to explore strategies for developing and expanding affiliations. It is understood that establishing a new affiliation is not always easy and requires the conscientious commitment of two complex institutions. However, the committee believes that equity and efficiency would be served if every VAMC were affiliated.

Given the changing demographic structure of the veteran population—with the implied shifts in the nature of patient workload presenting at VAMCs—the committee believes that the VA should develop innovative affiliation arrangements that emphasize patient care, education, and research related to the chronically ill. These innovative models would be oriented around, and give emphasis to, ambulatory and long-term care.

In recommending this, the committee urges the VA not to reduce its commitment to existing affiliation relationships, unless demographic shifts or reductions in patient workload so dictate. Rather, it encourages the VA to nurture affiliations across the board as a primary means for promoting access to high-quality care for veterans.

NONPHYSICIAN PRACTITIONERS AND VA PHYSICIAN REQUIREMENTS

In chapter 10, the committee presents recommendations about the present and future role of four particular types of nonphysician practitioners (NPPs):

physician assistants, nurse practitioners, certified registered nurse anesthetists, and clinical nurse specialists.

- If certain specific changes were made in the way the VA collects FTEE data on NPPs, these providers could be integrated directly into the EBPSM in ways not possible at present. Similarly, both the SADI and the DSE expert judgment models could be modified readily to incorporate NPPs with greater specificity than presently. If these steps were taken, it would be possible to derive physician requirements conditional upon the assumed availability, and productivity, of each type of NPP, using either an empirically based or an expert judgment approach to the computations. Hence, the physician staffing recommendations emerging from the Reconciliation Strategy would be conditional on the assumed distribution of NPPs at the VAMC.
- Continuing education on the use of NPPs should be provided to VA physicians, and to the nonphysician practitioners themselves, on an ongoing basis.
- National guidelines on the use of NPPs should be strengthened where they exist, established where they do not, and updated on a regular basis over time. They should be orchestrated in a way that allows adequate flexibility at the local level for innovation and quality control.
- To promote the development and diffusion of new information about the appropriate use of NPPs, the VA should support research projects that examine the range of activities now performed by these practitioners across the system. The focus should be on innovative uses of NPPs that hold promise for increasing access to care while not compromising quality.

COMMITTEE CONCLUSIONS AND RECOMMENDATIONS

In the report's final chapter, the committee summarizes all of its conclusions and recommendations to the VA. Among these are specific proposals for testing, refining, and extending the physician requirements methodology so that it will improve over time.

In the years ahead, a number of factors affecting the empirical validity of the methodology will change, at varying rates: the mix and acuity level of cases presenting at the VAMCs, medical technology, practice patterns, the scope of services offered by the VA, and the kinds and quality of data relevant to the models. Thus, it is important that the physician requirements methodology not be regarded as a static product; as the VA health care system changes, the methodology must adapt accordingly. The committee believes that its proposed approach is flexible enough to accommodate a variety of alternative scenarios.

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4

The Empirically Based Physician Staffing Models

The underlying premise of this chapter is that empirical observations on the current practice of medicine in the VA can be useful in helping to determine how many physicians the VA should have in order to meet its patient care and physician training commitments.

The basic idea is that statistical models can be developed describing the relationships between patient care workload, physician Full-Time-Equivalent Employees (FTEE) (by specialty and including residents), and other productivity-influencing factors. With data drawn from the current system, these models can be empirically estimated, i.e., their unknown parameters are assigned specific values. From these estimated models, predictions can be derived about the amount of physician FTEE required to meet projected future workload levels. Such analyses can be performed on a specialty-specific basis and at different levels of aggregation—from the hospital-ward level all the way to derivation of national estimates. These statistical models are grounded in the current practice of medicine in the VA and provide a base against which expert judgment models can be evaluated.

Two alternative, yet complementary, variants of what the committee has termed the Empirically Based Physician Staffing Models (EBPSM) will be presented and analyzed in some detail in this chapter. A quick overview follows.

In the production function (PF) variant of the EBPSM, the rate of production of patient workload (e.g., bed-days of care) for a given patient care area (PCA) (e.g., the medicine bed service) at a VA medical center (VAMC) is hypothesized to be related to such factors as physician FTEE allocated expressly to patient care in that PCA; the number of residents, by postgraduate year, assigned to that PCA; nurse FTEE per physician FTEE there; support-staff FTEE per physician FTEE there; and other variables possibly associated with physician productivity in that PCA (e.g., the VAMC's affiliation status).

Each VAMC is divided into 14 or fewer (depending on the scope of services offered) PCAs: inpatient care—medicine, surgery, psychiatry, neurology, rehabilitation medicine, and spinal cord injury; ambulatory care—medicine, surgery, psychiatry, neurology, rehabilitation medicine, and other physician services (including emergency care and admitting & screening); and long-term care—nursing home and intermediate care.

A PF is estimated statistically for each PCA. To derive the total physician FTEE in a given specialty (e.g., neurology) or program area (e.g., ambulatory care) required for patient care at a given VAMC, one must solve for the FTEE required to meet patient workload on each relevant PCA, then sum across PCAs.

In the inverse production function (IPF) variant of the EBPSM, specialty-specific rather than PCA-specific models are estimated. For a given specialty (e.g., neurology), the quantity of physician FTEE devoted to patient care and resident education across all PCAs at the VAMC is hypothesized to be a function of such factors as total inpatient workload associated with that specialty (e.g., total bed-days of care for patients assigned a neurology-associated diagnosis-related group); total ambulatory care workload associated with the specialty; total long-term care workload associated with the specialty; the number of residents in that specialty at the VAMC, by postgraduate year; and other variables possibly associated with physician time devoted to patient care and resident education.

There are separate facility-level IPFs for each of the following 11 specialty groups: medicine, surgery, psychiatry, neurology, rehabilitation medicine, anesthesiology, laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and spinal cord injury. (Included in this latter group are physicians in any specialty who are assigned to the spinal cord injury "cost center" in the VA personnel data system.)

For each specialty, to derive the total number of physicians required for patient care and resident education on the PCAs, one must substitute the appropriate values of workload, resident FTEE, and other control variables into that specialty's IPF, then solve directly for the corresponding physician FTEE level. The statistical confidence limits on the prediction also can be computed directly (which is not possible for the PF-based FTEE estimate, as will be seen).

Both the PF and the IPF deal with only a portion of total physician FTEE at the VAMC, albeit a very important and quantitatively significant portion in each case. The fraction of physician FTEE allocated to patient care only—the focus of the PF variant—will vary by specialty and facility, of course, but it rarely falls below 65 percent and generally lies in the 70-95 percent range (see Table 9.1 in chapter 9). The sum of FTEE devoted to patient care and resident education—the focus of the IPF variant—generally lies in the 80-95 percent range. (The rationale for including both patient care and resident education in the IPF and only patient care in the PF is discussed in the section on Formal Presentation of the EBPSM.)

It follows that, under either the PF or IPF variant, total FTEE required at the facility is the sum of the model-derived estimate plus separate estimates for FTEE components not incorporated in the model. Included in the latter would be FTEE for research, continuing education, and other miscellaneous assignments. The process of deriving total physician FTEE for a given specialty or program area at a VAMC is illustrated below in the section "Using VA Data to Assign Values to Variables."

This chapter is organized as follows: Simplified versions of both the PF and the IPF are presented to explain the intuition behind the workings of both models. The models are then formally stated, and the data used for defining the variables in each model are discussed. Estimated PF models for all 14 PCAs and IPF models for all 11 specialties are reported, with several equations singled out for additional analysis.

Then, the estimated IPF is applied to compare the model-derived physician FTEE level at a given facility in FY 1989 with the actual FTEE found there in that specialty. A similar analysis is performed using the estimated PF equations. Then, for selected PF equations, the model-derived workload at a given facility in FY 1989 is compared with the actual workload generated there. These calculations are performed for four actual (though unidentified) VAMCs. The estimated PF and IPF models are used, alternatively, as the centerpieces of an algorithm to derive facility-specific physician requirements for two selected future years, 2000 and 2005. For illustration, the analyses focus again on the same four VAMCs. In the final section, the committee presents recommendations for future data gathering and statistical analyses by the VA, aimed at improving the models.

Overseeing the development of both variants of the EBPSM was the committee's data and methodology panel, which worked closely with the study's staff and statistical consultants.

HOW THE EMPIRICALLY BASED MODELS WORK

The purpose of this section is to give the statistically oriented, but time-limited reader a basic understanding of the PF and the IPF variants of the EBPSM.

Throughout this section, simplifications are made in two respects. First, the hypothetical statistical models constructed below are smaller and generally simpler than the PF and the IPF equations presented in the next two sections. Second, our interpretations of statistical concepts are somewhat informal and intuitive; at various points, the reader is referred elsewhere for a more rigorous statement of definition or principle.

Nonetheless, most of the methodological issues arising in the larger equations, whether regarding model specification or statistical interpretation, can be well illustrated through the simpler equations.

PF and IPF variants are now considered, in turn, with some concentration on the former to introduce statistical concepts; the choice between the PF and the IPF for this purpose was entirely arbitrary and not intended to suggest a prior preference for one variant over the other.

Anatomy of the PF Variant

In building and testing a statistical model of a behavioral relationship, several steps are involved.

- A prior hypothesis is formed about the nature of the behavioral relationship—a process frequently inspired by a formal knowledge of, or general "feel" for, the relevant data.
- The hypothesis is transformed into a model, which requires both selecting and operationally defining the model's variables, and choosing the model's functional form—that is, a mathematical statement about the way the variables are thought to interact. A model will have one or more parameters; once these are determined, the model is fully determined.
- With the available data, empirical values are assigned to all variables in the model.
- Statistical techniques are used to estimate the model's parameters.
- Both the statistical strength and the theoretical plausibility of the parameter estimates, and of the model as a whole, are noted and a decision is made as to whether to accept the present model as the best available or to continue searching for a better one. Such a search could involve developing new data, specifying additional variables, or trying different functional forms.

For simplicity, in the PF models discussed below, no distinction is made between PCAs or specialties, and the variables are not defined with the specificity required in later sections.

Suppose the prior hypothesis is that the rate of production of patient care workload is positively related to the quantity of physician FTEE, and not related systematically to any other factor.

The choice of variables for the corresponding model is clear: workload (*W*) and physician FTEE (Phys). A functional form must be selected; in the absence of additional information, the simplest choice is a linear relationship. Thus,

$$W = b_0 + b_1 \text{ Phys} + \text{ERROR} \qquad (4.1)$$

where b_0 and b_1 are the parameters to be estimated, and ERROR is a random error term that reflects the net influence of all factors not included in the model. It is a feature of all regression models.

The equation says that workload is a function of one systematic influence—physician FTEE—and a large number of nonsystematic, random influences whose net effect is captured by ERROR. Necessary conditions for Equation 4.1 to be a valid model are that its systematic part be correctly specified, with both Phys (the independent variable) and ERROR meeting certain well-defined conditions.[1]

Suppose there are paired observations on W and Phys from a sufficiently large number of VAMCs.[2] Given Equation 4.1, the aim now is to use these data to determine the best-fit *linear* relationship between W and Phys. The standard statistical technique for doing this is the least-squares method.[3] This can be assumed to lead to the following estimated model, with its accompanying indicators of statistical goodness of fit:

$$W = 6.30 + \underset{(3.41)}{8.42}\ \text{Phys} \qquad \bar{R}^2 = 0.72 \tag{4.1'}$$

where b_0 and b_1 have been replaced by their estimated values, 3.41 is the *t*-statistic indicating the statistical strength of the estimated coefficient above it, and $\bar{R}^2$ is an overall measure of the equation's goodness of fit. The sample size (*N*) of VAMC PCAs used in estimating the equation is often displayed as well; for the PF equations presented later in this chapter, *N* varies from about 80 to 160 depending on the type of PCA. This equation, and the hypothetical data points "used" in estimating it, are pictured symbolically in Figure 4.1.

[1] Basically, it is required that ERROR be a normally distributed random variable, with a mean of zero and a variance that is constant; this implies that the variance cannot vary with either W (the dependent variable), or Phys (the independent variable). (ERROR is normally distributed with these properties if, and only if, the dependent variable W is normally distributed with constant mean and variance.) It is also required that Phys be nonprobabilistic (nonstochastic), that not all Phys values in the sample are the same, and that Phys does not grow or decline in value without limit as the sample size grows (without limit).

For models with more than one independent variable, i.e., multivariate models, it is also required that there be no perfectly linear relationship between any two variables (in fact, among any subset of independent variables).

For a detailed discussion of these conditions, see Kmenta (1986).

[2] Strictly speaking, the number of observations must only exceed the number of parameters being estimated by one. But for stable estimates, a larger sample size than this is required. For a univariate model such as Equation 4.1, analysts typically want at least 20 data points. The larger the number of independent variables, the larger the sample size usually required (Kmenta, 1986).

[3] The best-fit model under the least-squares method has the following defining property: It minimizes the sum of the squared deviations between the actual values of W and the corresponding model-predicted values of this dependent variable.

To explore this, refer to Figure 4.1. For the *i*th value of physician time (Phys_i), there is a paired observation on workload (W_i), and a model-predicted workload value $(\hat{W}_i)$. The model error for this *i*th case is defined as $(\hat{W}_i - W_i)$. This term is squared to get $(\hat{W}_i - \hat{W}_i)^2$ This is repeated for all *N* observations; then the *N* squared terms are summed. The *least-squares regression line* is the particular line so positioned that it forces this sum of squares to be as small as possible. The formulas for the least-squares regression method use the data to compute parameter estimates—call them $\hat{b}_0$ and $\hat{b}_1$ and $\hat{b}_0$ and $\hat{b}_1$, that effectively achieve this positioning (Kmenta, 1986).

Of the two estimated coefficients, the more important by far is $\hat{b}_1 = 8.42$ Given the positive algebraic sign on this estimate, it can be interpreted as follows: for a small increment (decrement) in physician FTEE (ΔPhys), workload can be expected to increase (decrease) by (8.42 × ΔPhys). That is, (8.42 × ΔPhys) = ΔW, which implies that (Δw/ΔPhys) = 8.42 is the slope of the PF in Figure 4.1. For example, if W was defined in terms of patient days generated per day in the PCA, the addition of one full-time physician is expected to increase workload production by 8.42 patient days per day.

Thus, 8.42 can be viewed as the productivity multiplier that transforms changes in physician FTEE into changes in the rate of workload production. It can be shown that as ΔPhys decreases (in absolute value) and as these physician FTEE levels more closely approach the sample mean of Phys, the statistical reliability of this multiplier increases.

Roughly speaking, the larger the *t*-statistic in absolute value, the greater the statistical strength of the estimated coefficient; the absolute-value proviso is required since *t* and the estimated coefficient take on the same sign, which can be negative. A common rule of thumb is that an estimate is significant if its *t*-statistic is about 2.00 or greater in absolute value. However, there is no unconditional rule for determining how large *t* must be for the estimate to be declared statistically significant. Under common rules of thumb, *t*-statistics ranging from about 1.7 to 2.6 (in absolute value) may be taken to indicate that the associated coefficient estimate is statistically significant.[4]

The overall goodness-of-fit measure $\bar{R}^2$ is a statistic, taking on values between 0 and 1, indicating the fraction of the total variation in the dependent variable

[4] More typically, a t-statistic such as that shown in Equation 4.1' is used to test the null hypothesis that its associated coefficient (b_1) is different from 0 (sometimes referred to as a two-tail test of significance). For a given value of this statistic (t^*), one rejects the hypothesis that $b_1 = 0$ with a certain degree of statistical confidence (c^*) stated in percentage terms. The larger that t^* is, the larger is c^*, all else equal. For example, if a sample size of about 30 or greater is assumed, a value of $t = 1.96$ allows one to reject the hypothesis that $b_1 = 0$ with about 95 percent confidence; if $t = 2.58$, c is about 99 percent. If the null hypothesis is rejected, then $\hat{b}_1$ is declared statistically significant and used as the (least-squares) estimate of b_1 (Kmenta, 1986).

In some cases it may be more reasonable to test the null hypothesis that $b_1 = 0$ against the alternative that $b_1 > 0$ (referred to as a one-tail test of significance). In that case, a value of $t = 1.65$ allows one to reject the hypothesis that $b_1 = 0$ with 95 percent confidence.

In sum, whether a given t value is interpreted to indicate "statistical significance" depends on the confidence level chosen, the sample size used to estimate the model, and whether a two-tail or one-tail test is selected. (For additional commentary on this issue, see footnote 10 in this chapter.)

that can be "explained" by variation in the independent variable(s).[5] The larger the $\bar{R}^2$ is, the better is the equation's fit of the data. A value of 1.00 would indicate that the model accounts perfectly for variations in the dependent variable; in this case, all data points would fall on the estimated line. In Equation 4.1', the variation in Phys is found to explain 72 percent of the variation in W.

Although no estimate for ERROR is shown, "observations" on this random component are also generated and play an important role in assessing whether the assumptions made about ERROR (see footnote 3) appear to hold (see "Estimated PF and IPF Equations," below). For the *i*th physician FTEE value, there is a corresponding W_i and a model-predicted $\hat{W}_i$. The difference between these two is termed the *i*th residual. Taken together, these residuals can be regarded as observations generated from the random variable, ERROR. If the assumptions about ERROR hold, these residuals should have a random appearance, that is, no discernible patterns or trends.

Of obvious importance is that Equation 4.1' can be used to derive physician requirements for patient care at a given VAMC. If a projected workload for the VAMC of 100 units per time period is substituted into the equation, such that

$$100 = 6.30 + 8.42 \text{ Phys}$$

then

$$\text{Phys} = 11.13 \text{ FTEE}$$

Next, some PF alternatives to Equations 4.1 and 4.1' are considered. These would be motivated in each case by data points that appear differently configured than those in Figure 4.1.

Suppose that there is an evident nonlinear relationship between physician FTEE and workload—in particular, that W rises with increases in Phys, but at a decreasing rate. This case of "diminishing marginal productivity" of physician

[5] More precisely, $\bar{R}^2$ represents a modification of the traditional goodness-of-fit measure (R^2) in order to adjust for the number of independent variables included in the model. It can be shown that R^2 always rises as the number of explanatory variables is increased, irrespective of the strength of their contributions. A new variable increases $\bar{R}^2$ if and only if its associated *t*-statistic exceeds 1 in absolute value. For the formulas to compute $\bar{R}^2$, see Kmenta (1986).

Many analysts advocate choosing the model specification that maximizes $\bar{R}^2$, on two grounds. The criterion is easy to use and simple to interpret. More important, it can be shown that choosing on this basis is equivalent to choosing the model that has minimum mean-squared error; the latter is defined as the expected value of the square of the difference between the estimated parameter value (here, $\hat{b}_1$) and then its true value (b_1) (Kmenta, 1986).

time is shown in Figure 4.2. A possible (though again hypothetical) estimated regression equation corresponding to this result is

$$W = 1.26 + \underset{(2.43)}{9.78\,\text{Phys}} - \underset{(-2.12)}{0.20\,\text{Phys}^2} \qquad \bar{R}^2 = 0.84 \qquad (4.2)$$

where the nonlinear relationship is modeled as a quadratic equation in which W reaches a maximum for some Phys value, then diminishes absolutely beyond that.

In geometric terms, the function pictured is an inverted parabola, with only the rising portion of the curve relevant to the data likely generated in the "real world" practice of medicine. That is, for sufficiently large values of Phys (not shown in Figure 4.2), the equation would indicate that workload *declines* with increases in physician FTEE.

As portrayed, the coefficient estimates for both the linear and the quadratic terms are statistically significant. If, on the other hand, the estimate for Phys had been significant whereas the estimate for Phys^2 had not been, the hypothesis of a linear relationship would have been sustained.

The derivation of physician requirements from Equation 4.2 is illustrated by again setting $W = 100$ and solving the resulting quadratic relationship; the clinically relevant solution is Phys = 14.30.

Next, a multivariate regression model is considered, in which the rate of workload production depends on more than physician FTEE, for example, also on whether the VAMC is affiliated with one or more non-VA health care institutions. To accommodate this analysis, a data set enlarged to include a variable labeled "Affil" is required. If a VAMC is affiliated, Affil = 1; otherwise, Affil = 0. (That there may be different degrees of affiliation is thus ignored here.)

The use of such categorical (or dummy) variables is quite common in regression analysis. As can be seen in the following three sections, multivariate models can include any combination of continuous variables (such as Phys) and categorical variables.

The simplest hypothesis here, portrayed in Figure 4.3, is that affiliated and unaffiliated VAMCs have PFs that differ only by a parallel shift; that is, for any value of Phys, the difference between the workload rates at the two types of VAMCs is a constant; the physician productivity multiplier (the slope) is the same in both cases. Thus, it is posited that there is something about being affiliated that raises, or lowers, a VAMC's overall productivity, but does not affect the *marginal* effect of physicians on workload.

A hypothetical equation that, in conjunction with Figure 4.3, portrays these assumptions is

$$W = 2.12 + 7.20\ \text{Phys} + 27.46\ \text{Affil} \quad \bar{R}^2 = 0.88 \tag{4.3}$$
$$\qquad\qquad (1.98) \qquad\quad (2.79)$$

which indicates that affiliated VAMCs are more productive, all else equal. The committee emphasizes that this is merely an illustration with no policy implications intended or possible; how the actual effect of affiliation status on productivity and physician requirements can be inferred is discussed later in the chapter.

The amount of physician FTEE required to meet workload at a VAMC now depends on whether it is affiliated. If Affil = 1 in Equation 4.3, the FTEE required to produce W = 100 is 9.78; if Affil = 0, the required value of Phys is 13.59 FTEE.

An interesting alternative hypothesis is that affiliation status affects both the VAMC's overall productivity level (for any value of Phys) and the physician productivity multiplier. Such a situation is shown symbolically in Figure 4.4 and reflected in the following (hypothetical) estimated equation:

$$W = 3.91 + 8.10\ \text{Phys} + 28.92\ \text{Affil} - 1.80\ (\text{Phys} \times \text{Affil}) \quad \bar{R}^2 = 0.91 \tag{4.4}$$
$$\qquad\qquad (2.14) \qquad\quad (1.99) \qquad\quad (-2.44)$$

where the net impact of affiliation on productivity involves the resolution of two effects. Although the direct-effect variable (Affil) is still positive and significant, the interaction-term variable (Phys × Affil) is negative and significant. Regarding the influence of the latter, if a VAMC is unaffiliated, Affil = 0 and thus is also the interaction-term variable; the physician productivity multiplier remains 8.10. But for an affiliated facility, with Affil = 1, the multiplier is effectively reduced to (8.10-1.80) = 6.30.

It can be shown that whether affiliation status is associated with higher productivity on net—that is, whether for a given Phys value, W is greater for an affiliated VAMC—depends here on the absolute level of Phys. This is evident from Figure 4.4.

Based on Equation 4.4, the physician FTEE required to produce $W = 100$ for an affiliated facility is 10.66, whereas it is 11.86 for an unaffiliated VAMC.

Anatomy of the IPF Variant

The PF and the IPF are potentially complementary constructs. Each yields a well-defined answer to a well-defined question, though not the same question. The PF seeks to identify factors associated with the production of patient workload in each PCA of the VAMC. If a variable does not make an independent contribution to explaining overall productivity, it will not merit inclusion in the PF, at least by conventional statistical criteria.

For each specialty, the IPF seeks to identify factors associated with the total amount of physician FTEE devoted to patient care and resident education across all PCAs at the VAMC. The volume of patient workload at the facility, especially on PCAs where the specialty is active, is a likely explanatory factor. But it need not be the only such factor; and if it happened not to be statistically significant, the IPF might still prescribe a positive amount of physician FTEE for the VAMC.

Two related features of the IPF become evident in later sections. First, compared with the PF variant, deriving physician requirements through the IPF is computationally more straightforward. Second, statements of statistical confidence, often summarized in terms of "prediction intervals,' can be computed around the IPF's best estimate of physician requirements; this is not possible with the PF, which permits instead the computation of prediction intervals around the level of workload that a given physician FTEE level (in conjunction with other factors) is expected to produce.

The following simplified and hypothetical IPF specifications are structurally so similar to the PF equations above that the presentation can be relatively compact.

The simple hypothesis that physician FTEE is linearly related to workload is depicted in Figure 4.5 and by the estimated equation

$$\text{Phys} = -0.84 + \underset{(2.34)}{0.09\,W} \qquad \bar{R}^2 = 0.61 \tag{4.5}$$

which can be compared with Equation 4.1' to make an important point: Regression theory does not permit one to derive one estimated equation from the other by simple algebraic manipulation. That is, if one solves Equation 4.1' for Phys in terms of W, the result is *not* Equation 4.5 (Kmenta, 1986).

Equation 4.5 serves to reemphasize another point: Drawing inferences from a regression can be precarious for independent-variable values lying far outside the sample range. A negative quantity of physician FTEE is predicted for values of W less than 9.3, but is of no practical relevance if workload observations in the sample—all in the range, say, of 60 through 110—are representative of VAMC workload levels generally.

From Equation 4.5, the quantity of physician FTEE required for patient care and resident education at a VAMC for which $W = 100$ is equal to -0.84 + 0.09(100) = 8.16.

An alternative hypothesis—that as workload increases, physician FTEE requirements increase at an increasing rate—is illustrated in Figure 4.6 and in the following hypothetical estimated equation:

$$\text{Phys} = 1.34 + \underset{(2.01)}{0.08\,W} + \underset{(2.38)}{0.0001\,W^2} \qquad \bar{R}^2 = 0.69 \tag{4.6}$$

On the other hand, the hypothesis of a linear relationship would have been sustained had the estimated coefficient of W^2 not been statistically significant.

If projected workload at a VAMC is again 100 units, Equation 4.6 implies that the physician FTEE required for patient care and resident education is 10.34.

The (illustrative) hypothesis that less physician time is required in response to any given workload level in an affiliated VAMC, compared with an unaffiliated facility, is depicted in Figure 4.7 and in the following equation:

$$\text{Phys} = 2.98 + \underset{(2.13)}{0.085\,W} - \underset{(-2.77)}{4.80\,\text{Affil}} \qquad \bar{R}^2 = 0.72 \tag{4.7}$$

where the marginal (incremental) relationship between workload and physician FTEE, as captured in the estimated coefficient on W, is assumed to be the same for both types of facilities.

To produce workload at a rate of W = 100, an affiliated VAMC would require 6.68 physician FTEE, according to Equation 4.7, whereas an unaffiliated VAMC would require 11.48 FTEE.

An IPF specification that depicts, hypothetically, the results from testing this assumption directly is shown in Figure 4.8 and in the following equation:

$$\text{Phys} = 2.79 + \underset{(2.07)}{0.045\,W} - \underset{(-2.22)}{1.444\,\text{Affil}} + \underset{(2.43)}{0.025\,(W \times \text{Affil})} \qquad \bar{R}^2 = 0.84 \tag{4.8}$$

This equation implies that in an affiliated VAMC the marginal effect of small changes in workload on physician requirements (for patient care and resident education) is transmitted through a multiplier of 0.045. But if a facility is affiliated, so that Affil = 1, the multiplier becomes (0.045 + 0.025) = 0.07, which implies lower efficiency *on the margin*. As with Equation 4.4, whether an affiliated VAMC is more, or less, productive overall than an unaffiliated VAMC will depend on the net effect of the direct-effect and interaction terms, in concert, and hence will depend on the value of W at which the assessment is made.

Using W = 100, it can be found from Equation 4.8 that an affiliated facility requires 8.35 physician FTEE, whereas the requirement in an unaffiliated VAMC is 7.29.

Implicitly assumed in all of these examples is that the quality of care, however defined, does not vary significantly across the sample—that is, units of W are of comparable quality across VAMCs and for all rates of production. In addition, if these estimated models are to be used prescriptively to derive physician requirements consistent with high-quality care, it is necessary that paired sample observations on W and Phys reflect the delivery of high-quality care (or else that adjustments be made, perhaps statistically, to attempt to compensate for the assumption not being met).

In subsequent sections, these assumptions, which are important not only in the present study but in all manpower planning analysis, are discussed. However, rarely have such analyses confronted the quality question explicitly and rarely have practical solutions been suggested for dealing with it. Clearly, it represents a major challenge.

FORMAL PRESENTATION OF THE EBPSM

In this section, the general forms of the PF and the IPF variants of the EBPSM are presented. The focus is primarily on behavioral assumptions, with their statistical implications, and the selection and operational definition of variables.

The discussion represents a natural extension of the ideas in the preceding section, with larger, more realistic specifications of the PF and the IPF replacing the simplistic equations there. The statistical modeling points covered in the preceding section apply throughout this chapter and will be restated only when they illuminate the current discussion. Again, the presentation is built around one model variant, and then (once the notation and definitions are established) the presentation proceeds more rapidly through the second. The decision to examine the PF first does not itself imply any committee preference between the two variants.

Production Function

A PF approach to determining VA physician requirements for patient care rests on the following related ideas. The rate at which a VAMC "produces" patient care in a given domain (i.e., a PCA) depends on how it chooses to combine a number of inputs, including staff physicians, residents, nurses, support staff, and nonpersonnel factors such as supplies and capital equipment. In fact, there may be alternative combinations of these inputs capable of producing workload at the same rate (and quality-of-care level).

Hence, to derive the quantity of staff physician FTEE required in a given setting, one must know or have estimates of the PF itself, the workload to be produced, and some rule (or algorithm) for jointly selecting the desired combination of physician and nonphysician inputs.

There is a substantial literature in economics on PF specification and estimation, with notable applications to hospital care (Jensen and Morrisey, 1986a,b; Pauly, 1980; Feldstein, 1967), physician services (Reinhardt, 1975), and dentistry (Scheffler, 1981; Kushman et al., 1979; Scheffler and Kushman, 1977; Maurizi, 1969). Those applications and the PFs specified in this study are broadly similar in that output (workload) is related to inputs, while controlling for factors (e.g., age of practitioner or, in this case, VAMC affiliation status) that may impinge on the productivity of one or more inputs.

But the PF equations developed here do differ from earlier ones in some respects:

- One distinction is that these PF models are estimated by PCA, whereas the hospital studies cited are all facility-specific and the ambulatory care-oriented studies are all practice-level (or firm-level) specific. Hence, the PF models here arguably offer a better vehicle to control for case-mix variations than these more highly aggregated production models; those studies above that did attempt to adjust for case mix had to employ relatively indirect approaches (e.g., Feldstein's use of a case-proportions vector as a control-variable device).
- A more fundamental distinction, however, concerns the structure of incentives and resulting implications for organizational behavior. Specifically, all of the earlier analyses were set in the private sector, and cost minimization was assumed (sometimes implicitly) to be a necessary condition for the provider organization to achieve its goal (which typically was profit maximization). This, in turn, implies the assumption that the organization being modeled is operating at maximum production efficiency; given whatever level of inputs is chosen (for economic reasons), the resulting output rate is the maximum attainable. And, in theory, the input and output rates are jointly determined.

It can be shown that these assumptions, taken together, have troubling implications for the estimation of PFs of the type represented in Equations 4.1' through 4.4 by the traditional least-squares method.[6]

On the other hand, a VAMC is a public-sector organization charged with a multi-objective mission, but maximizing profits is not one of them. Rather, it is assumed that each VAMC attempts to meet its patient care mission in a way that balances several concerns: that eligible veterans are treated in a timely

[6] Specifically, without further assumptions, the coefficient estimates will be both biased and "inefficient," as will predictions of physician requirements.

The coefficient estimates are biased because the simultaneity of input and output determination means that the error term will be correlated with one or more independent variables. In terms of Equations 4.1' through 4.4, this means ERROR will not be independent of Phys, as required (see note 1). The fact that such PFs are assumed to indicate the *maximum* rate of output for given inputs means that ERROR will not be normally distributed, resulting in a loss of precision (i.e., excess variance) in the coefficient estimates.

Not surprisingly, economists have been able to construct assumptions under which these (single-equation) PFs for the profit-oriented firm can be estimated without bias and loss of statistical precision (Reinhardt, 1975). In practice, these assumptions are typically invoked, sometimes implicitly, without much testing.

manner; that the quality of care be acceptable; and that budget, other resource, and administrative constraints be met. Consistent with this, it is assumed for the PF analysis that a VAMC adjusts inputs and workload in a step-sequence process: Subject to resource and budget availability, the VAMC sets input levels for each fiscal year in accordance with projected workload. Then, in the course of the year, it attempts to modulate (up or down) the rate of workload so that a clinically acceptable relationship is maintained between workload and inputs. The net result is that certain problems of bias and inefficiency that threaten PF estimates from the for-profit sector should not be similarly expected here.[7]

• For several technical and economic theory reasons, all the PF analyses cited earlier except those by Jensen and Morrisey (1986a,b) found it useful to impose certain *a priori* restrictions on the functional (or mathematical) relationship among inputs. This usually serves to simplify the examination of such technical issues as the relative substitutability among inputs and whether or not there are scale economies in production.

Like Jensen and Morrisey, however, the committee elected not to impose arbitrary mathematical restrictions on the form of the PF. Rather, the approach here is to choose the functional representation of the variables yielding the best-fit, clinically sensible relationship between workload and the factors that produce it. The estimated models presented in this chapter have what Jensen and Morrisey term a "flexible functional form," which allows exploration of the usual technical questions with few mathematical restrictions.

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[7] In the language of microeconomics, these behavioral assumptions are *consistent with* either of the following alternative, and more rigorous, characterizations of the VAMC's "objective function":

(1) that the facility attempts to maximize the quality-of-care, subject to the constraints that (a) all of the presenting eligible workload must be treated and (b) budgets must not be exceeded; or

(2) that the facility attempts to minimize the cost of providing care, subject to the constraints that (a) all of the presenting eligible workload must be treated and (b) inputs are used at levels associated with achieving (or exceeding) minimum quality-of-care standards. In fact, this second characterization is explored experimentally in chapter 7 in the subsection entitled, "Choosing an Optimal Specialty Mix of VA Physicians Through Linear Programming."

Although there is an expectation that VAMCs will produce patient care services with high technical efficiency, the incentives to do so may be weaker than in the private sector (though they have been strengthened in recent years). A recent application of data envelopment analysis indicated that about one-third of all VAMCs were not delivering patient care with maximum cost-efficiency (Sexton et al., 1989).

Although a substantial part of this variability may be attributable to differences across VAMCs in the commitment to teaching and research (which affects the relative amount of staff physician time available for patient care), the end result is the following: in a given sample of VAMCs, variation can be expected in the efficiency with which inputs are transformed into output. Even if this study's PFs were to include variables to control for differences in teaching and research, considerable variability still could be expected across VAMCs in the rate of workload, given any fixed set of input levels.

The PF variant of the EBPSM is presented below in the general form endorsed by the committee. For some of the variables, data are not available presently on a systemwide basis, and they could not be tested for inclusion in the models. Still, as a basis for comparison and a guide for future work, the complete model is:

$$W_{ij} = f[\{StaffPhys_{ij}\}, \{ConPhys_{ij}\}, \{Res_{ij}\}, C\&A_{ij}, WOC_{ij}, \{NPP_{ij}\}, Nurse_{ij}, Support_{ij}, Prodfact_{ij}, ERROR_{ij}], \quad (4.9)$$

where

W_{ij}	=	the annual rate of production of workload in PCA *j* of VAMC *i*;
$\{Staffphys_{ij}\}$	=	a set of variables, each of which takes the form $Staffphys_{ijk}$ = the amount of FTEE allocated to direct patient care in PCA *j* of VAMC *i* for staff physicians based in cost center *k*, where each *k* corresponds to one of the 11 specialty groups examined here in detail;
$\{ConPhys_{ij}\}$	=	a set of variables for physicians under contract to VAMC *i*, such that $ConPhys_{ijk}$ = the contract physician FTEE from specialty *k* devoted to PCA *j*;
$\{Res_{ij}\}$	=	a set of variables to account for the net productive contribution of residents, with each variable of the form Res_{ijy} = the amount of postgraduate year *y* resident FTEE allocated to PCA *j* at VAMC *i*;
$C\&A_{ij}$	=	for non-VA physicians who perform consulting and attending duties on a fee-for-visit basis, the amount of FTEE allocated to PCA *j* at VAMC i;
WOC_{ij}	=	for non-VA physicians who perform consulting and attending duties without (monetary) compensation, the amount of FTEE allocated to PCA *j* at VAMC *i*;
$\{NPP_{ij}\}$	=	a set of variables, each of the form NPP_{ijm} = the amount of FTEE of nonphysician practitioner type *m* (e.g., physician assistant) assigned to PCA *j* at VAMC *i*;

$Nurse_{ij}$	=	the amount of nursing service FTEE allocated to PCA *j* at VAMC *i*;
$Support_{ij}$	=	for all personnel categories excluding physicians and nurses (and, as appropriate, also excluding psychologists and social workers), the total FTEE allocated to PCA *j* at VAMC *i*;
$Prodfact_{ij}$	=	one or more variables for factors (e.g., capital equipment) influencing the productive efficiency of physicians and other providers in PCA *j* at VAMC *i*;
$ERROR_{ij}$	=	the random-error term for PCA *j* at VAMC *i*, assumed to obey the assumptions discussed in the preceding section and footnote 1.

In the section musing VA Data to Assign Values to Variables,' how each of these variables is operationally defined is discussed.

Each VAMC will have up to 14 distinct PCAs, including six inpatient, six ambulatory, and two long-term care.

Inverse Production Function

Several questions about the IPF naturally arise. How does it differ from the PF? What behavioral assumptions underlie the IPF, and what do these imply about the statistical specification of the IPF? Why pursue both the PF and the IPF? These questions are considered in turn.

In the PF variant, the basic question is: What factors account for the production of patient care workload? In the IPF, the basic question is: What factors account for the observed level of staff physician FTEE?

The IPF's underlying assumption is that the amount of physician FTEE from a given specialty required for patient care and resident education is a function of the volume of patient care workload to be produced, the number of residents to be taught on the PCAs, and possibly other factors influencing the relationship between workload, resident education, and staff physician requirements.

From a cause-and-effect standpoint, the basic behavioral assumption in the IPF variant (in contrast with the PF) is that the VAMC adjusts physician FTEE levels in response to a given projected workload level, controlling for other factors. Thus, the volume of workload per time period cannot be significantly modulated (i.e., it is "exogenously" determined by demand-influencing factors beyond the VAMC's control).[8]

In concept, an IPF can be estimated for each specialty-PCA combination (e.g., for neurology requirements on the inpatient medicine PCA), or for each specialty on a facility-total basis by aggregating across PCAs (e.g., for neurology requirements for all 14 PCAs combined). However, efforts to estimate PCA-specific IPFs for each specialty produced equations frequently exhibiting poor goodness of fit and coefficient estimates whose algebraic signs were counterintuitive. Hence, the focus in this study is exclusively on facility-level IPFs, whose aggregated FTEE observations yield more reliable estimates.

Both the PF and the IPF are pursued because each variant has its strengths and drawbacks, conceptually and statistically, and because together they can play complementary roles in helping the VA decision maker determine appropriate staffing. The first point becomes increasingly evident in subsequent sections. The second point is examined specifically in the section, "Estimated PF and IPF Equations," through a demonstration application; it is further evaluated in chapters 7 and 11.

The general form of the IPF variant of the EBPSM is:

$$\text{StaffPhys}'_{ik} = g[\{W_{ik}\}, \{\text{Res}_{ik}\}, \{\text{NPP}_{ik}\}, \text{Prodfact}_{ik}, \text{ERROR}_{ik}] \qquad (4.10)$$

where

$\text{StaffPhys}'_{ik}$	=	across all PCAs at VAMC *i*, the total amount of specialty *k* staff physician and contract physician FTEE devoted to patient care and resident education;
$\{W_{ik}\}$	=	a set of workload variables, each of the form W_{ijk} = the level of workload on PCA *j* of VAMC *i* associated with specialty *k*;
$\{\text{Res}_{ik}\}$	=	a set of variables, each of the form Res_{iky} = the amount of postgraduate year y resident FTEE at VAMC *i* in specialty *k*;
$\{\text{NPP}_{ik}\}$	=	a set of variables, each of the form NPP_{ikm} = the amount of FTEE of nonphysician practitioner type *m* associated with the PCA-related activities of physicians in specialty *k* at VAMC *i*;

[8] That the PF and IPF have different underlying assumptions does not in any way constitute an *empirical* contradiction. Every model has, by definition, its defining assumptions; and the PF and IPF are models offering alternative perspectives on the same underlying production process.

Prodfact_{ik}	=	one or more variables for factors influencing the productive efficiency of specialty *k* physicians at VAMC *i*;
ERROR_{ik}	=	the random-error term for specialty *k* at VAMC *i*.

Originally, the general specification of the IPF also included variables for nurse and support staff. But after a number of statistical analyses, it became clear that the physician-substitutive role these providers are hypothesized to play could not be modeled adequately at the facility level. Rather, the PCA is the more appropriate level of aggregation for studying these relationships in the production of workload.

One additional distinction between the IPF and the PF lies in the scope of what is included in the physician FTEE variable. In the IPF, an attempt is made to account for all physician FTEE devoted to VA mission-related activities across PCAs. Patient care and resident education typically dominate these activities. (Because the PCA-related part of research FTEE cannot be separated from total research FTEE in the current data systems and because most research occurs off the PCAs, research is excluded from the IPF equation; to derive total physician FTEE through an IPF (or a PF) approach, research FTEE must be incorporated in a separate step.) Hence, the dependent variable in Equation 4.10 incorporates all patient-care-designated FTEE (including physicians under contract) plus FTEE allocated to resident instruction.

Since the PF attempts to account for the distinct factors involved in producing workload, it is the workload-producing component of physician FTEE—namely, the part allocated to direct care in the data system—that is the most appropriate basis for defining the variable StaffPhys in Equation 4.9. Some early versions of the PF in which StaffPhys was defined as the sum of FTEE for patient care and resident education did not perform as well statistically as similar specifications with StaffPhys based on patient care FTEE only. (This may have been due to multicollinearity induced by a positive correlation between physician FTEE for resident education and the RES variables.) Moreover, when the direct-care and resident-education parts of physician FTEE were run as separate variables in PF equations for various PCAs, the former was invariably significant and the latter was almost never significant. In fact, the same was also true in all PF equations where staff physician FTEE for direct-care and contract-physician FTEE (ConPhys) variables were entered together. Hence, in the PF models presented below, StaffPhys always appears in some form, whereas neither ConPhys nor a variable for FTEE devoted to resident education merits entry.

USING VA DATA TO ASSIGN VALUES TO VARIABLES

For the PF or the IPF to be implemented, these variants of the EBPSM must in fact be given their empirical base. In this section, the use of VA data to assign values to the variables in Equations 4.9 and 4.10 is described. A number of internally developed VA data sets were employed.

Although the data proved adequate for operationalizing the variables of greatest importance *a priori*, facility-specific information was not available systemwide on certain others: non-VA consulting physician FTEE, nonphysician practitioner FTEE at the PCA level, and such PCA-specific measures of Prodfact as the volume and mix of capital equipment. These variables are thus omitted from the estimated equations reported in the next section.

In what follows, reference is often made to several components of the VA's national data system, but there is no attempt to provide the VA with a comprehensive overview of its own information sources. Rather, the focus is on aspects pertinent to the construction of the variables.

For reasons discussed below, all variables—and thus all estimated equations—are defined in terms of FY 1989 data.

Workload

It is useful to consider, in turn, each of the three major type-of-care areas: inpatient care, ambulatory care, and long-term care.

Inpatient Care

For the PF variant, six PCAs, corresponding to the six major inpatient bed sections defined within the VA data systems, have been delineated: medicine, surgery, psychiatry, neurology, rehabilitation medicine, and spinal cord injury. For each PCA, we built upon existing VA data analyses to define three alternative workload variables: *Discharges/Year, Bed-Days of Care/Year*, and an annualized cost-weighted, case-mix-adjusted variable called the *Weighted Work Unit* (WWU) score.

The data source for all three is the VA Patient Treatment File (PTF), which contains a hospital discharge abstract on every patient discharged from a VA facility (or from a non-VA facility where the VA was the payer). Each abstract contains sufficient information to assign the patient's discharge to a primary bed section, and hence PCA, and to allocate the patient's total bed-days for each stay to the PCA(s) where treatment was rendered.

Suppose, for example, a patient spent the first five days on a medicine ward, the next seven days on a surgery ward, six additional days on a medicine ward, and then was discharged. As a result, a total of 11 bed-days would be assigned to the inpatient medicine PCA, seven bed-days to the inpatient surgery PCA, and one discharge to the inpatient medicine PCA.

The assignment of WWU scores to patients is more complex and is best illustrated by a pair of examples:

- Suppose a patient is admitted to the medicine service, stays six days, and then is discharged from the facility. On the basis of the patient's primary diagnosis and other information in the PTF, the stay is assigned a diagnosis-related group (DRG) category. This category will already have associated with it a weight based on the VA national average direct cost of treating patients in this DRG relative to all other DRGs. If the patient's length of stay (in this case, six days) happens to be neither exceptionally short nor long for this DRG, this cost weight (after being normalized) *becomes* the patient's WWU score. For purposes of this study, it is assigned to the facility's inpatient medicine PCA and becomes one small piece of this VAMC's cumulative annual "medicine WWU" score. For very short stays (typically below the 2nd percentile), a smaller weight than this would be assigned; for stays beyond the 98th percentile, the weight would be increased, though not in proportion to the extra days in the facility. (These percentiles are not theoretically derived, but reflect merely a VA policy decision regarding outliers.)

  WWU scores are normalized so that a score of one is assigned to an admission whose direct cost equals the VA national average direct cost for inpatient admissions. These normalized scores range from about 0.17 (nasal trauma and deformity) to about 13.01 (heart transplant) per admission.

  Most VA inpatient stays do involve only one bed section, and thus PCA; but when this is not the case, the accounting becomes more intricate.
- Consider again the patient who was admitted to the medicine service, then transferred to surgery, then transferred back to medicine, then discharged from the facility. Suppose, as is sometimes the case, the patient's primary diagnosis changes upon each transfer. Then, the following workload data are generated: the patient's first, five-day stay in medicine is assigned a DRG, and thus a medicine WWU score; the seven-day stay in surgery gets a DRG and a surgery WWU score; and the six-day transfer back to medicine is assigned a DRG and a medicine WWU score.

The sum of the medicine WWU scores is assigned, for purposes here, to the inpatient medicine PCA and becomes part of this facility's cumulative medicine WWU total for the year. Similarly, the surgery score is assigned to the inpatient surgery PCA and adds to the facility's cumulative annual surgery WWU total.

In this way, the "raw materials" are derived for generating observations on W_{ij} in Equation 4.9 and W_{ijk} in Equation 4.10. For the PF equations, workload is defined in terms of the annual sum of *all* WWU scores linked to PCA *j*.

However, in each PF equation, the dependent variable actually used was not the workload index itself, but rather the natural logarithm of workload, plus 1. The purpose of this log transformation is to generate a dependent variable that is approximately normally distributed, as required by the assumptions of the least-squares statistical model (see footnote 1).

Let w_{ij} be the direct sum of all medicine, surgery, psychiatry, neurology, and rehabilitation medicine WWUs generated in inpatient PCA *j* of VAMC *i*. The corresponding dependent variable for *j*'s PF is $W_{ij} = \text{In}[w_{ij} + 1]$. [The addition of 1 is required simply to ensure that W_{ij} is well-defined even when $w_{ij} = 0$.]

Regarding the IPF, the workload variables used in the final equations are not, in fact, PCA-specific, but specific rather to the three type-of-care areas—inpatient, ambulatory, and long-term care (LTC). For specialty *k*'s IPF, the relevant notation for workload variables becomes W*i*, Inpatient, *k*' W*i*, Ambulatory, *k*' and W*i*, LTC, *k*'

For each IPF, one must determine which inpatient PCAs are appropriate for computing W*i*, Inpatient, *k*' and likewise for the ambulatory care and long-term care workload variables.

For a specialty such as medicine, which has its own inpatient PCA, inpatient WWU is equivalent simply to the sum of medicine WWU across all inpatient PCAs; this also applies, of course, to the IPF equations for surgery, psychiatry, neurology, and rehabilitation medicine.

For a specialty such as nuclear medicine, which has no direct PCA identification, the PCA scope of the inpatient WWU variable must be defined. In this case, the inpatient WWU variable was constructed as the sum of all medicine, surgery, and neurology WWUs generated in the facility's five inpatient PCAs. Similarly, inpatient WWU definitions were developed for the IPFs estimated for anesthesiology, laboratory medicine, diagnostic radiology, and radiation oncology.

For the spinal cord injury PF, the required PCA-specific WWU score is defined as the sum of all inpatient WWU scores (in medicine, surgery, and so on) linked expressly to the spinal cord injury (SCI) PCA. For the SCI IPF, this same figure is likewise used as the WWU total associated with the specialty of SCI.

Ambulatory Care

The VA Staff Outpatient File contains a number of data items about each ambulatory care visit, including (most important for purposes here) a listing of the clinic stops encountered by the patient. Each clinic stop corresponds to a well-defined site, or locus, of activity—for example, the admitting & screening area, the neurology clinic, or the x-ray station. An ambulatory care visit can be conceptualized as a sequence of clinic-stop visits.

In FY 1989, there were 101 clinic-stop sites. With the assistance of the VA's Boston Development Center, each was mapped into one of six mutually exclusive and exhaustive clinic-stop groups: medicine, surgery, psychiatry, neurology, rehabilitation medicine, and other physician services (which include the emergency unit and admitting & screening). These groups correspond to the six ambulatory care PCAs defined earlier. A patient receiving care at the cardiology clinic stop thus has an encounter in the ambulatory medicine PCA. Clearly, one patient visit may generate encounters with multiple PCAs.

On the basis of the VA's own analyses of these data, four alternative ambulatory care workload measures were defined:

- *Clinic Stops/Year* for ambulatory PCA *j* at VAMC *i* are computed as the direct sum of all recorded encounters at all clinic stops in that PCA domain during the year. (However, if a patient encounters any clinic stop more than once during a visit to the VAMC, only one encounter for that stop is recorded in the Staff Outpatient File.)
- *People/Year* for PCA *j* is defined as the total number of unique persons (social security numbers) encountering the clinic stops in that PCA's domain during the year. A given patient can be counted more than once. A patient treated at both the emergency unit and the general surgery clinic during the year will make a unit contribution to the numerator of People/Year for both the other physician services and ambulatory surgery PCAs.
- *Patients/Year* for PCA *j* is constructed in a two-step process. First, for each patient having any encounters with the ambulatory care program at VAMC *i* during the year, the fraction of all clinic stops falling in the domain of PCA *j* is computed. These fractions are then summed across all patients to obtain Patients/Year for *j*.
- *The Capitation Weighted Work Unit* (CAPWWU) score is a cost-weighted workload measure that does adjust partially for visit-mix differences across PCAs (both within and across facilities). On the basis of his/her pattern of recorded clinic stops at VAMC *i*, each patient is placed in one of five capitation groups: high-use psychiatric, high-use rehabilitative, high-use medical, mid-use psychiatric, and standard use (comprising all patients not falling in one of the other four). The patient will also fall into one of eight age categories and, hence, into one of 40 (5 × 8) age-capitation group cells. Each cell has a cost weight based on the VA national average ambulatory care cost of patients in that cell relative to the other 39.

The patient is assigned his/her cell's cost weight. In a final step, this weight is allocated fractionally among the ambulatory PCAs at VAMC *i* in proportion to how the patient's clinic-stop encounters were distributed across these PCAs during the year. For example, if the patient had five clinic stops in the cardiology clinic, five in the hypertension clinic, and 10 in the thoracic surgery clinic (and no other clinic stops), half of his cost weight would be assigned to the ambulatory medicine PCA and the other half to the ambulatory surgery PCA. In reality, it is frequently the case that patients contribute CAP WU to multiple PCAs during a single visit to the facility.

Whenever any of these measures served as the workload index in a PF, a log transformation was applied in generating dependent-variable values, for reasons discussed above.

Long-Term Care

For patients admitted to an intermediate-care or nursing-home bed, sufficient information is recorded altogether in the VA Patient Treatment File, Extended Patient Treatment File, and Patient Assessment File to permit the calculation of three alternative workload measures:

- *Patients/Year* for LTC PCA *j* (either intermediate care or nursing home) at VAMC *i* is taken directly from the PTF. This workload variable is defined as the number of unique patients (social security numbers) discharged from PCA *j* during the fiscal year, plus the additional patients residing there on the last day of the fiscal year.
- *Patient Days/Year* for LTC PCA *j* is also derived directly from the PTF.
- *The Resource Utilization Group Weighted Work Unit* (RUGWWU) score is a workload measure that attempts to adjust for LTC treatment cost differences associated with differences in the clinical characteristics and physical and functional status of LTC patients. Using the RUG patient classification model developed for the New York State Medicaid program, the VA assigns each intermediate-care and nursing-home patient to one or more of 16 patient groups. Each patient group has a preassigned RUGWWU score based on the estimated national average resource cost of patients in that group relative to the other 15; the relative intensity of nursing care is the major determinant of estimated cost. If the patient is linked to more than one group (a frequent event), his RUGWWU score for this LTC admission is that associated with the most expensive of the RUGs.

Each LTC discharge at VAMC *i* generates a RUGWWU score assigned to the appropriate PCA. Again, there are special computational rules for handling LTC patients still occupying a bed on the last day of the fiscal year.

Whenever these measures were used as the workload index in a PF, a natural log transformation was first applied.

VA Staff Physician FTEE

The data required for calculating both StaffPhys_{ijk} in the PF variant and the core (staff physician) component of StaffPhys'_{ik} in the IPF variant are derived entirely from the VA Cost Distribution Report (CDR). In addition, the PF variables Nurse_{ij} and Support_{ij} are computed from the CDR. This part of the VA national data system is thus pivotal in any empirically based approach to physician staffing.

For each VAMC, the CDR reveals the distribution of expenditures (direct as well as indirect "cost" components) from several different perspectives. First, it shows expenditures distributed across various service delivery categories, including medicine, surgery, psychiatry, neurology, rehabilitation medicine, intermediate medicine, nursing home, and spinal cord injury bed sections, and to various specialty-defined clinic-stop groupings within ambulatory care. The correspondence between these categories and the 14 PCAs should be evident.

At the same time, the CDR also shows the distribution of VAMC expenditures across cost centers, most of which correspond to some "organizational element" involved in either the direct provision or indirect support of patient care. Important for purposes here is that each of the 11 physician specialties has its own cost center (for example, medicine is cost center 201, surgery 202).

Within each of these cost centers there is a subaccount (termed the 1081) that shows the recorded allocation of total physician FTEE in that specialty (1) to each of the service delivery categories above—and, hence, to each of the 14 PCAs—and (2) within each PCA, to the activity headings of direct patient care, research, instruction of residents (and others), continuing education, and certain administrative and miscellaneous tasks. These subaccounts, initially available in the national data system in 1989, become the key to linking physician FTEE by specialty to PCAs and to various mission-related activities within each PCA. (It follows that each physician FTEE observation reflects the actual (recorded) staffing at the VAMC, not the number of positions authorized.)

In the PF variant, to derive VAMC *i*'s value for StaffPhys_{ijk}, where, for example, *j* is the inpatient medicine PCA and *k* represents the specialty of surgery, proceed as follows with *i*'s CDR. Go to cost center 202 (surgery) and from its physician subaccount (1081), record the amount of FTEE allocated to inpatient medicine direct care. This is accomplished by checking under the CDR account number (in this case, 1100.00) corresponding to that mission-related activity (direct care) in that service delivery category (inpatient medicine). All staff physician FTEE variables for use in the PFs are so computed.

Computing StaffPhys'_{ik} for the IPF variant requires some additional steps. This facility-and specialty-specific variable is defined as the sum of staff physician and contract physician FTEE allocated to direct patient care, plus staff physician FTEE allocated to resident training. The staff physician direct-care component (usually the largest part) is obtained by summing StaffPhys_{ijk} across all PCAs at VAMC *i*. The resident training part is obtained by adding up specialty *k*'s PCA-specific FTEE allocations to the CDR category of "Education & Training, Instructional Cost," which largely reflects the physician's time allocated to resident training (time spent with other trainees, although a small percentage of the total, would necessarily be included). Similarly, the contract physician component of $\text{StaffPhys}'_{jk}$ is derived as the sum across PCAs of ConPhys_{ijk}, as defined in Equation 4.9.

Because $\text{StaffPhys}'_{ik}$ is not specific to PCA, it should be much less affected than StaffPhys_{ijk} by any intrafacility FTEE recording errors in the CDR.

There are no separate CDR categories for physician time allocated to routine administrative activities or various types of leaves of absence. It is assumed throughout that the net effect of VAMC *i*'s adjustments to staffing levels in response to these realities is reflected implicitly in the observed values of Staff Phys_{ijk}

As discussed in chapter 2, it is assumed that an FTEE represents a homogeneous concept, e.g., that two half-time physicians are the productive equivalent of one full-time, and so on. Consequently, it is implicitly assumed that, for each VA physician and PCA, the proportion of direct-care FTEE devoted to administration and leaves (and thus not to hands-on patient care) is the same at all FTEE levels. (In reality, this proportionality assumption may be violated; to investigate this would require special data collection and analysis.)

Nurse FTEE

Observations on the PF variable Nurse_{ij} are derived from facility *i*'s CDR as follows. Under the nursing service cost center (241) at VAMC *i*, the nursing subaccount (1061) shows the amount of nursing service FTEE allocated to each PCA at the facility. Additionally, certain smaller amounts of nursing FTEE may be assigned directly to other, physician-related cost centers such as medicine and surgery. Each such cost center also has a nursing subaccount showing the allocation of its own nursing FTEE across PCAs. The value assigned to Nurse_{ij} is thus the sum of all nursing FTEE allocations at VAMC *i* to PCA *j*.

Several alternative ways of accounting for the productivity influence of nurses were examined in each of the PF models. The expression involving nurse FTEE that proved most satisfactory, both in conceptual and statistical terms, was $\text{Nurse}_{ij}/\text{StaffPhys}_{ij}$, where the denominator is the total FTEE for physicians involved in hands-on delivery of care in PCA *j* of VAMC *i*. (Included in this denominator were the following specialties: internal medicine, surgery, psychiatry, neurology, and rehabilitation medicine.) Such a variable allows examination, in the full context of the PF equation, of the effect of nursing staff *intensity* on physician productivity—which seems the appropriate focus in this study. Moreover, when $Nurse_{ij}$ alone was used in versions of Equation 4.9, implausible or otherwise unsatisfactory estimates often emerged for the coefficients of the VA staff physician variables.

Support-Staff FTEE

Almost all VA providers who are neither physicians nor nurses have no distinct cost center assignment (though two important exceptions are psychologists and social workers). Consequently, it is not possible to allocate to PCAs the FTEE of physician assistants, nurse practitioners, clinical nurse specialists, nurse anesthetists, ward clerks, phlebotomists, and other personnel.

The response was to proceed as follows: For each PCA *j*, total physician FTEE was added to total nurse FTEE, and the result subtracted from total (from all sources) PCA FTEE. The result is the residual FTEE quantity labeled $Support_{ij}$. It is a composite measure of all nonphysician, nonnurse FTEE on that PCA. (Whenever psychologists or social workers were included in an equation, their FTEE was subtracted, as well, in computing $Support_{ij}$.)

Just as with nursing FTEE, the form of a support-staff variable that performed most satisfactorily in the estimated PF was $Support_{ij}/StaffPhys_{ij}$, where the denominator, as above, is the sum of all hands-on physician FTEE on the PCA. This variable proved to be an important covariate in many estimated PFs, often out-performing the nursing intensity variable.

Contract Physician FTEE

Observations on the variable $ConPhys_{ijk}$ were not derived from the CDR, but from the FY 1989 version of a survey conducted annually by the VA Central Office. Each facility is asked to estimate, based on its existing physician contracts, the resulting amount of FTEE by specialty and service delivery category (which can then be linked to PCAs).

In the PF equations, a distinct $ConPhys_{ijk}$ variable can be specified for each specialty. In the IPF, the sum of these variables across PCAs yields $ConPhys_{ik}$, which becomes one component of the dependent variable in Equation 4.10.

Resident FTEE

To derive observations on Res_{ijy}, the total FTEE of postgraduate year (PGY) *y* residents in PCA *j* at VAMC *i*, information was combined from two data sources, neither of which alone would be adequate for the task. From the VA Office of Academic Affairs, the number of VA-supported residency positions actually filled, by specialty and PGY, at each VAMC in FY 1989 was obtained. These data, however, cannot address the question of how residents allocate their time across PCAs.

From each facility's CDR, a rough allocation of resident FTEE to PCAs, by specialty, can be inferred for all residents supported by the VA either through salary or contract. For most VAMCs, this comprises well over 90 percent of the residency positions authorized by the Office of Academic Affairs. The CDR data, however, do not break out resident FTEE by PGY.

The response was to proceed as follows: For each specialty at the VAMC, CDR data were used to compute the fraction of resident FTEE allocated to inpatient care, ambulatory care, and long-term care. (A more finely tuned breakout into PCAs was deemed unreliable at present.) These fractions were applied to the resident position data for VAMC *i* in order to assign all resident FTEE in a given specialty and PGY to the three type-of-care areas (inpatient, ambulatory, and long-term care). Once allocated to a type-of-care area, this specialty-specific resident FTEE was then assigned to the PCA most closely associated with its specialty.

For example, suppose there are 40 residents in medicine at VAMC *i*, and 10 of these are second-year. Suppose that, from the CDR, it is found that 70 percent of all medicine resident FTEE at VAMC *i* is devoted to inpatient care, 20 percent to ambulatory care, and 10 percent to long-term care. Then, (10 × 0.70) = 7 residents would be assigned to the inpatient medicine PCA; (10 × 0.20) = 2 would be allocated to the ambulatory medicine PCA; and (10 × 0.10) = 1 would be split evenly between the LTC PCAs of nursing home and intermediate care. There are similar PCA mapping rules for the other 10 specialties specifically examined in this study.

Now, in both the PF and the IPF equations reported below, the RES variables are specific to PGY "group" rather than to individual year. The variable $Residents_{ij}$ will refer to the FTEE for all first-, second-, and third-year residents in PCA*j* of VAMC *i*. The variable $Fellows_{ij}$ will refer to the FTEE for all PGY 4, 5, 6, and 7 residents in PCA *j* of VAMC *i*.

This consolidation was adopted after analyses showed that using RES variables specific to each postgraduate year in the PF and the IPF equations sacrificed parsimony for only small gains in explanatory power.

Nonpersonnel Factors Influencing Physician Productivity

In the PF and the IPF equations estimated here, two basic types of control variables were tested as proxies for productivity-influencing factors (Prodfact). As part of the resource allocation model (RAM) that the VA was using in FY 1989 to help determine budgets at VAMCs, each facility was classified into one of six mutually exclusive and exhaustive RAM groups. Derived from a cluster analysis of facility attributes (Stefos et al., 1990), the RAM groups can be characterized roughly as follows: small affiliated VAMCs (in subsequent terminology, HGroup1); small general unaffiliated (HGroup2); mid-size affiliated (HGroup3); mid-size general unaffiliated (HGroup4); metro affiliated (HGroup5); and psychiatric (HGroup6). The rationale for using these RAM group variables as proxies for Prodfact in Equations 4.9 and 4.10 is that physician style of practice and overall productivity may vary by type of facility, all else equal.

A second set of proxy variables for Prodfact indicates the VA geographic region (Eastern, Central, Southern, or Western) where the VAMC is located. Being tested is the hypothesis that there are regional variations in physician practice styles and the technology of care in VAMCs.

In the final months of the study, the committee did locate (non-CDR) data on annual capital equipment purchases by VAMCs; as discussed in the final section, these data can be transformed into a PCA-specific capital equipment index that may improve the overall performance of the empirically based staffing models. In subsequent iterations of these models, attention should be given to uncovering additional variables, computable at the VAMC level, that would help explain variations in physician productivity across facilities. Because it focuses on the workload production process at the PCA level, the PF variant is likely to benefit especially from these new variables.

ESTIMATED PF AND IPF EQUATIONS

In this section, the committee presents PF estimates for each of 14 PCAs and IPFs for each of 11 VA specialty groupings.

For every estimated equation below, literally scores of alternative specifications were tested. For each PCA or specialty, the effect of using alternative workload measures was examined. For each workload measure, alternative sets of independent (right-hand-side) variables were tested and for each variable set, the influence of alternative functional forms (i.e., mathematical transformations of the variables) was examined.

Reported below for each PCA or specialty is the estimated equation judged to be "best" by two criteria applied jointly and interactively: the clinical plausibility of the estimated coefficients and statistical measures of goodness of fit. In making these judgments, the committee benefited greatly from the recommendations of its data and methodology panel; that panel, in turn, worked closely with statistical consultants based at Duke University and with the study staff.

Before the equations are presented, some general comments are appropriate.

- All analyses use data from FY 1989, the first year for which PCA-specific physician FTEE allocations were available on a nationwide basis.

- With two exceptions, all equations specify workload in terms of weighted work units (either WWUs, CAPWWUs, or RUGWWUs, as the context requires); with few exceptions, equations estimated with a WWU-type workload exhibited stronger goodness of fit than similar ones using workload measures that do not control at all for case-mix and acuity differences.

However, on the advice of the psychiatry panel, for the inpatient psychiatry PF, bed-days of care (BDOC) was substituted for the WWU variable; the panel expressed concerns about the latter because it is based on a DRG classification system that may not be well oriented to psychiatry diagnoses. The other exception to a WWU-type workload specification occurred in the ambulatory care "other physician services" PF equation, where a variable defined in terms of clinic stops led to a significant improvement in overall goodness of fit.

- Variables indicating the VAMC region of location are not included in the equations below. In most cases, such variables were not statistically significant; when they were, specialty panel members had difficulty assessing their clinical plausibility. Some members of the data and methodology panel contended also that models for determining future physician requirements should not have regional effects embedded in them.
- To explore whether the assumptions imposed on the error term in these regression equations are being significantly violated, a scatterplot was produced for each equation, showing its "studentized" residuals plotted against the corresponding predicted values of the dependent variable. As noted in the second section above, the *r*th residual is the algebraic difference between the actual and the predicted values of the dependent variable at the *r*th observation in the data set; studentized residuals have been normalized in a way that improves the ability to assess visually any systematic trends in the scatterplot. If the assumptions about ERROR hold, a random-looking plot can be expected. To illustrate such analysis, scatterplots are presented for selected equations in this chapter; in Volume II, *Supplementary Papers*, scatterplots for all estimated PF and IPF equations are shown.
- *In general, the remainder of this section builds upon, and assumes familiarity with, the preceding portions of the chapter (and associated footnotes). Frequent reference is made to definitions, modeling concepts, and statistical principles introduced in those sections.*

In what follows, the PF equations are presented by PCA, and then the IPF equations are presented by specialty.

PF Estimates

The general framework for these estimated PF equations is captured in Equation 4.9. Where possible, the variable names introduced there and in the preceding section are adopted below; but, because of the greater level of specificity here, some additional definitions are required. For simplicity, subscripts are suppressed, but it is understood that all variables in a given PCA equation are specific to that PCA at VAMC *i*. For example, W_{ij} in Equation 4.9 is written simply as *W*.

Upon its first appearance, each variable is formally defined; in subsequent appearances, it is defined again only when necessary to avert ambiguity.

The sample size for each PF equation reflects the number of VAMCs with that particular type of PCA.

Inpatient Medicine

$$W = \underset{}{6.144} + \underset{(9.431)}{0.213\ \text{MED\_MD}} - \underset{(-4.276)}{0.007\ (\text{MED\_MD})^2} + \underset{(2.700)}{0.138\ \text{SUR\_MD}}$$

$$+ \underset{(2.373)}{0.163\ \text{PSY\_MD}} + \underset{(1.703)}{0.106\ \text{NEU\_MD}} + \underset{(3.681)}{0.015\ \text{RESIDENTS}}$$

$$+ \underset{(1.909)}{0.015\ \text{FELLOWS}} + \underset{(10.001)}{0.048\ \text{SUPPORT/MD}} + \underset{(2.629)}{0.048\ \text{SOCW}}$$

$$- \underset{(-4.455)}{0.237\ \text{HGROUP6}} - \underset{(-2.843)}{0.003\ (\text{MED\_MD} \times \text{FELLOWS})} \qquad (4.11)$$

$$\text{with } \bar{R}^2 = 0.822 \text{ and } N = 159$$

where

W	=	$\ln[w_{ij} + 1]$ = the natural logarithm of total WWUs, plus 1, produced in the inpatient medicine PCA during the fiscal year;
MED_MD	=	VA staff physician FTEE from the medicine service allocated to direct care in the inpatient medicine PCA;
$(\text{MED\_MD})^2$	=	variable testing for nonlinear relationship between VA staff internist FTEE and workload production—specifically, that there are diminishing marginal returns to increases in internist FTEE;

SUR_MD	=	VA staff physician FTEE from surgery allocated to direct care in the inpatient PCA;
PSY_MD	=	VA staff physician FTEE from psychiatry allocated to direct care in this PCA;
NEU_MD	=	VA staff physician FTEE from neurology allocated to direct care in this PCA;
SUPPORT/MD	=	support-staff FTEE divided by total FTEE for physicians involved in hands-on delivery of care in the inpatient medicine PCA, defined to include internists, surgeons, psychiatrists, neurologists, and rehabilitation medicine physicians (hereafter, this variable will be labeled more succinctly "support-staff FTEE per total physician FTEE in this PCA");
RESIDENTS	=	second-and third-year-resident FTEE allocated to this PCA (interns were omitted after statistical testing);
FELLOWS	=	FTEE of residents PGY 4 and above allocated to this PCA;
SOCW	=	social worker FTEE allocated to this PCA;
HGROUP6	=	categorical variable assuming a value of 1 if facility is in RAM Group 6 (psychiatric hospital);
(MED_MD × FELLOWS)	=	interaction term for the joint influence of VA staff internists and fellows on the rate of workload production in this PCA;
N	=	number of inpatient medicine PCAs (equivalent to the number of VA medicine services) in the sample.

As stated earlier, the number in parentheses beneath each estimated coefficient is its *t*-statistic, indicating its statistical strength. As also noted, $\bar{R}^2$ measures the overall goodness of fit of the estimated equation to the data; this statistic ranges approximately from 0 to 1, with higher values indicating a better fit.

From Equation 4.11, it can be inferred that, in their consultative roles, surgeons, psychiatrists, and neurologists contribute significantly to workload production; residents, fellows, and social workers are clearly important, although there is a negative interaction effect involving fellows and staff internists (i.e., their total contribution to workload is less than the sum of their individual contributions, all else equal); the intensity of support staff positively influences productivity on the inpatient medicine PCA (though a NURSE/MD variable was not significant); and medicine PCAs in VA psychiatric hospitals produce significantly fewer WWUs/year than at other VAMCs, controlling for other factors. The net impact of staff internists on workload production, a central question, cannot be inferred from Equation 4.11 by inspection; it will be considered shortly.

The scatterplot of studentized residuals from Equation 4.11 is displayed in Figure 4.9. Their overall random appearance is not surprising, given the clinical plausibility and statistical strength of the estimated coefficients in Equation 4.11, as well as its high overall goodness of fit.

It would be instructive to pause at this first (of many) equations and discuss the general interpretation of the estimated coefficients. This is best done by example.

Consider first the coefficient of a continuous independent variable such as PSY_MD. A unit increase in psychiatrist FTEE devoted to direct care is expected to lead to a 0.163 unit increase in *W*. Since the latter is a nonlinear (logarithmic) function of workload, the corresponding expected increase in WWUs will depend on the absolute level of WWUs at which the PSY_MD increase is applied. If, at baseline, production in the medicine PCA was 2,484/year (the FY 1989 national mean), the corresponding *W* value is 1n(2,484 + 1) = 7.818. A full unit increment in PSY_MD implies a new W equal to (7.818 + 0.163) = 7.981. To find the resulting expected WWU level, one exponentiates this and subtracts 1, to get 2,924—a substantial increase in workload.[9]

in the PCA.

[9] The impact on annual workload productivity of adding one additional internist FTEE (i.e., the "marginal product" of the internist) is clearly of interest here, but is more complicated to derive since MED_MD appears in four terms in Equation 4.11 and three of these are nonlinear. It can be shown (via some differential calculus) that (Δw/ ΔMED_MD) = 0.213-0.014 MED_MD -0.003 FELLOWS -0.048 SUPPORT/MD^2, where SUPPORT and MD are now treated arithmetically as distinct entities, each bearing the same definition as before. (Note, in particular, that the variable in the final term is not (SUPPORT/MD)^2; rather, only the denominator is squared in this partial-derivative expression.)

Consequently, the impact of increases in MED_MD depends not only on *W* (as before), but also on the existing FTEE levels of internists, fellows, support staff, and total hands-on physicians (MD)

The estimated coefficient of a categorical variable such as HGROUP6 can be interpreted as follows: All else equal, *W* is expected to be 0.237 unit smaller in a psychiatric hospital than in a VAMC in its "reference group" of facilities—defined here as all VAMCs in the other five RAM groups. (In general, the subset of items omitted from the equation is termed the reference group; it can be shown that all categorical variables require, statistically, a reference group.) Suppose the WWU level in the "typical" reference-group facility is 2,484/year, which establishes a reference-group baseline *W* of 7.818 (as previously calculated). The corresponding W for the typical RAM Group 6 facility is (7.818-0.237) = 7.581. After exponentiation and subtraction of 1, the expected WWUs/year are found to be about 1,960. (This assumes, of course, that the significant distinctions between RAM Group 6 facilities and all others in the production of W is captured in the variable HGROUP6.)

Similar calculations are pursued in chapter 7 under the general heading of Sensitivity Analysis.

Note, finally, that the process of arriving at the particular inpatient medicine PF shown in Equation 4.11 involved the testing of numerous alternative specifications. The statistical significance of both the direct effect (linear) and squared terms of each type of physician specialist and resident was investigated; interaction terms involving all of these inputs in pairwise combinations were likewise tested; a number of variables not appearing in the final version, such as NURSE/MD and hospital groups other than HGROUP6, were also examined. In the end, the version of the inpatient medicine PCA appearing in Equation 4.11 represented in the committee's judgment, the best-fitting clinically plausible model. Each of the PF (and IPF) equations presented here evolved similarly.[10]

To illustrate the implied computations, consider now the marginal product of the internist in the VA systemwide "average" or "most typical" inpatient medicine PCA. This is obtained by setting each of the relevant variables to its sample-mean value, then executing the marginal product formula above. For FY 1989, these means are as follows: MED_MD = 5.34; MD = 6.52; SUPPORT = 92.96; and FELLOWS = 5.41. Substituting these values into the formula yields ($\Delta W/\Delta$MED_MD) = 0.017. Given a national average workload of 2,484 WWUs, the internist marginal product is computed to be about 42 WWUs/yr.

There is a cautionary note to all of these analyses: they are more accurate the smaller the contemplated change in MED_MD.

For a more complete discussion of marginal productivity analysis, including applications to several other PF models, see Volume II, *Supplementary Papers*.

[10] An important caveat applies in the interpretation of significance levels and statements of statistical confidence appearing (or implied) throughout this chapter (and in most studies using multiple regression analysis to ferret out behavioral relationships). Because a multiplicity of alternative functional forms and independent variables were examined in the process of arriving at the "final" version of each PF and IPF model, there is a persistent risk that reported (or implied) confidence levels overstate "true" statistical confidence. Each model was estimated from only one

Inpatient Surgery

$$W = 5.753 + \underset{(9.497)}{0.279\ \text{SUR\_MD}} - \underset{(6.593)}{0.016\ (\text{SUR\_MD})^2} + \underset{(5.200)}{0.156\ \text{MED\_MD}}$$

$$+ \underset{(6.979)}{0.163\ \text{OTHER\_MD}} + \underset{(3.743)}{0.026\ \text{NURSE/MD}} + \underset{(5.024)}{0.033\ \text{SUPPORT/MD}}$$

$$+ \underset{(4.782)}{0.046\ (\text{RESIDENTS} + \text{FELLOWS})}$$

$$- \underset{(-3.660)}{0.001\ (\text{RESIDENTS} + \text{FELLOWS})^2}$$

$$- \underset{(-3.835)}{0.221\ \text{HGROUP2}} - \underset{(-3.711)}{0.421\ \text{HGROUP6}}$$

$$- \underset{(-3.477)}{0.035\ (\text{MED\_MD} \times \text{OTHER\_MD})} \qquad (4.12)$$

$$\text{with } \bar{R}^2 = 0.943 \text{ and } N = 130$$

where

OTHER_MD	=	total FTEE allocated to inpatient surgery PCA by VA staff physicians not in medicine, surgery, psychiatry, neurology, or rehabilitation medicine cost centers;

sample; moreover, multiple comparisons were undertaken using that sample. The resulting confidence statements should be regarded as "nominal" indications of statistical importance.

Since the samples available for these analyses (all for one year, FY 1989) were not large enough to warrant use of split-sample techniques to validate the models, other precautionary steps were taken. Considerable attention was paid to characterizing the shape of the relationships among variables and to verifying that implicit model assumptions were satisfied. Care was taken to avoid "overfitting" the models. Regression diagnostic methods were employed to examine the patterns of residuals, assess the effects of outliers, and check for multicollinearity.

Subsequent work with these models, which the committee advocates (in chapter 11) that the VA undertake, should focus on certain methods of internal validation, such as bootstrapping. The latter, for example, could be helpful in evaluating the extent of overfitting (or overoptimism), that may be present in the models.

NURSE/MD	=	= nursing-staff FTEE divided by total FTEE for physicians involved in handson delivery of care in the inpatient surgery PCA, defined to include internists, surgeons, psychiatrists, neurologists, and rehabilitation medicine physicians (hereafter, this variable will be labeled more succinctly, "nursing-staff FTEE per total physician FTEE in this PCA");
(RESIDENTS + FELLOWS)	=	= total FTEE of residents PGY 2 and above allocated to this PCA;
HGROUP2	=	= categorical variable assuming a value of 1 if facility is in RAM Group 2 (small general unaffiliated VAMC); and
(MED_MD × OTHER_MD)	=	= interaction term for the joint influence of VA staff internists and VA "other" physicians on the rate of workload production in the inpatient surgery PCA.

The studentized residuals from Equation 4.12 are shown in Figure 4.10. No systematic trends or patterns are evident.

Inpatient Psychiatry

$$W = 8.588 + \underset{(6.941)}{0.198}\ \text{PSY\_MD} + \underset{(5.296)}{0.131}\ \text{RESIDENTS}$$

$$- \underset{(-3.450)}{0.014}\ (\text{PSY\_MD} \times \text{RESIDENTS}) + \underset{(6.184)}{0.129}\ \text{SOCW}$$

$$- \underset{(-2.972)}{0.463}\ \text{HGROUP2} + \underset{(2.909)}{0.394}\ \text{HGROUP4} + \underset{(4.006)}{0.795}\ \text{HGROUP5}$$

$$+ \underset{(6.642)}{1.622}\ \text{HGROUP6} + \underset{(2.775)}{0.329}\ (\text{PSY\_MD} \times \text{HGROUP2})$$

$$- \underset{(-3.531)}{0.132}\ (\text{PSY\_MD} \times \text{HGROUP5})$$

$$- \underset{(-5.342)}{0.201}\ (\text{PSY\_MD} \times \text{HGROUP6}) \qquad (4.13)$$

$$\text{with } \bar{R}^2 = 0.874 \text{ and } N = 141$$

where

W	=	$\ln[BDOC_{ij} + 1]$ = the natural logarithm of total bed-days of care, plus 1, produced in the inpatient psychiatry PCA during the fiscal year;
HGROUP4	=	categorical variable assuming a value of 1 if facility is in RAM Group 4 (mid-size general unaffiliated VAMC); and
HGROUP5	=	categorical variable assuming a value of 1 if facility is in RAM Group 5 (metro affiliated).

Note that although the social worker variable was strongly significant, a variable (not shown) for psychologist FTEE was not an important determinant of workload in inpatient psychiatry. (This is not the case, however, in the ambulatory psychiatry PCA.)

Inpatient Neurology

$$W = \underset{}{2.153} + \underset{(6.642)}{4.237\ \text{NEU\_MD}} - \underset{(-2.196)}{0.546\ \text{MED\_MD}} + \underset{(2.854)}{1.669\ \text{SUR\_MD}}$$

$$+ \underset{(4.852)}{0.047\ \text{SUPPORT/MD}} + \underset{(2.038)}{0.515\ \text{SOCW}} + \underset{(6.826)}{2.087\ \text{HGROUP}(3+5)}$$

$$- \underset{(-5.621)}{3.602\ [\text{HGROUP}(3+5) \times \text{NEU\_MD}]} \qquad (4.14)$$

$$\text{with } \bar{R}^2 = 0.722 \text{ and N} = 80$$

where

HGROUP(3 +5)	=	a categorical variable assuming a value of 1 if facility is in either RAM Group 3 (mid-size affiliated) or RAM Group 5 (metro affiliated).

The surprising negative sign on MED_MD persisted across many alternative specifications of Equation 4.14. After much analysis it remains unclear whether this represents a true negative influence of internist FTEE on the rate of throughput in neurology bed sections or an FTEE reporting bias of some type; the committee's neurology panel favored the latter explanation.

The sample of 80 consists of the 79 VAMCs with officially defined neurology bed sections, plus one other facility with a significant enough neurology presence to merit an inpatient PCA designation.

Inpatient Rehabilitation Medicine

$$W = 1.330 + \underset{(8.653)}{1.864\ \text{RMS\_MD}} + \underset{(2.310)}{1.160\ \text{MED\_MD}}$$

$$+ \underset{(2.445)}{7.191\ \text{LAB\_MD}} + \underset{(9.872)}{0.970\ \ln(\text{SUPPORT/MD})} \qquad (4.15)$$

$$\text{with } \bar{R}^2 = 0.674 \text{ and } N = 79$$

where

RMS_MD	=	VA staff physician FTEE from the rehabilitation medicine service allocated to direct care in the inpatient rehabilitation medicine PCA;

LAB_MD	=	VA staff physician FTEE from laboratory medicine allocated to activities related to direct care in the inpatient rehabilitation medicine PCA; and
In(SUPPORT/MD)	=	the natural logarithm of support-staff FTEE per total physician FTEE in this PCA.

The sample of 79 consists entirely of VAMCs with officially designated rehabilitation medicine services. Note that Equation 4.15 does not include either workload or FTEE for SCI treatment; instead, SCI is analyzed as a separate PCA.

Figure 4.11 shows the studentized residuals from Equation 4.15. Although the point grouping is not as "tight" as for Equations 4.11 and 4.12, which exhibited superior goodness of fit, there are still no discernible trends or patterns.

Spinal Cord Injury

$$W = 2.051 \underset{(4.546)}{+ 0.456\ \mathrm{SCI\_MD}} \underset{(-2.317)}{- 0.020\ (\mathrm{SCI\_MD})^2}$$

$$\underset{(2.754)}{+ 0.148\ \mathrm{NURSE/MD}} \underset{(-3.208)}{- 0.003\ (\mathrm{NURSE/MD})^2}$$

$$\underset{(5.334)}{+ 0.140\ \mathrm{SUPPORT/MD}} \underset{(-4.319)}{- 0.002\ (\mathrm{SUPPORT/MD})^2} \qquad (4.16)$$

$$\text{with } \bar{R}^2 = 0.915 \text{ and } N = 21$$

where

W	=	the natural logarithm of the sum of all medicine, surgery, psychiatry, neurology, and rehabilitation medicine WWUs, plus 1, generated in the SCI PCA; and
SCI_MD	=	VA staff physician FTEE from the SCI service allocated to direct care in the SCI PCA.

The sample consists of 21 VAMCs with officially designated SCI services.

Ambulatory Medicine

$$
\begin{aligned}
W = {} & 14.017 + \underset{(5.047)}{0.063\ \text{MED\_MD}} + \underset{(2.285)}{1.143\ \text{RMS\_MD}} \\
& + \underset{(3.841)}{0.060\ \text{OTHER\_MD}} + \underset{(3.747)}{0.150\ \text{RESIDENTS}} \\
& - \underset{(-\,2.917)}{0.010\ (\text{RESIDENTS})^2} + \underset{(3.043)}{0.349\ \text{HGROUP}(3+5)} \\
& - \underset{(-4.013)}{0.633\ \text{HGROUP6}} + \underset{(2.292)}{0.104\ (\text{MED\_MD} \times \text{HGROUP6})} \qquad (4.17) \\
& \text{with } \bar{R}^2 = 0.647 \text{ and } N = 168
\end{aligned}
$$

where

W	=	$\ln[w_{ij} + 1]$ = natural logarithm of total CAPWWUs, plus 1, produced in the ambulatory medicine PCA during the fiscal year.

Recall that OTHER_MD is defined in Equation 4.12 as all physician FTEE assigned to direct care in the PCA *exclusive* of the direct-care FTEE of internists, surgeons, psychiatrists, neurologists, and rehabilitation medicine physicians.

In Figure 4.12, the studentized residuals from Equation 4.17 are plotted, and no trends or patterns are apparent.

Ambulatory Surgery

$$
\begin{aligned}
W = {} & 12.549 + \underset{(7.261)}{0.694}\ \text{SUR\_MD} + \underset{(4.289)}{0.069}\ \text{SUPPORT/MD} \\
& + \underset{(2.434)}{0.137}\ \text{RESIDENTS} + \underset{(2.622)}{0.094}\ \text{FELLOWS} - \underset{(-3.467)}{0.422}\ \text{HGROUP2} \\
& + \underset{(4.149)}{0.708}\ \text{HGROUP}(3+4+5) - \underset{(-3.710)}{0.549}\ \text{HGROUP6} \\
& - \underset{(-2.169)}{0.032}\ (\text{SUR\_MD} \times \text{RESIDENTS}) \\
& - \underset{(-4.830)}{0.495}\ [\text{SUR\_MD} \times \text{HG}(3+4+5)] \qquad (4.18)
\end{aligned}
$$

with $\bar{R}^2 = 0.824$ and $N = 156$

where

HGROUP(3+4+5)	=	categorical variable assuming a value of 1 if facility is in either RAM Group 3, 4, or 5.

Ambulatory Psychiatry

$$
\begin{aligned}
W = {} & 12.900 + \underset{(6.362)}{0.264}\ \text{PSY\_MD} - \underset{(-3.381)}{0.011}\ (\text{PSY\_MD})^2 \\
& + \underset{(2.704)}{0.132}\ \text{OTHER\_MD} + \underset{(4.093)}{0.145}\ \text{PSYCH} - \underset{(-2.771)}{0.008}\ (\text{PSYCH})^2 \\
& + \underset{(4.462)}{0.110}\ \text{NURSE/MD} + \underset{(2.292)}{0.183}\ \text{FELLOWS} - \underset{(-5.103)}{0.725}\ \text{HGROUP2} \\
& + \underset{(3.484)}{0.523}\ (\text{PSY\_MD} \times \text{HGROUP2}) \qquad (4.19)
\end{aligned}
$$

with $\bar{R}^2 = 0.814$ and $N = 156$

where

PSYCH	=	psychologist FTEE allocated to direct care in the ambulatory psychiatry PCA.

Thus, psychologists do make a significant contribution to the production of ambulatory psychiatry CAPWWUs, although subject to diminishing marginal productivity; this is also true for psychiatrists.

Ambulatory Neurology

$$W = \underset{}{11.120} + \underset{(5.502)}{0.460\ \text{NEU\_MD}} + \underset{(2.814)}{0.224\ \text{RESIDENTS}} + \underset{(6.007)}{0.734\ \text{HGROUP3}} + \underset{(6.733)}{0.872\ \text{HGROUP5}} \quad (4.20)$$

$$\text{with } \bar{R}^2 = 0.591 \text{ and } N = 72$$

Ambulatory Rehabilitation Medicine

$$W = 11.892 + \underset{(6.376)}{1.390\ \text{RMS\_MD}} + \underset{(2.798)}{0.003\ \text{SUPPORT/MD}} + \underset{(6.027)}{0.732\ \text{HGROUP3}} + \underset{(4.123)}{0.683\ \text{HGROUP4}} + \underset{(9.234)}{1.591\ \text{HGROUP5}} + \underset{(3.029)}{0.452\ \text{HGROUP6}} - \underset{(-4.373)}{1.082\ (\text{RMS\_MD} \times \text{HGROUP5})} \quad (4.21)$$

$$\text{with } \bar{R}^2 = 0.583 \text{ and } N = 140$$

Ambulatory Other Physician Services

$$W = \underset{}{10.474} + \underset{(2.844)}{0.064}\ \text{MED\_MD} + \underset{(2.004)}{0.128}\ \text{PSY\_MD} + \underset{(2.948)}{0.116}\ \text{RAD\_MD}$$

$$+ \underset{(3.122)}{0.062}\ \text{SOCW} + \underset{(6.208)}{0.711}\ \text{HGROUP}(3+5)$$

$$+ \underset{(3.227)}{0.457}\ \text{HGROUP4} \qquad (4.22)$$

$$\text{with } \bar{R}^2 = 0.573 \text{ and } N = 168$$

where

W	=	ln(Clinic Stops + 1) = natural logarithm of total clinic stops, plus 1, produced in the ambulatory other physician services PCA during the fiscal year; and
RAD_MD	=	VA staff physician FTEE from radiology allocated to direct-care activities in this PCA.

The ambulatory other physician services PCA includes the emergency unit and admitting & screening, plus a number of miscellaneous clinic-stop sites. Put differently, it incorporates all clinic-stop sites not included in the other five ambulatory PCAs where physician-related services are rendered.

Nursing Home Care

$$W = 9.451 + \underset{(5.158)}{0.918}\ \text{MED\_MD} - \underset{(-4.062)}{0.246}\ (\text{MED\_MD})^2$$

$$+ \underset{(5.360)}{2.401}\ \text{RMS\_MD} - \underset{(-4.177)}{2.610}\ (\text{RMS\_MD})^2 + \underset{(2.302)}{0.854}\ \text{SUR\_MD}$$

$$+ \underset{(2.784)}{1.666}\ \text{OTHER\_MD} - \underset{(-1.930)}{1.502}\ (\text{OTHER\_MD})^2 + \underset{(5.943)}{0.159}\ \text{SOCW}$$

$$+ \underset{(6.401)}{0.005}\ \text{SUPPORT/MD} - \underset{(-6.798)}{0.000005}\ (\text{SUPPORT/MD})^2 \qquad (4.23)$$

$$\text{with } \bar{R}^2 = 0.702 \text{ and } N = 118$$

where

W	=	$\ln[w_{ij} + 1]$ = natural logarithm of total RUGWWUs, plus 1, produced in the nursing home PCA during the fiscal year.

Intermediate Care

$$
\begin{aligned}
W = {} & 8.869 + \underset{(2.522)}{0.322}\ \text{INT\_MD} - \underset{(-1.867)}{0.047}\ (\text{INT\_MD})^2 + \underset{(6.991)}{0.806}\ \text{MED\_MD} \\
& + \underset{(4.860)}{3.341}\ \text{RMS\_MD} - \underset{(-2.003)}{1.749}\ (\text{RMS\_MD})^2 \\
& - \underset{(3.699)}{0.601}\ (\text{MED\_MD} \times \text{RMS\_MD}) + \underset{(3.994)}{0.860}\ \text{OTHER\_MD} \\
& + \underset{(3.646)}{0.003}\ \text{SUPPORT/MD} + \underset{(2.602)}{0.436}\ \text{HGROUP}(4+5) \\
& + \underset{(3.402)}{0.785}\ \text{HGROUP6} \\
& - \underset{(2.602)}{0.268}\ [\text{MED\_MD} \times \text{HGROUP}(4+5)] \\
& - \underset{(-3.293)}{0.442}\ (\text{MED\_MD} \times \text{HGROUP6}) + \underset{(3.754)}{0.097}\ \text{SOCW} \qquad (4.24)
\end{aligned}
$$

$$\text{with } \bar{R}^2 = 0.803 \text{ and } N = 129$$

where

INT_MD	=	VA staff physician FTEE from intermediate medicine (i.e., recorded in the intermediate medicine cost center) allocated to direct care in the intermediate care PCA.

IPF Estimates

The general framework for these estimated IPF equations is captured in Equation 4.10. When possible, the variable names introduced there and in the previous section are adopted below, but, as with the PF equations, more specific definitions are required in some instances. Subscripts again are suppressed, but it is understood that all variables in a particular IPF are specific to the equation's associated specialty. For example, W_{ik} in Equation 4.10 becomes simply W.

Any variable not already defined in a PF equation will be defined upon its first appearance below; thereafter, the definition will be repeated only when required to avoid ambiguity.

Several additional adjustments specific to the IPF variant should be noted.

Contract physician FTEE was included in an IPF's $StaffPhys'_{ik}$ variable whenever it represented a nonnegligible percentage of total specialty *k* FTEE.

In an IPF for a specialty lacking a single dominant PCA (e.g., laboratory medicine), the WWU makeup of its inpatient workload variable, the CAPWWWU makeup of its ambulatory workload variable, and the RUGWWU makeup of its long-term care workload variable all had to be defined. How this was handled for laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and anesthesiology is indicated, in turn, in the estimated equations below.

For computational reasons only, all workload variables are divided by the constant 10,000; this affects the absolute size of the corresponding coefficient estimate but not its algebraic sign or statistical significance.

The sample size for each specialty's IPF is a reflection of the number of VAMCs that reported data from that specialty's cost center in FY 1989.

Medicine

$$\begin{aligned}
\text{MED_MD}' = {} & 1.234 + \underset{(3.846)}{3.982}\ \text{MEDWWU} + \underset{(3.428)}{0.00078}\ \text{MEDCAPWWU} \\
& + \underset{(1.990)}{0.014}\ \text{MEDRUGWWU} + \underset{(1.869)}{0.012}\ \text{FELLOWS} \\
& + \underset{(2.416)}{0.608}\ \text{HGROUP2} + \underset{(2.370)}{0.767}\ \text{HGROUP3} \\
& + \underset{(2.551)}{0.667}\ \text{HGROUP4} + \underset{(2.079)}{0.822}\ \text{HGROUP5} \\
& + \underset{(2.367)}{0.332}\ \text{HGROUP6} - \underset{(-1.986)}{2.707}\ (\text{MEDWWU} \times \text{HGROUP2}) \\
& - \underset{(-2.705)}{3.311}\ (\text{MEDWWU} \times \text{HGROUP3}) \\
& - \underset{(-1.971)}{2.380}\ (\text{MEDWWU} \times \text{HGROUP4}) \\
& - \underset{(-2.801)}{3.271}\ (\text{MEDWWU} \times \text{HGROUP5}) \qquad (4.25)
\end{aligned}$$

with $\bar{R}^2 = 0.595$ and $N = 164$

where

MED_MD'	=	natural logarithm of the sum of all VA internist FTEE devoted to direct care (i.e., the sum of all MED_MD variables) across all PCAs, plus total internist FTEE allocated to resident training across all PCAs, plus 1;
MEDWWU	=	total medicine WWUs produced during the fiscal year in the inpatient PCAs of medicine, surgery, psychiatry, neurology, and rehabilitation medicine (divided by 10,000);
MEDCAPWWU	=	total CAPWWUs produced during the fiscal year in the ambulatory PCAs of medicine and other physician services (divided by 10,000);

MEDRUGWWU	=	total RUGWWUs produced during the fiscal year in the long-term care PCAs of nursing home and intermediate care (divided by 10,000); and
FELLOWS	=	total FTEE of medicine residents PGY4 and above at the VAMC.

The CAPWWU total covers not only ambulatory medicine, but also the other physician services PCA because the latter includes the emergency unit and admitting & screening, important clinic stops with heavy internist involvement.

From Equation 4.25 it can be inferred that inpatient, ambulatory care, and long-term care WWUs all influence the amount of internist FTEE required for direct care and resident education at the VAMC; internist requirements are positively related to the number of fellows; and the relationship between RAM-group assignment and internist requirements is complex and depends, in particular, on the absolute level of MEDWWU.

In Figure 4.13, the studentized residuals from Equation 4.25 are shown. Although there are several outlier points, reflecting the relatively modest R^2 achieved, no marked trends are evident.

Surgery

$$\begin{aligned} SUR\_MD' = {} & 0.959 + \underset{(5.887)}{2.172}\ SURWWU \\ & + \underset{(9.975)}{0.0007}\ SURCAPWWU - \underset{(-6.096)}{1.773}\ HGROUP6 \\ & - \underset{(-5.887)}{0.009}\ (SURWWU \times SURCAPWWU) \\ & + \underset{(5.215)}{20.731}\ (SURWWU \times HGROUP6) \end{aligned} \qquad (4.26)$$

$$\text{with } \bar{R}^2 = 0.817 \text{ and } N = 139$$

where

SUR_MD'	=	the natural logarithm of the sum of all VA surgeon FTEE devoted to direct care (i.e., the sum of all SUR_MD variables) across all PCAs, plus total surgeon FTEE allocated to resident training, plus 1;

SURWWU	=	total surgery WWUs produced during the fiscal year across all inpatient PCAs (divided by 10,000); and
SURCAPWWU	=	total CAPWWUs produced during the fiscal year in the ambulatory surgery PCA (divided by 10,000).

In the course of the study, some data and methodology panel members hypothesized that the influence of inpatient and ambulatory workload on physician requirements would reflect a synergistic relationship. The negative interaction effect involving SURWWU and SURCAPWWU is consistent with the hypothesis, which is sustained in several other IPF equations, that the total influence of inpatient and ambulatory workload on physician requirements is less than the simple sum of their individual "direct" effects.

The studentized residuals from Equation 4.26 displayed in Figure 4.14 exhibit no systematic trend.

Psychiatry

$$\begin{aligned} \text{PSY\_MD}' = {} & 0.634 + \underset{(7.438)}{4.611}\ \text{PSYWWU} \\ & \underset{(-2.586)}{-\,3.080}\ (\text{PSYWWU})^2 + \underset{(10.883)}{0.005}\ \text{PSYCAPWWU} \\ & \underset{(-5.507)}{-\,0.405}\ \text{HGROUP2} + \underset{(4.133)}{0.038}\ \text{INSOCW} \\ & \underset{(-5.264)}{-\,0.0009}\ (\text{PSYWWU} \times \text{PSYCAPWWU}) \qquad (4.27) \end{aligned}$$

$$\text{with } \bar{R}^2 = 0.887 \text{ and } N = 164$$

where

PSY_MD'	=	the natural logarithm of the sum of VA psychiatrist FTEE devoted to direct care (i.e., the sum of all PSY_MD variables) across all PCAs, plus total psychiatrist FTEE allocated to residency training, plus 1;
PSYWWU	=	total psychiatry WWUs during the fiscal year across all inpatient PCAs (divided by 10,000);

PSYCAPWWU	=	total CAPWWUs during the fiscal year in the ambulatory psychiatry PCA; and
INSOCW	=	total inpatient social worker FTEE.

The studentized residuals from Equation 4.26 are shown in Figure 4.15. Neurology

Neurology

$$\begin{aligned} NEU\_MD' = {} & 0.351 + \underset{(4.897)}{23.770}\ NEUWWU + \underset{(5.544)}{0.015}\ NEUCAPWWU \\ & + \underset{(2.102)}{0.263}\ HGROUP4 + \underset{(3.029)}{0.626}\ HGROUP5 \\ & - \underset{(-3.105)}{21.193}\ (NEUWWU \times HGROUP5) \qquad (4.28) \end{aligned}$$

$$\text{with } \bar{R}^2 = 0.568 \text{ and } N = 89$$

where

NEU_MD'	=	natural logarithm of the sum of VA neurologist FTEE devoted to direct care (i.e., the sum of NEU_MD) across PCAs, plus total neurologist FTEE allocated to resident training, plus 1;
NEUWWU	=	total neurology WWUs produced during the fiscal year across the inpatient PCAs (divided by 10,000);
NEUCAPWWU	=	total CAPWWUs produced during the fiscal year in the ambulatory neurology PCA (divided by 10,000).

Rehabilitation Medicine

$$
\begin{aligned}
\text{RMS\_MD}' = {} & 0.425 + 6.590\ \text{RMSWWU} \\
& + \underset{(5.014)}{0.004}\ \text{RMSCAPWWU} + \underset{(3.587)}{0.019}\ \text{RMSRUGWWU} \\
& + \underset{(2.885)}{0.049}\ \text{RESIDENTS} + \underset{(4.394)}{0.245}\ \text{FELLOWS} \\
& - \underset{(-3.611)}{0.002}\ (\text{RMSCAPWWU} \times \text{FELLOWS}) \qquad (4.29)
\end{aligned}
$$

with $\bar{R}^2 = 0.605$ and $N = 136$

where

RMS_MD'	=	natural logarithm of the sum of VA rehabilitation medicine physician FTEE devoted to direct care (i.e., the sum of all RMS_MD variables) across PCAs, plus total RMS FTEE allocated to resident training, plus 1;
RMSWWU	=	total RMSWWUs produced during the fiscal year across the inpatient PCAs;
RMSCAPWWU	=	total CAPWWUs produced during fiscal year in the ambulatory rehabilitation medicine PCA;
RMSRUGWWU	=	total rehabilitation medicine RUGWWUs produced during the fiscal year in the LTC PCAs of nursing home care and intermediate care;
RESIDENTS	=	total FTEE of RMS residents PGY1-PGY3 at the VAMC; and
FELLOWS	=	total FTEE of RMS residents PGY4 and above at the VAMC.

Spinal Cord Injury

$$\text{SCI\_MD}' = \underset{}{0.452} + \underset{(5.292)}{20.625\ \text{SCIWWU}} - \underset{(-2.629)}{56.418\ (\text{SCIWWU})^2} \qquad (4.30)$$

$$\text{with } \bar{R}^2 = 0.808 \text{ and } N = 21$$

where

SCI_MD'	=	the natural logarithm of the total FTEE devoted by physicians in the SCI cost center to direct care and resident education in the SCI PCA, plus 1; and
SCIWWU	=	the sum of all medicine, surgery, psychiatry, neurology, and rehabilitation medicine WWUs generated during the fiscal year in the SCI PCA.

Anesthesiology

$$\text{AN\_MD}' = 0.323 + \underset{(2.999)}{2.496\ \text{ANWWU}}$$

$$- \underset{(-2.242)}{2.039\ (\text{ANWWU})^2} + \underset{(2.541)}{0.041\ \text{RESIDENTS}}$$

$$+ \underset{(2.454)}{0.102\ \text{FELLOWS}} + \underset{(2.324)}{0.261\ \text{HGROUP3}}$$

$$+ \underset{(2.917)}{0.418\ \text{HGROUP5}} \qquad (4.31)$$

$$\text{with } \bar{R}^2 = 0.697 \text{ and } N = 109$$

where

AN_MD'	=	the natural logarithm of the sum of all VA anesthesiologist FTEE devoted to direct care (i.e., the sum of AN_MD) across all PCAs, plus total contract anesthesiologist FTEE at the VAMC, plus total VA anesthesiologist FTEE allocated to resident education, plus l;

ANWWU	=	total surgery WWUs produced during the fiscal year across all inpatient PCAs (divided by 10,000);
RESIDENTS	=	total FTEE of anesthesiology residents PGY1-PGY3 at the VAMC; and
FELLOWS	=	total FTEE of anesthesiology residents PGY4 and above at the VAMC.

Laboratory Medicine

$$\begin{aligned}\text{LAB\_MD}' = {} & 0.250 + \underset{(7.598)}{1.032}\ \text{LABWWU} + \underset{(4.229)}{0.006}\ \text{LABCAPWWU} \\ & \underset{(-3.264)}{-\ 0.0004}\ (\text{LABWWU} \times \text{LABCAPWWU}) \\ & \underset{(2.073)}{+\ 0.032}\ \text{RESIDENTS} \\ & \underset{(2.124)}{+\ 0.123}\ \text{HGROUP3} \underset{(-5.684)}{-\ 0.359}\ \text{HGROUP6} \qquad (4.32) \\ & \text{with } \bar{R}^2 = 0.803 \text{ and } N = 156\end{aligned}$$

where

LAB_MD'	=	the natural logarithm of the sum of VA laboratory medicine physician FTEE devoted to direct care (i.e., the sum of LAB_MD) across all PCAs, plus total contract laboratory medicine FTEE at the VAMC, plus total VA laboratory medicine FTEE allocated to resident education, plus 1;
LABWWU	=	total inpatient WWUs at the VAMC (divided by 10,000);
LABCAPWWU	=	total CAPWWUs at the VAMC (divided by 10,000); and
RESIDENTS	=	total FTEE of laboratory medicine residents PGY1-PGY3 at the VAMC.

Diagnostic Radiology

$$\begin{aligned} \text{RAD\_MD}' &= \underset{}{0.280} + \underset{(5.517)}{1.578\ \text{RADWWU}} \\ &\quad - \underset{(-3.486)}{0.569\ (\text{RADWWU})^2} + \underset{(2.717)}{0.0004\ \text{RADCAPWWU}} \\ &\quad + \underset{(2.707)}{0.013\ \text{RADRUGWWU}} + \underset{(4.012)}{0.378\ \text{HGROUP3}} \\ &\quad + \underset{(3.257)}{0.264\ \text{HGROUP4}} + \underset{(2.341)}{0.326\ \text{HGROUP5}} \qquad (4.33) \end{aligned}$$

with $\bar{R}^2 = 0.804$ and $N = 164$

where

RAD_MD'	=	the natural logarithm of the sum of VA diagnostic radiology physician FTEE devoted to direct care (i.e., the sum of RAD_MD) across all PCAs, plus total diagnostic radiology contract physician FTEE at the VAMC, plus total VA diagnostic radiology physician FTEE allocated to resident education, plus 1;
RADWWU	=	the sum of all MEDWWU, SURWWU, and NEUWWU at the VAMC (divided by 10,000);
RADCAPWWU	=	the sum, of all MEDCAPWWU, SURCAPWWU, NEUCAPWWU, and OTHERCAPWWUs (divided by 10,000), where the latter is the total CAPWWUs generated in the ambulatory other physician services PCA; and
RADRUGWWU	=	total MEDRUGWWU at the VAMC (divided by 10,000).

Nuclear Medicine

$$
\begin{aligned}
\text{NM\_MD}' &= 0.203 + \underset{(4.657)}{0.915}\ \text{NMWWU} \\
&\quad - \underset{(-2.914)}{0.349}\ (\text{NMWWU})^2 + \underset{(3.645)}{0.015}\ \text{NMRUGWWU} \\
&\quad + \underset{(2.161)}{0.086}\ \text{RESIDENTS} + \underset{(3.170)}{0.133}\ \text{FELLOWS} \qquad (4.34)
\end{aligned}
$$

$$\text{with } \bar{R}^2 = 0.548 \text{ and } N = 99$$

where

NM_MD'	=	the natural logarithm of the sum of VA nuclear medicine physician FTEE devoted to direct care (i.e., the sum of NM_MD) across all PCAs, plus total nuclear medicine contract physician FTEE at the VAMC, plus total VA nuclear medicine physician FTEE allocated to resident education, plus 1;
NMWWU	=	the sum of all MEDWWU, SURWWU, and NEUWWU at the VAMC (divided by 10,000);
NMRUGWWU	=	total MEDRUGWWU at the VAMC (divided by 10,000);
RESIDENTS	=	total FTEE of nuclear medicine residents PGY1-PGY3 at the VAMC; and
FELLOWS	=	total FTEE of nuclear medicine residents PGY4 and above at the VAMC.

Radiation Oncology

$$\begin{aligned} \text{RO\_MD}' = {} & 0.031 + \underset{(1.874)}{0.601}\ \text{ROWWU} + \underset{(1.935)}{0.0006}\ \text{ROCAPWWU} \\ & + \underset{(2.437)}{0.029}\ \text{RORUGWWU} - \underset{(-3.047)}{0.613}\ \text{HGROUP5} \qquad (4.35) \end{aligned}$$

$$\text{with } \bar{R}^2 = 0.376 \text{ and } N = 30$$

where

RO_MD'	=	the natural logarithm of the sum of VA radiation oncology physician FTEE devoted to direct care (i.e., the sum of RO_MD) across PCAs, plus total radiation oncology contract physician FTEE at the VAMC, plus total VA radiation oncology physician FTEE allocated to resident training, plus 1;
ROWWU	=	the sum of MEDWWU, SURWWU, and NEUWWU at the VAMC (divided by 10,000);
ROCAPWWU	=	the sum of MEDCAPWWU, SURCAPWWU, NEUCAPWWU, and OTHERCAPWWU (divided by 10,000); and
RORUGWWU	=	total MEDRUGWWU at the VAMC (divided by 10,000).

EBPSM APPLICATION 1: USING THE MODELS TO ASSESS PHYSICIAN STAFFING LEVELS AND WORKLOAD PRODUCTIVITY AT VAMCS

Irrespective of the weight accorded empirically based models in the overall strategy for determining future physician requirements (see chapter 6), the EBPSM can serve as an important mechanism for evaluating the relative performance of individual VAMCs (or groups of them) at any point in time.

Each estimated IPF regression equation can be used to determine whether physician FTEE in a particular specialty at a particular facility is either more, or less, than expected, given the VAMC's workload and other relevant attributes such as affiliation status. Similarly, each estimated PF equation can assess whether a particular PCA produced either more, or less, workload than expected, given such relevant attributes as current VA physician, resident, and nonphysician staffing levels and affiliation status.

To demonstrate this, three illustrative analyses are presented below. In the first subsection below, the estimated IPF equations are used to compare the predicted quantity of physician FTEE for direct care and resident education at a facility in FY 1989 with the actual FTEE level allocated there to those purposes. In the second subsection below, the estimated PF models are manipulated to derive physician requirements for direct care (only), by specialty, at a facility; these FY 1989 estimates are compared with the actual FTEE allocated to direct care. Finally, the PF equations are used to derive predicted workload production, by PCA, at the facilities for FY 1989; each prediction is compared with the corresponding actual rate of productivity in that PCA at the facility.

For the remainder of this chapter, and in parts of the next two chapters, the analyses focus on four actual VAMCs selected to illustrate several aspects of the physician requirements methodology. The facilities (which will remain anonymous) are VAMC I, mid-size affiliated; VAMC II, metro affiliated; VAMC III, mid-size general unaffiliated; and VAMC IV, psychiatric.

The particular staffing results that emerge for these four VAMCs are not heavily emphasized because the committee does not wish to imply that *systemwide* policy conclusions can or should be drawn from them. Rather, the purpose is to show how the VA decision maker can use the empirically based model to examine actual-versus-expected performance—and, in the process, garner information useful to an ongoing dialogue about physician staffing involving VA Central Office and the VAMCs. This theme is pursued again in chapter 7.

Using the IPF to Compare Predicted and Actual Physician FTEE Devoted to Direct Patient Care and Resident Education

The policy question being examined here is as follows. In specialty *k* at VAMC *i* at some point in time, there will be some actual (recorded) quantity of physician FTEE devoted to patient care and resident teaching in the PCAs. The IPF estimated for *k* can probe the following question: Given these actual workload rates and other facility-specific attributes acknowledged in the equation, how much specialty *k* FTEE would the model predict as being required for patient care and resident education at VAMC *i*? If predicted FTEE exceeds actual FTEE, the model is implying that to handle the workload and resident education requirements at a facility with VAMC *i*'s particular set of characteristics, more physician FTEE was anticipated than found. In this particular sense, VAMC *i* could be characterized as "understaffed" in specialty *k* relative to other VAMCs. (This, alone, is not sufficient for a *policy* conclusion that *i* is understaffed in *k*—unless the VA decision maker has already elected to build the physician staffing methodology around the IPF, one of several possibilities examined in chapter 6.)

If actual FTEE exceeds predicted FTEE, the facility has more physician FTEE in specialty *k* for patient care and resident education than would be expected on a systemwide-average basis; in this sense, it is "overstaffed" for these missions. If actual and predicted FTEE happen to be equal, the model—estimated from a representative (and almost complete) sample of facilities—implies VAMC *i* has just the quantity of specialty *k* one would expect.

For each prediction, a "prediction interval" yielding information about its statistical precision can be computed. In general, let *P* be the IPF's predicted FTEE value for specialty *k* and VAMC *i*, and let *L* and *U* be the lower and upper limits of, say, its 95 percent prediction interval. This interval is denoted as (*L,U*) and interpreted as follows: For a VAMC with *i*'s exact attributes, including workload to be produced, there is a 95 percent probability that specialty *k* FTEE (devoted to patient care and teaching) will be found to lie in the interval bounded by *L* and *U*. [For a technical discussion of prediction intervals and the formula for calculating them, see Moses (1986) and Kmenta (1986).]

In Tables 4.1 through 4.4, actual and predicted physician FTEE for direct patient care and resident education are compared for each of 11 specialties at the selected VAMCs. The choice of a 95 percent prediction interval, although common, is arbitrary; intervals can be calculated similarly for whatever confidence level the decision maker desires.

Frequently, there is a substantial divergence (in percentage terms) between actual and IPF-predicted physician FTEE. Any such divergence constitutes *prima facie* evidence that staffing in that specialty at that facility departs substantially from VA system norms. But it may or may not indicate a physician staffing problem.

Subsequent discussions with the facility could reveal any of several explanations for the divergence: an error in the CDR data; significant assistance from non-VA consulting physicians that reduced staff physician requirements (assuming predicted FTEE exceeds actual); or an especially severe case mix within the DRGs assigned, so that WWUs understate the demands on physician time (assuming actual exceeds predicted). Or, these discussions might indeed indicate that the facility is understaffed or overstaffed, relative to the VA system "norms" embedded implicitly in the IPF equations.

Using the PF to Compare Projected and Actual Physician FTEE Devoted to Direct Patient Care

An alternative approach for deriving specialty-specific physician FTEE requirements for direct patient care is through manipulation of the estimated PF equations.

Compared with the IPF-based approach just discussed, a PF-based strategy has the advantage of allowing VA staff physician patient-care requirements for the facility to be derived on the basis of requirements at the PCA level *and* of allowing the latter to reflect the productivity contributions of staff physicians relative to other providers, including residents, nurses, and support staff. Thus, staff physician requirements for patient care can be derived while controlling for other factors that contribute to patient care.

However, the PF-based approach does present some complications, as will be seen. If a certain specialty's FTEE variable does not merit inclusion in a given PCA's PF on statistical grounds, physician requirements in that specialty for that PCA will always be computed as 0, whatever the specialty's actual time and contributions to patient care. Also, because the dependent variable is workload and not physician FTEE, prediction intervals on FTEE requirements cannot be computed directly. (Note that under the least-squares regression model, physician FTEE is assumed to be nonprobabilistic in these PF specifications; hence it is not possible to derive a statement of statistical precision about the level of physician FTEE found to be consistent with the production of a given patient workload.)

A third issue, well illustrated by the estimated PF equations above, is that for any given workload level, W^*, projected for a given PCA, there is typically not one, but many (sometimes an infinite number of) provider combinations which, when substituted into the PCA's PF, yields a predicted value of W equal precisely to W^*. Which provider combination should be chosen? The question is clearly important because the choice effectively determines the relative and absolute physician FTEE levels accorded to that PCA in response to W^*. (In traditional production theory in economics, the issue is resolved because the assumption of profit maximization implies that the firm will be led always to choose the one combination of inputs that minimizes cost, given the desired rate of output.)

In response, the following approach has been adopted in this chapter to determining physician requirements via the estimated PF models. To simplify, let the estimated PF for a given PCA be W = b_0 + b_1 StaffPhys + b_2 Residents + b_3 (Nurse/StaffPhys), and let the current values of workload and the three independent variables be denoted by the 0 subscript.

If the workload target for the PCA is declared to be W^* (see chapter 8 on how future workload levels are projected on a facility-and PCA-specific basis), what equal proportionate change in all provider variables from their current values would yield new values consistent with meeting a projected workload rate of W^*?. The answer is to solve for the constant c such that $W^* = b_0 + b_1(c\text{StaffPhys}_0) + b_2(c\text{Residents}_0) + b_3(c\text{Nurse}_0/c\text{StaffPhys}_0)$. What is termed the "projected" level of staff physician FTEE thereby consistent with producing workload W^* is $c\text{StaffPhys}_0$. ("Projected" rather than "predicted" is used to indicate the nonprobabilistic nature of the calculation.)

In chapter 7, an alternative, conceptually stronger, though more complicated technique—called linear programming (LP)—is illustrated for deriving physician requirements for patient care using the estimated PF equations, in conjunction with other data and assumptions about the use of resources in the PCAs. In particular, LP allows such questions to be asked as: What combination of staff physician FTEE and other provider FTEE minimizes the dollar cost of providing patient care, subject to the constraints that (1) projected workload targets are met and (2) the FTEE ratios among various providers are not so high or low as to be clinically or administratively implausible. (As shown also in chapter 7, additional constraints can be imposed requiring that provider FTEE levels, and ratios, adhere to certain quality-of-care requirements that may be imposed by the VA decision maker.)

In what follows, however, the simple "multiplier adjustment" approach, described above, is used to derive physician requirements for patient care from the estimated PF equations.

The results are summarized in Tables 4.5 through 4.11. All tables pertain to VAMC II (only) and show actual-versus-projected physician FTEE requirements for patient care in FY 1989 for the following five specialties and two VA programs, respectively: medicine, surgery, psychiatry, neurology, rehabilitation medicine; ambulatory care and long-term care.

Physician requirements cannot be derived by this PF-based technique for the specialties for which a PF could not be estimated: anesthesiology, laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology.

There is no separate table for SCI physicians because all of their direct patient care is assumed to occur in the SCI PCA. When the multiplier adjustment process is applied to the estimated SCI PF, a projected value of SCI_MD for VAMC II for FY 1989 of 0.64 is derived, compared with the CDR-recorded value of 0.72.

These results are presented in some detail not to make particular policy statements about VAMC II (though some interesting points are suggested), but rather to demonstrate concretely that the PF variant of the empirically based model can be used as one basis for assessing the level of physician staffing at VAMCs.

As with the IPF application, divergences between actual and projected staffing do not *ipso facto* indicate inappropriate staffing—the data do not "speak for themselves." Rather, they must be interpreted in light of (1) additional information that the VAMC or others may wish to bring to bear and (2) the relative weight accorded an empirically based approach in the overall physician requirements methodology. The considerable discussion in chapter 6 about a "Reconciliation Strategy" is aimed precisely at resolving this second issue.

Using the PF to Compare Predicted and Actual Rates of Workload Productivity

The estimated PF equations are naturally well suited for examining an important question that bears on physician requirements. Specifically, for any PCA at any VAMC, how does its actual rate of workload production compare with the rate predicted by the appropriate PCA-specific PF? That is, given the quantity of staff physicians (by specialty), residents, nurses, and support personnel allocated to the PCA at a point in time, is the PCA's actual workload productivity higher, lower, or about equal to what its PF indicates would be expected for a facility with these attributes?

Recall that the PF has been estimated from observations across the VA system on the relationship between provider FTEE and workload levels; thus, any particular workload prediction derived from it is a reflection of the systemwide average rate of productivity expected, given that PCA's particular array of physician and nonphysician providers.

In Tables 4.12 through 4.15, the results of just such an analysis are summarized for four selected PCAs at the four VAMCs in FY 1989.

That the predicted workload diverges significantly from actual workload in some instances prompts several points:

- Even for a perfectly specified PF model, some divergence could be expected between actual and predicted due solely to random error.
- Although the PF (and the IPF) equations exhibit strong goodness of fit by social science standards, there is no guarantee that they are perfectly specified. Indeed, certain possibly important variables—for example, non-VA consulting physician FTEE and capital equipment—cannot be included in the equations at present because there are no systemwide data on them. Moreover, certain idiosyncratic local factors—for example, that the VAMC has been recruiting unsuccessfully for specialty *k* physicians for several years—cannot easily be incorporated in these models. Even if variables capturing such effects could be developed, the modest sample sizes here limit the number of independent variables that can be successfully accommodated.
- It therefore follows that sharp departures of actual from predicted values should be taken seriously—but as a signal for investigation into factors behind the divergence, not as an automatic mandate for staffing changes.

EBPSM APPLICATION 2: DERIVATION OF FUTURE PHYSICIAN REQUIREMENTS, BY SPECIALTY, FOR VAMCS

In what follows, the committee demonstrates how the empirically based models can be used to determine future VA physician requirements at VAMCs.

The technical procedures for using the IPF to derive physician requirements for patient care and resident education and the PF to derive requirements for patient care were illustrated in the previous section. Because the aim there was to estimate physician FTEE required for FY 1989, all workload values used in those equations were actual FY 1989 observations.

In the calculations summarized in Tables 4.16 through 4.27, projections of future VA workload are applied to the estimated IPF and PF equations to derive estimates of future physician requirements, by specialty. To compress and focus the presentation, the calculations pertain only to the four selected VAMCs and to the fiscal years of 2000 and 2005.

The workload projection methodology used here, as summarized in chapter 8, represents an adaptation of existing VA procedures to the specific requirements of this study. In particular, the VA methodology was extended to accommodate inpatient WWUs, ambulatory care CAPWWUs, and long-term care RUGWWU s—workload measures central to this study's equations, but not now used in VA strategic planning models.

Since previous sections have set the stage, a brief presentation of the results proceeds.

Using the IPF to Derive Future Physician Requirements For Direct Patient Care and Resident Education

These analyses are summarized in Tables 4.16 through 4.19 for VAMCs I through IV, respectively, and show physician requirements for patient care and resident education in 11 specialties for FYs 2000 and 2005.

Each FTEE calculation is expressed as a "prediction," accompanied by a 95 percent prediction interval. The interpretation is as follows. The focus, in general, is on specialty *k* at VAMC *i* in some future year *t*. Given projections of the level of workload relevant to specialty *k* at *i* in year *t*, the facility's RAM group status, and other factors reflected in *k*'s IPF, this model generates a best estimate (a "prediction") of the amount of physician *k* FTEE to be found at *i* in *t*. The prediction interval indicates the statistical precision of this forecast.

Since this IPF has been estimated with a systemwide sample of observations on *current* FTEE levels for *k* in relationship to *current* workload, the predicted FTEE level can be interpreted as the answer to the following question: How much specialty *k* FTEE is required to handle future patient care and resident education, *assuming that the current average relationship between workload and FTEE, as estimated via the IPF, continues to prevail?*[11]

To illustrate the calculation process, consider the derivation of medicine FTEE requirements for VAMC I for FY 2000, as summarized in Table 4.16. The vehicle for this derivation is the estimated IPF for medicine, Equation 4.25. From the workload projection analyses of chapter 8, it can be shown that MEDWWU for VAMC I for FY 2000 is 0.4432 (that is, 4,432 WWUs/10,000), that MEDCAPWWU is 486.4956 (= 4,864,956 CAPWWUs/10,000), and that MEDRUGWWU is 2.0827 (= 20,827 RUGWWUs/10,000). Since VAMC I is a RAM Group 3 facility, HGROUP3 = 1, and all other RAM group variables are set to 0. Regarding the interaction terms in Equation 4.25, only (MEDWWU × HGROUP3) is nonzero, and it now equals MEDWWU.

The final problem is determining an appropriate value for FELLOWS for FY 2000—a difficult estimate that the VA Office of Academic Affairs, which administers the VA residency support program, has had no reason to pursue to this point. As a practical response, it was assumed that the number of PGY4 residents and above in medicine would change in proportion to inpatient workload. At VAMC I in FY 1989, there were 14 fellows in medicine, and MEDWWU was 0.3718, so that the 2000:1989 MEDWWU ratio is 0.4432/0.3718 = 1.192. When this multiplier is applied to 14, the projected value of FELLOWS is 16.69 FTEE.

When these variable values are substituted into Equation 4.25, the resulting predicted quantity of internist FTEE required for patient care and resident education is 17.18, as indicated in Table 4.16. (This can be compared with the predicted and actual FTEE levels for FY 1989, which from Table 4.1 are 14.77 and 19.41, respectively.) The accompanying prediction-interval calculation for FY 2000 implies that the probability is 0.95 that a facility with VAMC I's attributes and facing the workload demands calculated above will be found to have an internist FTEE level for patient care and resident education between 7.70 and 36.98. The considerable width of this and many of the other prediction intervals reported in the tables here is a reflection of several factors: uncertainty about whether the "true" model for predicting the dependent variable has been determined (which becomes magnified when the prediction is made for independent variable values that depart significantly from the FY 1989 sample means), and additional uncertainty because the future observation of the dependent variable (the thing being predicted) arises from a random process (or so the model assumes).

[11] Hence, it is assumed in these (facility-specific) IPFs either that nurse and support-staff intensity are unimportant *or* that they are adjusted by the VAMC in ways that preserve the underlying physician FTEE-workload relationship being modeled in the IPF.

The committee notes that most FTEE predictions in Tables 4.16 through 4.19 appear plausible (or not implausible), as did the projected workload levels used in their derivation.

Using the PF to Derive Future Physician Requirements For Direct Patient Care

These analyses are summarized in Tables 4.20 through 4.27. Each shows, for a given future year and VAMC, the projected FTEE required for direct patient care, by specialty, in each PCA. By summing across any row, the total projected physician FTEE for the associated PCA is obtained. By summing down a given column, the projected total FTEE for that specialty is obtained. Separate totals are presented for inpatient care, the ambulatory care program, and the PCAs comprising long-term care here.

These workload projections were all derived by the multiplier adjustment method discussed in some detail in the previous section. It was applied here as follows: For a given VAMC and future year, the projected workload for each PCA was inserted into the left-hand side (dependent-variable position) of that PCA's PF. The multiplier adjustment method was then invoked to derive direct-care FTEE levels for all physicians (and only those physicians) included in the PF. This yields the FTEE values displayed in each row of the table. The process is repeated for all PCAs—that is, for all estimated PFs—so that FTEE requirements for any specialty are computed as the sum of all PCA-specific requirements.

Because the two empirically based variants differ both in modeling assumptions and in the process used to calculate future physician FTEE, the PF and IPF estimates for a given PCA and year are not expected to exhibit, in every instance, the expected ordered relationship—namely, that the IPF estimate should exceed the PF because the former also includes resident education.

As a concluding note, *the committee emphasizes that none of the estimates presented in this and the previous section are for total physician FTEE requirements. Rather, the PF projections pertain solely to patient care, and the IPF predictions are for both patient care and resident education*. As indicated in chapter 2, these two mission-related activities absorb the bulk of physician time in all specialties. But some staff physicians do devote significant time to research, and small amounts of FTEE are typically allocated to continuing education, quality assurance, and other activities, (including regulatory functions).

Hence, for an EBPSM to be complete, data-driven approaches must also be developed for determining future FTEE for research, continuing education, and other activities at the VAMC. Specifically, when the IPF variant is used, FTEE estimates for each of the above will need to be added in separately. When the

PF variant is used, FTEE for these activities and also for resident education will need to be incorporated.

Recommendations on how to derive these additional FTEE components, plus a worked example illustrating the process for computing total physician requirements in a specialty, are presented in chapter 6.

PROPOSALS FOR REFINING AND EXTENDING THE EBPSM

In sum, the results reported in this chapter demonstrate that, with few exceptions, statistically strong and clinically meaningful models for determining physician requirements can be developed and estimated using currently available VA data.

It must be acknowledged, however, that a recurring theme sounded by the committee's six specialty and two clinical program panels was that the data used in these models—particularly physician FTEE data from the CDR—were at risk of being skewed through various types of reporting errors. The committee is in no position to challenge the claim that such measurement errors, of omission or commission, do occur; undoubtedly they do. But it can be concluded that such errors are not so pervasive or virulent as to preclude the development of plausible, good-fitting models relating physician FTEE and workload. Nonetheless, the committee believes that VA data relevant to the EBPSM can and should be improved. Specific proposals are offered below for enhancing the quality of existing data and for developing, on a systemwide basis, additional information required for the construction of new variables.

In general, the VA should test, evaluate, and revise, as needed, the EBPSM on an ongoing basis. With the demands on the VA health care system in dynamic transition, the EBPSM should not be treated as a static construct.

Improving the Accuracy of Data From the CDR

The VA should consider several options:

1. Each VAMC center is now required to have a data validation committee with a mandate to ensure that each service's FTEE allocations are reasonable and, further, that the allocations transmitted by the facility to VA Central Office accurately reflect the data reported by the services. These committees should be actively encouraged to work aggressively at quality control.
2. Positive incentives should be instituted for individual physicians and administrators to fill out CDR worksheets accurately—or penalties should be

applied for evident sloppiness or misrepresentation. These incentives and penalties could involve tangible "carrots and sticks" or simply moral suasion.

3. For short, concentrated periods, physicians and administrators should be required to track how physician time is being allocated across activities; the results should be compared with the corresponding FTEE allocations in CDRs.

The VA has recently appointed a national Data Validation Task Force to identify facilities whose reported figures, on a wide variety of items, diverge significantly from system norms. This task force should devote particular attention to FTEE allocations in CDRs.

Developing Improved and New Variables For the Models

The scope of the VA's national data system should be broadened to permit the construction of potentially important new variables and the refinement of existing variables for use in the EBPSM.

1. At present, it is not possible to distinguish full-time (FT) and various levels of part-time (PT) physician FTEE in the national CDR accounts. Data breaking out full-time and part-time physician FTEE (by how many "eights" each physician represents) are available in the VA payroll system. This information should be integrated into the CDR accounts to yield specialty-specific observations on the amount of physician FTEE, by FT-PT category, allocated to each PCA at all VAMCs. Only then can such basic questions be investigated as whether two half-time VA physicians are equivalent in productivity to one full-time physician; the current practice of aggregating across all physicians in a specialty to create a single FTEE measure assumes such an equivalency. In addition, the CDR should be amended so that physician FTEE for resident education, research, and administration *not* occurring in the PCAs can be clearly distinguished.
2. It is also not possible at present to distinguish physicians by subspecialty in the national CDR accounts; for example, the quantity of FTEE allocated by the cardiologist to the medicine inpatient PCA or by the neurosurgeon FTEE to the ambulatory surgery PCA are not available from these accounts at the moment. Investigations exploring the merits of including subspecialty FTEE in the PF equations and of producing IPFs specific to subspecialties cannot be undertaken unless these more detailed breakouts of FTEE data are developed and automated centrally.
3. Estimates of Consulting & Attending and Without-Compensation physician FTEE are not available on a systemwide basis presently. The VA should strongly consider focused, time-limited surveys to collect this information by specialty and PCA at each VA facility. Only then can the net contributions of

C&A and WOC physicians in the production of workload be evaluated appropriately.

4. Data on the type, amount, and vintage of capital equipment affecting the efficient delivery of high-quality care should be made available for each PCA in all VAMCs. Expert judgment would be required to identify the relevant equipment for each PCA. Preliminary investigations by the study staff in late 1990 revealed that facility-specific information on capital equipment acquisitions is maintained by the VA Office of Acquisitions & Materiel Management. It now appears that variables can be constructed from these data indicating the dollar amount and type of capital equipment, by PCA, at a VAMC. Considerable analysis would be required, however, to produce such variables in a form suitable for inclusion in the PF equations.
5. For each resident supported by the VA via salary or contract, a CDR worksheet is completed, but it allocates the resident's time only to the broad categories of Inpatient Medicine, Inpatient Surgery, Inpatient Psychiatry, and Outpatient Care. These categories need to be further broken out on the worksheet to allow a direct (rather than inferential) assignment of resident FTEE to each PCA in the facility.
6. At present, there are potentially important nonphysician personnel categories for which FTEE totals are available on a facility-total basis, but not allocated to PCAs. Included here are physician assistants, nurse practitioners, ward clerks, phlebotomists, and, in fact, all categories not assigned a distinct cost center in the CDR. In response to this limitation, the committee created for the PF analysis the PCA-specific variable called SUPPORT, defined generally as the total nonphysician, nonnursing service FTEE allocated to the PCA. Because this variable cannot now be further spliced into distinct personnel categories, a PCA-specific PF whose nonphysician component is tailored to the mix of personnel typically found on that PCA cannot be constructed. The VA should strongly consider enhancing the CDR national accounts so that FTEE data for all personnel categories relevant to the EBPSM are available at the PCA level.
7. With the VA's assistance, the committee was able to develop a number of alternative operational definitions of patient case workload. The strong goodness of fit and overall statistical soundness of most estimated PF and IPF equations provide *prima facie* evidence supporting the validity of these workload measures. But the VA should consider further analyses testing whether there are other output variables, derivable from existing VA data, that are more sensitively related to physician time requirements.

Further Methodological Development

The committee recommends that the VA periodically review the selection of variables and overall functional form of the EBPSM.

Over time, a number of factors affecting the PF and the IPF equations can be expected to change, at varying rates: the mix and acuity level of cases presenting at VAMCs; medical technology; practice patterns; the range of services offered by the VA; the relative balance between inpatient, ambulatory, and long-term care services; and the quality and scope of data from the Cost Distribution Report and other sources. Moreover, the motivation and effort level of individual physicians may well be influenced by some of these VA system changes. The VA should investigate measurable factors that appear to account for differences in individual physician productivity, then use these factors in subsequent analyses that relate physician requirements, in part, to the predicted effort level per FTEE.

Consequently, it is important that all equations be reestimated periodically to test whether these various secular changes suggest modification of the models —either their mathematical form or variable makeup. For maximum statistical power, these investigations require the pooling of data over time to generate a time series of cross-sectional observations for each PF and IPF equation (Kmenta, 1986). As its sample size grows, the statistical precision of each equation will improve. Moreover, by using time-dependent 'control" variables, the analyst can explicitly allow for the possibility that a given explanatory variable may wield different degrees of influence over time on the outcome of interest (either physician FTEE in the IPF or PCA workload in the PF). As multiple years of data accumulate, it will become possible to undertake certain innovative, split-sample methods of internal model validation, such as bootstrapping (see footnote 10 in this chapter).

Since a complete new data set emerges each year, it would be feasible to reexamine the EBPSM on an annual basis. For selected facilities, actual values of workload or FTEE could be compared with the values predicted by the EBPSM. The reasons for significant discrepancies could be explored, likely leading to improved specifications of the EBPSM.

These recommendations underscore a critical point: Building a strong physician requirements methodology calls for an evolutionary process—one with the flexibility to adapt to changing times and learn from its own discoveries.

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Table 4.1 CDR-Based Actual Physician FTEE and IPF-Derived Predicted FTEE for Direct Patient Care and Resident Education by Specialty at VAMC I, FY 1989

	Physician FTEE Statistics		
Specialties	Actual[1]	Predicted[1]	95 % Prediction Interval
Medicine	19.41	14.77	(6.73, 31.33)
Surgery	6.91	11.73	(6.60, 20.17)
Psychiatry	10.53	13.02	(6.85, 24.00)
Neurology	0.96	2.75	(1.23, 5.28)
Rehabilitation Medicine	1.90	3.51	(1.72, 6.54)
Spinal Cord Injury	2.52	1.99	(0.80, 4.02)
Anesthesiology	6.65	3.54	(1.42, 7.46)
Laboratory Medicine	1.86	4.77	(2.53, 8.38)
Diagnostic Radiology	3.95	5.47	(2.60, 10.46)
Nuclear Medicine	1.44	1.61	(0.77, 2.86)
Radiation Oncology	2	2	2

NOTE: VAMC I = mid-size affiliated.

[1] Indudes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

[2] VAMC I has no cost center for this specialty.

Table 4.2 CDR-Based Actual Physician FTEE and IPF-Derived Predicted FTEE for Direct Patient Care and Resident Education by Specialty at VAMC II, FY 1989

	Physician FTEE Statistics		
Specialties	Actual[1]	Predicted[1]	95 % Prediction Interval
Medicine	44.52	43.98	(19.99, 96.13)
Surgery	14.51	15.08	(8.52, 26.30)
Psychiatry	19.33	22.85	(12.16, 42.07)
Neurology	4.32	5.06	(2.47, 9.54)
Rehabilitation Medicine	2.51	4.08	(2.03, 7.59)
Spinal Cord Injury	0.76	1.61	(0.55, 3.39)
Anesthesiology	5.72	7.92	(3.59, 16.39)
Laboratory Medicine	7.16	5.88	(3.06, 10.68)
Diagnostic Radiology	13.70	9.93	(4.92, 19.12)
Nuclear Medicine	1.92	1.68	(0.78, 3.07)
Radiation Oncology	1.21	2.86	(1.03, 6.32)

NOTE: VAMC II = metro affiliated.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

Table 4.3 CDR-Based Actual Physician FTEE and IPF-Derived Predicted FTEE for Direct Patient Care and Resident Education by Specialty at VAMC III, FY 1989

	Physician FTEE Statistics		
Specialties	Actual[1]	Predicted[1]	95 % Prediction Interval
Medicine	23.42	16.28	(7.23, 35.32)
Surgery	7.37	8.56	(4.74, 15.01)
Psychiatry	8.47	12.84	(6.68, 24.09)
Neurology	2	2	2
Rehabilitation Medicine	1.68	1.87	(0.74, 3.70)
Spinal Cord Injury	2	2	2
Anesthesiology	1.00	1.45	(0.30, 3.64)
Laboratory Medicine	2.00	3.25	(1.60, 5.99)
Diagnostic Radiology	4.60	3.85	(1.68, 7.81)
Nuclear Medicine	2	2	2
Radiation Oncology	2	2	2

NOTE: VAMC III = mid-size general unaffiliated.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

[2] VAMC III has no cost center for this specialty.

Table 4.4 CDR-Based Actual Physician FTEE and IPF-Derived Predicted FTEE for Direct Patient Care and Resident Education by Specialty at VAMC IV, FY 1989

	Physician FTEE Statistics		
Specialties	Actual[1]	Predicted[1]	95 % Prediction Interval
Medicine	5.22	8.77	(3.74, 19.14)
Surgery	2	2	2
Psychiatry	16.38	19.06	(10.20, 35.03)
Neurology	1.78	1.05	(0.23, 2.45)
Rehabilitation Medicine	1.78	1.70	(0.61, 3.49)
Spinal Cord Injury	2	2	2
Anesthesiology	2	2	2
Laboratory Medicine	0.92	1.01	(0.23, 2.30)
Diagnostic Radiology	1.51	0.97	(0.11, 2.51)
Nuclear Medicine	0.48	0.60	(0.08, 1.36)
Radiation Oncology	2	2	2

NOTE: VAMC IV =large psychiatric facility.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

[2] VAMC IV has no cost center for this specialty.

Table 4.5 For Medicine, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Physician FTEE Statistics	
Patient Care Areas	Actual	Projected
Inpatient		
Medicine	10.95	12.13
Surgery	3.52	3.94
Psychiatry	0.57	0.00
Neurology	0.28	0.40
Rehabilitation Medicine	0.06	0.06
Spinal Cord Injury	0.51	0.00
Ambulatory		
Medicine	8.05	12.28
Surgery	0.28	0.00
Psychiatry	0.23	0.00
Neurology	0.00	0.00
Rehabilitation Medicine	0.06	0.00
Other Physician Services	12.47	9.59
Long-Term Care		
Nursing Home	0.68	0.60
Intermediate Care	0.11	0.18
Total	37.77	39.18

NOTE: VAMC II = metro affiliated.

Table 4.6 For Surgery, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Physician FTEE Statistics	
Patient Care Areas	Actual	Projected
Inpatient		
Medicine	0.05	0.06
Surgery	8.04	8.99
Psychiatry	0.00	0.00
Neurology	0.00	0.00
Rehabilitation Medicine	0.03	0.00
Spinal Cord Injury	0.00	0.00
Ambulatory		
Medicine	0.19	0.00
Surgery	0.94	1.64
Psychiatry	0.00	0.00
Neurology	0.00	0.00
Rehabilitation Medicine	0.03	0.00
Other Physician Services	2.96	0.00
Long-Term Care		
Nursing Home	0.00	0.00
Intermediate Care	0.03	0.00
Total	12.27	10.69

NOTE: VAMC II = metro affiliated.

Table 4.7 For Psychiatry, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Physician FTEE Statistics	
Patient Care Areas	Actual	Projected
Inpatient		
Medicine	0.27	0.30
Surgery	0.05	0.00
Psychiatry	7.43	9.04
Neurology	0.00	0.00
Rehabilitation Medicine	0.02	0.00
Spinal Cord Injury	0.02	0.00
Ambulatory		
Medicine	0.00	0.00
Surgery	0.00	0.00
Psychiatry	9.61	7.27
Neurology	0.00	0.00
Rehabilitation Medicine	0.00	0.00
Other Physician Services	0.00	0.00
Long-Term Care		
Nursing Home	0.00	0.00
Intermediate Care	0.00	0.00
Total	17.40	16.61

NOTE: VAMC II = metro affiliated.

Table 4.8 For Neurology, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Physician FTEE Statistics	
Patient Care Areas	Actual	Projected
Inpatient		
Medicine	0.45	0.50
Surgery	0.10	0.00
Psychiatry	0.61	0.00
Neurology	0.76	1.08
Rehabilitation Medicine	0.33	0.00
Spinal Cord Injury	0.03	0.00
Ambulatory		
Medicine	0.00	0.00
Surgery	0.04	0.00
Psychiatry	0.27	0.00
Neurology	0.56	2.03
Rehabilitation Medicine	0.00	0.00
Other Physician Services	0.00	0.00
Long-Term Care		
Nursing Home	0.00	0.00
Intermediate Care	0.25	0.00
Total	3.40	3.61

NOTE: VAMC II = metro affiliated.

Table 4.9 For Rehabilitation Medicine, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Physician FTEE Statistics	
Patient Care Areas	Actual	Projected
Inpatient		
Medicine	0.09	0.00
Surgery	0.10	0.00
Psychiatry	0.30	0.00
Neurology	0.08	0.00
Rehabilitation Medicine	0.36	0.37
Spinal Cord Injury	0.24	0.00
Ambulatory		
Medicine	0.00	0.00
Surgery	0.00	0.00
Psychiatry	0.00	0.00
Neurology	0.00	0.00
Rehabilitation Medicine	1.15	0.66
Other Physician Services	0.01	0.00
Long-Term Care		
Nursing Home	0.25	0.22
Intermediate Care	0.14	0.23
Total	2.72	1.48

NOTE: VAMC II = metro affiliated.

Table 4.10 For Ambulatory Care, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Actual Physician FTEE Statistics						
Patient Care Arueas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	OTHER_MD[1]	Total
Medicine	8.05	0.19	0.00	0.00	0.00	0.34	**8.58**
Surgery	0.28	0.94	0.00	0.04	0.00	0.19	**1.45**
Psychiatry	0.23	0.00	9.61	0.27	0.00	0.13	**10.24**
Neurology	0.00	0.00	0.00	0.56	0.00	0.00	**0.56**
Rehabilitative Medicine	0.06	0.03	0.00	0.00	1.15	0.05	**1.29**
Other Physician Services	12.47	2.96	0.00	0.00	0.01	8.05	**23.49**
Total	21.09	4.12	9.61	0.87	1.16	8.76	**45.61**
	Projected Physician FTEE Statistics						
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	OTHER_MD[1]	Total
Medicine	10.61	0.00	0.00	0.00	0.00	0.45	11.06
Surgery	0.00	1.70	0.00	0.00	0.00	0.00	1.70
Psychiatry	0.00	0.00	7.27	0.00	0.00	0.00	7.27
Neurology	0.00	0.00	0.00	1.77	0.00	0.00	1.77
Rehabilitative Medicine	0.00	0.00	0.00	0.00	0.39	0.00	0.39
Other Physician Services	9.59	0.00	0.00	0.00	0.00	3.53	13.12
Total	20.20	1.70	7.27	1.77	0.39	3.98	35.31

NOTE: See text for identification of terms; VAMC II = metro affiliated.

[1] Includes all physician direct care FTEE not reflected already in MED_MD, SUR_MD, PSY_MD, NEU_MD, and RMS_MD.

Table 4.11 For Long-Term Care, CDR-Based Actual Physician FTEE and PF-Derived Projected FTEE for Direct Patient Care at VAMC II, FY 1989

	Actual Physician FTEE Statistics							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	INT_MD	OTHER_MD[1]	**Total**
Nursing Home	0.68	0.00	0.00	0.00	0.25	0.00	0.07	**1.00**
Intermediate Care	0.11	0.03	0.00	0.25	0.14	0.00	0.03	**0.56**
Total	0.79	0.03	0.00	0.25	0.39	0.00	0.10	**1.56**
	Projected Physician FTEE Statistics							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	INT_MD	OTHER MD[1]	Total
Nursing Home	0.60	0.00	0.00	0.00	0.22	0.00	0.06	**0.88**
Intermediate Care	0.18	0.00	0.00	0.00	0.23	0.00	0.05	**0.46**
Total	0.78	0.00	0.00	0.00	0.45	0.00	0.11	**1.34**

NOTE: See text for identification of terms; VAMC II = metro affiliated.

[1] Includes all physician direct care FTEE not reflected already in MED_MD, SUR_MD, PSY_MD, NEU_MD, RMS_MD, and INT_MD.

Table 4.12 CDR-Based Actual Workload and PF-Derived Predicted Workload in Selected Patient Care Areas of VAMC I, FY 1989

	Workload Statistics		
Patient Care Areas	Actual	Predicted	95% Prediction Interval
Inpatient Medicine[1]	3,400	3,585	(2,396, 5,337)
Inpatient Surgery[1]	4,481	3,185	(2,221, 4,600)
Inpatient Psychiatry[2]	23,090	21,404	(9,896, 46,165)
Ambulatory Medicine[3]	3,541,283	3,815,567	(1,567,511, 9,202,630)
Nursing Home[4]	15,201	20,676	(10,279, 41,855)

NOTE: VAMC I = mid-size affiliated.

[1] Workload expressed in Weighted Work Units (WWUs).

[2] Workload expressed in Bed-Days of Care (BDOC).

[3] Workload expressed in Capitation Weighted Work Units (CAPWWUs).

[4] Workload expressed in Resource Utilization Group Weighted Work Units (RUGWWUs).

Table 4.13 CDR-Based Actual Workload and PF-Derived Predicted Workload in Selected Patient Care Areas of VAMC II, FY 1989

	Workload Statistics		
Patient Care Areas	Actual	Predicted	95% Prediction Interval
Inpatient Medicine[1]	7,484	6,919	(4,604, 10,352)
Inpatient Surgery[1]	6,467	5,932	(4,084, 8,642)
Inpatient Psychiatry[2]	78,401	61,980	(28,481, 133,688)
Ambulatory Medicine[3]	9,705,467	5,258,203	(2,171,655, 12,854,502)
Nursing Home[4]	63,665	67,466	(33,793, 134,910)

NOTE: VAMC II = metro affiliated.

[1] Workload expressed in Weighted Work Units (WWUs).

[2] Workload expressed in Bed Days of Care (BDOC).

[3] Workload expressed in Capitation Weighted Work Units (CAPWWUs).

[4] Workload expressed in Resource Utilization Group Weighted Work Units (RUGWWUs).

Table 4.14 CDR-Based Actual Workload and PF-Derived Predicted Workload in Selected Patient Care Areas of VAMC III, FY 1989

	Workload Statistics		
Patient Care Areas	Actual	Predicted	95 % Prediction Interval
Inpatient Medicine[1]	2,115	2,121	(1,427, 3,157)
Inpatient Surgery[1]	2,674	2,378	(1,636, 3,430)
Inpatient Psychiatry[2]	97,723	48,054	(21,699, 106,413)
Ambulatory Medicine[3]	5,664,334	2,352,995	(940,343, 5,871,280)
Nursing Home[4]	26,146	33,292	(16,515, 66,733)

NOTE: VAMC III = mid-size general unaffiliated.

[1] Workload expressed in Weighted Work Units (WWUs).

[2] Workload expressed in Bed-Days of Care (BDOC).

[3] Workload expressed in Capitation Weighted Work Units (CAPWWUs).

[4] Workload expressed in Resource Utilization Group Weighted Work Units (RUGWWUs).

Table 4.15 CDR-Based Actual Workload and PF-Derived Predicted Workload in Selected Patient Care Areas of VAMC IV, FY 1989

	Workload Statistics		
Patient Care Areas	Actual	Predicted	95% Prediction Interval
Inpatient Medicine[1]	1,633	1,818	(1,214, 2,746)
Inpatient Surgery[1]	5	5	5
Inpatient Psychiatry[2]	110,757	92,595	(35,954, 240,334)
Ambulatory Medicine[3]	255,454	733,584	(295,079, 1,839,729)
Nursing Home[4]	85,314	49,493	(24,760, 99,056)

NOTE: VAMC IV = psychiatric.

[1] Workload expressed in Weighted Work Units (WWUs).

[2] Workload expressed in Bed-Days of Care (BDOC).

[3] Workload expressed in Capitation Weighted Work Units (CAPWWUs).

[4] Workload expressed in Resource Utilization Group Weighted Work Units (RUGWWUs).

[5] PCA not found at VAMC IV.

Table 4.16 IPF-Derived Predictions of Physician Requirements for Direct Patient Care and Resident Education by Specialty at VAMC I, FYs 2000 and 2005[1]

	FY 2000		FY 2005	
Specialties	Predicted FTEE Requirements	95% Prediction Intervals	Predicted FTEE Requirements	95% Prediction Interval
Medicine	17.18	(7.70, 36.98)	19.30	(8.71, 41.39)
Surgery	13.22	(7.45, 22.71)	13.86	(7.88, 23.90)
Psychiatry	16.58	(8.60, 31.39)	15.70	(8.13, 29.67)
Neurology	3.08	(1.44, 5.88)	4.29	(2.16, 7.89)
Rehabilitation Medicine	4.64	(2.19, 8.98)	4.78	(2.25, 9.23)
Spinal Cord Injury	1.77	(0.66, 3.65)	1.77	(0.66, 3.65)
Anesthesiology	4.52	(1.94, 9.41)	4.77	(2.06, 9.86)
Laboratory Medicine	6.23	(3.38, 10.99)	6.33	(3.42, 11.11)
Diagnostic Radiology	6.41	(3.12, 12.24)	6.56	(3.21, 12.50)
Nuclear Medicine	2.28	(1.18, 3.96)	2.13	(1.07, 3.72)
Radiation Oncology	1.87	(0.52, 4.38)	1.95	(0.57, 4.55)

NOTE: VAMC I = mid-size affiliated.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

Table 4.17 IPF-Derived Predictions of Physician Requirements for Direct Patient Care and Resident Education by Specialty at VAMC II, FYs 2000 and 2005[1]

	FY 2000		FY 2005	
Specialties	Predicted FTEE Requirements	95% Prediction Intervals	Predicted FTEE Requirements	95% Prediction Interval
Medicine	63.33	(26.49, 148.23)	68.54	(28.78, 161.05)
Surgery	15.15	(8.34, 26.84)	14.93	(8.24, 26.50)
Psychiatry	13.98	(7.35, 26.06)	11.77	(6.11, 21.99)
Neurology	5.48	(2.64, 10.56)	5.61	(2.71, 10.78)
Rehabilitation				
Medicine	5.33	(1.82, 13.36)	5.36	(1.83, 13.39)
Spinal Cord Injury	1.32	(0.37, 2.92)	1.32	(0.37, 2.92)
Anesthesiology	11.80	(4.95, 26.54)	12.22	(5.13, 27.39)
Laboratory Medicine	6.16	(3.16, 11.36)	6.30	(3.24, 11.59)
Diagnostic Radiology	10.64	(4.97, 21.50)	10.55	(4.91, 21.29)
Nuclear Medicine	1.92	(0.86, 3.58)	1.95	(0.87, 3.63)
Radiation Oncology	2.35	(0.76, 5.36)	2.54	(0.86, 5.72)

NOTE: VAMC II = metro affiliated.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

Table 4.18 IPF-Derived Predictions of Physician Requirements for Direct Patient Care and Resident Education by Specialty at VAMC III, FYs 2000 and 2005[1]

	FY 2000		FY 2005	
Specialties	Predicted FTEE Requirements	95% Prediction Intervals	Predicted FTEE Requirements	95% Prediction Interval
Medicine	17.47	(7.78, 38.14)	17.01	(7.52, 37.01)
Surgery	9.03	(5.04, 15.81)	8.60	(4.73, 15.02)
Psychiatry	10.53	(5.44, 19.45)	9.08	(4.65, 16.95)
Neurology	2.16	(0.79, 4.56)	2.15	(0.79, 4.56)
Rehabilitation				
Medicine	2.05	(0.82, 4.10)	1.50	(0.50, 3.20)
Spinal Cord Injury	0.57	(0.0[2], 1.77)	0.57	(0.0[2], 1.77)
Anesthesiology	1.68	(0.42, 4.11)	1.63	(0.39, 4.01)
Laboratory Medicine	3.05	(1.48, 5.63)	3.00	(1.45, 5.57)
Diagnostic Radiology	4.27	(1.90, 8.56)	4.16	(1.84, 8.37)
Nuclear Medicine	1.00	(0.36, 1.92)	0.99	(0.36, 1.92)
Radiation Oncology	1.28	(0.18, 3.37)	1.22	(0.15, 3.29)

NOTE: VAMC III = mid-size general unaffiliated.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

[2] Lower bound truncated at 0.

Table 4.19 IPF-Derived Predictions of Physician Requirements for Direct Patient Care and Resident Education by Specialty at VAMC IV, FYs 2000 and 2005[1]

	FY 2000		FY 2005	
Specialties	Predicted FTEE Requirements	95% Prediction Intervals	Predicted FTEE Requirements	95% Prediction Interval
Medicine	10.33	(4.52, 22.37)	10.25	(4.47, 22.14)
Surgery	0.0[2]	(0.0, 0.0)[2]	0.02	(0.0, 0.0)[2]
Psychiatry	20.45	(10.96, 37.48)	20.38	(10.92, 37.35)
Neurology	0.92	(0.14, 2.22)	1.46	(0.46, 3.13)
Rehabilitation Medicine	2.00	(0.78, 4.07)	1.97	(0.76, 4.02)
Spinal Cord Injury	0.57	(0.0[3], 1.77)	0.57	(0.0[3], 1.77)
Anesthesiology	0.45	(0.0[3], 1.76)	0.45	(0.0[3], 1.76)
Laboratory Medicine	1.32	(0.40, 2.84)	1.36	(0.43, 2.90)
Diagnostic Radiology	1.14	(0.20, 2.81)	1.16	(0.21, 2.85)
Nuclear Medicine	0.69	(0.14, 1.49)	0.69	(0.15, 1.47)
Radiation Oncology	0.30	(0.0[3], 1.42)	0.27	(0.0[3], 1.37)

NOTE: VAMC IV = psychiatric.

[1] Includes all physician FTEE for direct care and resident education associated with the specialty's CDR cost center, across all patient care areas (and thus encompassing the emergency and admitting & screening areas of the other physician services PCA); excludes physicians in that specialty who are assigned to a CDR cost center other than the one normally associated with the specialty.

[2] Since VAMC IV had no surgery service and no recorded surgeon FTEE in FY 1989, it was deemed most reasonable to assign 0 FTEE for FY 2000 and FY 2005. Of course, if the mission and case mix of VAMC IV were to change in certain ways by the end of the century, it might well become reasonable to "predict" positive levels of surgeon FTEE for these two years.

[3] Lower bound truncated at 0.

Table 4.20 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC I, FY 2000

	Projected Physician FTEE Requirements for FY 2000							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	6.82	0.37	0.08	0.00	0.00	0.00	0.00	**7.27**
Surgery	3.52	7.40	0.00	0.00	0.00	0.00	0.06	**10.98**
Psychiatry	0.00	0.00	2.85	0.00	0.00	0.00	0.00	**2.85**
Neurology	0.25	0.10	0.00	0.41	0.00	0.00	0.00	**0.76**
Rehabilitation Medicine	0.11	0.00	0.00	0.00	0.79	0.00	0.00	**0.90**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	1.53	0.00	**1.53**
Subtotal	10.70	7.87	2.93	0.41	0.79	1.53	0.06	**24.29**
Ambulatory								
Medicine	4.41	0.00	0.00	0.00	0.00	0.00	0.72	**5.13**
Surgery	0.00	2.15	0.00	0.00	0.00	0.00	0.00	**2.15**
Psychiatry	0.00	0.00	5.83	0.00	0.00	0.00	0.00	**5.83**
Neurology	0.00	0.00	0.00	0.87	0.00	0.00	0.00	**0.87**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.96	0.00	0.00	**0.96**
Other Physician Services	2.71	0.00	0.32	0.00	0.00	0.00	1.03	**4.06**
Subtotal	7.12	2.15	6.15	0.87	0.96	0.00	1.75	**19.00**
Long-Term Care								
Nursing Home	0.73	0.00	0.00	0.00	0.07	0.00	0.14	**0.94**
Intermediate Care	0.22	0.00	0.00	0.00	0.02	0.00	0.11	**0.35**
Subtotal	0.95	0.00	0.00	0.00	0.09	0.00	0.25	**1.29**
Total	**18.77**	**10.02**	**9.08**	**1.28**	**1.84**	**1.53**	**2.06**	**44.58**

NOTE: VAMC I = mid-size affiliated.

Table 4.21 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC I, FY 2005

	Projected Physician FTEE Requirements for FY 2005							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	7.25	0.40	0.09	0.00	0.00	0.00	0.00	**7.74**
Surgery	3.92	8.24	0.00	0.00	0.00	0.00	0.06	**12.22**
Psychiatry	0.00	0.00	2.68	0.00	0.00	0.00	0.00	**2.68**
Neurology	0.26	0.11	0.00	0.43	0.00	0.00	0.00	**0.80**
Rehabilitation Medicine	0.12	0.00	0.00	0.00	0.81	0.00	0.00	**0.93**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	1.72	0.00	**1.72**
Subtotal	11.55	8.75	2.77	0.43	0.81	1.72	0.06	**26.09**
Ambulatory								
Medicine	4.56	0.00	0.00	0.00	0.00	0.00	0.74	**5.30**
Surgery	0.00	2.25	0.00	0.00	0.00	0.00	0.00	**2.25**
Psychiatry	0.00	0.00	5.80	0.00	0.00	0.00	0.00	**5.80**
Neurology	0.00	0.00	0.00	1.00	0.00	0.00	0.00	**1.00**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	1.00	0.00	0.00	**1.00**
Other Physician Services	2.83	0.00	0.34	0.00	0.00	0.00	1.07	**4.24**
Subtotal	7.39	2.25	6.14	1.00	1.00	0.00	1.81	**19.59**
Long-Term Care								
Nursing Home	0.83	0.00	0.00	0.00	0.08	0.00	0.16	**1.07**
Intermediate Care	0.23	0.00	0.00	0.00	0.02	0.00	0.12	**0.37**
Subtotal	1.06	0.00	0.00	0.00	0.10	0.00	0.28	**1.44**
Total	**20.00**	**11.00**	**8.91**	**1.43**	**1.91**	**1.72**	**2.15**	**47.12**

NOTE: VAMC I = mid-size affiliated.

Table 4.22 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC II, FY 2000

	Projected Physician FTEE Requirements for FY 2000							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	12.86	0.06	0.32	0.53	0.00	0.00	0.00	**13.77**
Surgery	4.07	9.30	0.00	0.00	0.00	0.00	0.01	**13.38**
Psychiatry	0.00	0.00	6.56	0.00	0.00	0.00	0.00	**6.56**
Neurology	0.42	0.00	0.00	1.13	0.00	0.00	0.00	**1.55**
Rehabilitation Medicine	0.06	0.00	0.00	0.00	0.39	0.00	0.00	**0.45**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.27	0.00	**0.27**
Subtotal	17.41	9.36	6.88	1.66	0.39	0.27	0.01	**35.98**
Ambulatory								
Medicine	12.83	0.00	0.00	0.00	0.00	0.00	1.53	**14.36**
Surgery	0.00	1.80	0.00	0.00	0.00	0.00	0.00	**1.80**
Psychiatry	0.00	0.00	5.84	0.00	0.00	0.00	0.00	**5.84**
Neurology	0.00	0.00	0.00	2.19	0.00	0.00	0.00	**2.19**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.82	0.00	0.00	**0.82**
Other Physician Services	8.78	0.00	0.00	0.00	0.00	0.00	3.23	**12.01**
Subtotal	21.61	1.80	5.84	2.19	0.82	0.00	4.76	**37.02**
Long-Term Care								
Nursing Home	0.90	0.00	0.00	0.00	0.33	0.00	0.09	**1.23**
Intermediate Care	0.29	0.00	0.00	0.00	0.37	0.00	0.08	**0.74**
Subtotal	1.19	0.00	0.00	0.00	0.70	0.00	0.17	**2.06**
Total	**40.21**	**11.16**	**12.72**	**3.85**	**1.91**	**0.27**	**4.94**	**75.06**

NOTE: VAMC II = metro affiliated.

Table 4.23 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC II, FY 2005

	Projected Physician *FTEE* Requirements for FY 2005							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	13.10	0.06	0.32	0.54	0.00	0.00	0.00	**14.02**
Surgery	4.13	9.44	0.00	0.00	0.00	0.00	0.01	**13.58**
Psychiatry	0.00	0.00	5.93	0.00	0.00	0.00	0.00	**5.93**
Neurology	0.42	0.00	0.00	I. 15	0.00	0.00	0.00	**1.57**
Rehabilitation Medicine	0.07	0.00	0.00	0.00	0.39	0.00	0.00	**0.46**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.27	0.00	**0.27**
Subtotal	17.72	9.50	6.25	1.69	0.39	0.27	0.01	**35.83**
Ambulatory								
Medicine	12.95	0.00	0.00	0.00	0.00	0.00	1.54	**14.49**
Surgery	0.00	1.84	0.00	0.00	0.00	0.00	0.00	**1.84**
Psychiatry	0.00	0.00	5.23	0.00	0.00	0.00	0.00	**5.23**
Neurology	0.00	0.00	0.00	2.25	0.00	0.00	0.00	**2.25**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.83	0.00	0.00	**0.83**
Other Physician Services	8.45	0.00	0.00	0.00	0.00	0.00	3.11	**11.56**
Subtotal	21.40	1.84	5.23	2.25	0.83	0.00	4.65	**36.20**
Long-Term Care								
Nursing Home	0.96	0.00	0.00	0.00	0.35	0.00	0.10	**1.41**
Intermediate Care	0.31	0.00	0.00	0.00	0.40	0.00	0.09	**0.80**
Subtotal	1.27	0.00	0.00	0.00	0.75	0.00	0.19	**2.21**
Total	**40.39**	**11.34**	**11.48**	**3.94**	**1.97**	**0.27**	**4.85**	**74.24**

NOTE: VAMC II = metro affiliated.

Table 4.24 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC III, FY 2000

	Projected Physician FTEE Requirements for FY 2000							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	6.81	0.43	0.00	0.00	0.00	0.00	0.00	**7.24**
Surgery	3.41	6.23	0.00	0.00	0.00	0.00	0.00	**9.64**
Psychiatry	0.00	0.00	7.86	0.00	0.00	0.00	0.00	**7.86**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.53	0.00	0.00	0.00	0.63	0.00	0.00	**1.16**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Subtotal	10.75	6.66	7.86	0.00	0.63	0.00	0.00	**25.90**
Ambulatory								
Medicine	13.21	0.00	0.00	0.00	0.61	0.00	0.00	**13.82**
Surgery	0.00	2.23	0.00	0.00	0.00	0.00	0.00	**2.23**
Psychiatry	0.00	0.00	2.96	0.00	0.00	0.00	0.00	**2.96**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.72	0.00	0.00	**0.72**
Other Physicians Services	9.33	0.00	0.24	0.00	0.00	0.00	1.50	**11.07**
Subtotal	22.54	2.23	3.20	0.00	1.33	0.00	1.50	**30.80**
Long-Term Care								
Nursing Home	1.88	0.00	0.00	0.00	0.20	0.00	0.00	**2.08**
Intermediate Care	3.20	0.00	0.00	0.00	0.28	0.00	0.00	**3.48**
Subtotal	5.08	0.00	0.00	0.00	0.48	0.00	0.00	**5.56**
Total	**38.37**	**8.89**	**11.06**	**0.00**	**2.44**	**0.00**	**1.50**	**62.26**

NOTE: VAMC III = mid-size general unaffiliated.

Table 4.25 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC III, FY 2005

	Projected Physician FTEE Requirements for FY 2005							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	6.66	0.42	0.00	0.00	0.00	0.00	0.00	**7.08**
Surgery	3.31	6.05	0.00	0.00	0.00	0.00	0.00	**9.36**
Psychiatry	0.00	0.00	7.55	0.00	0.00	0.00	0.00	**7.55**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.52	0.00	0.00	0.00	0.62	0.00	0.00	**1.14**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Subtotal	10.49	6.47	7.55	0.00	0.62	0.00	0.00	**25.13**
Ambulatory								
Medicine	12.72	0.00	0.00	0.00	0.59	0.00	0.00	**13.31**
Surgery	0.00	2.07	0.00	0.00	0.00	0.00	0.00	**2.07**
Psychiatry	0.00	0.00	2.81	0.00	0.00	0.00	0.00	**2.81**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.69	0.00	0.00	**0.69**
Other Physician Services	8.67	0.00	0.00	0.00	0.00	0.00	1.40	**10.07**
Subtotal	21.39	2.07	2.81	0.00	1.28	0.00	1.40	**28.95**
Long-Term Care								
Nursing Home	1.35	0.00	0.00	0.00	0.14	0.00	0.00	**1.49**
Intermediate Care	3.26	0.00	0.00	0.00	0.29	0.00	0.00	**3.55**
Subtotal	4.61	0.00	0.00	0.00	0.43	0.00	0.00	**5.04**
Total	**36.49**	**8.54**	**10.36**	**0.00**	**2.33**	**0.00**	**1.40**	**59.12**

NOTE: VAMC III = mid-size general unaffiliated.

Table 4.26 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC IV, FY 2000

	Projected Physician FTEE Requirements for FY 2000							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	5.07	0.00	0.71	0.40	0.00	0.00	0.00	**6.18**
Surgery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Psychiatry	0.00	0.00	19.49	0.00	0.00	0.00	0.00	**19.49**
Neurology	0.00	0.00	0.00	0.15	0.00	0.00	0.00	**0.15**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.72	0.00	0.00	**0.72**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Subtotal	5.07	0.00	20.20	0.55	0.72	0.00	0.00	**26.54**
Ambulatory								
Medicine	0.00[1]	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Surgery	0.00	0.00[1]	0.00	0.00	0.00	0.00	0.00	**0.00**
Psychiatry	0.00	0.00	0.21	0.00	0.00	0.00	9.75	**9.96**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.21	0.00	0.00	**0.21**
Other Physicians Services	0.00	0.00	0.20	0.00	0.00	0.00	0.65	**0.85**
Subtotal	0.00	0.00	0.41	0.00	0.21	0.00	10.40	**11.02**
Long-Term Care								
Nursing Home	0.08	0.00	0.00	0.00	0.29	0.00	1.81	**2.18**
Intermediate Care	0.18	0.00	0.00	0.00	0.40	0.00	22.88	**23.46**
Subtotal	0.26	0.00	0.00	0.00	0.69	0.00	24.69	**25.64**
Total	**5.33**	**0.00**	**20.61**	**0.55**	**1.62**	**0.00**	**35.09**	**63.19**

NOTE: VAMC IV = psychiatric.

[1] Actual projected FTEE estimate was slightly negative, because projected workload for this PCA for FY 2000 was significantly different than what PF would predict for the PCA, given its attributes. Put differently, the PCA in this facility is an "outlier" (see Chapter 7) and FTEE projections derived for it must be regarded with caution.

Table 4.27 PF-Derived Projections of Physician Requirements for Direct Patient Care, by PCA, in Seven Specialty Categories at VAMC IV, FY 2005

	Projected Physician FTEE Requirements for FY 2005							
Patient Care Areas	MED_MD	SUR_MD	PSY_MD	NEU_MD	RMS_MD	SCI_MD	OTHER_MD	**Total**
Inpatient								
Medicine	4.99	0.00	0.70	0.39	0.00	0.00	0.00	**6.08**
Surgery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Psychiatry	0.00	0.00	19.71	0.00	0.00	0.00	0.00	**19.71**
Neurology	0.00	0.00	0.00	0.16	0.00	0.00	0.00	**0.16**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.73	0.00	0.00	**0.73**
Spinal Cord Injury	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Subtotal	4.99	0.00	20.41	0.55	0.73	0.00	0.00	**26.68**
Ambulatory								
Medicine	0.00[1]	0.00	0.00	0.00	0.00	0.00	0.00[1]	**0.00**
Surgery	0.00[1]	0.00	0.00[1]	0.00	0.00	0.00	0.00	**0.00**
Psychiatry	0.00	0.00	0.21	0.00	0.00	0.00	9.96	**9.96**
Neurology	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Rehabilitation Medicine	0.00	0.00	0.00	0.00	0.22	0.00	0.00	**0.22**
Other Physicians Services	0.00	0.00	0.21	0.00	0.00	0.00	0.68	**0.89**
Subtotal	0.00	0.00	0.42	0.00	0.22	0.00	10.64	**11.28**
Long-Term Care								
Nursing Home	0.08	0.00	0.00	0.00	0.28	0.00	1.75	**2.11**
Intermediate Care	0.19	0.00	0.00	0.00	0.42	0.00	23.68	**24.29**
Subtotal	0.27	0.00	0.00	0.00	0.70	0.00	25.43	**26.40**
Total	**5.26**	**0.00**	**20.83**	**0.55**	**1.65**	**0.00**	**36.07**	**64.36**

NOTE: VAMC IV = psychiatric.

[1] Actual projected FTEE estimate was slightly negative, because projected workload for this PCA for FY 2005 was significantly different from what PF would predict for the PCA, given its attributes. Put differently, the PCA in this facility is an "outlier" (see Chapter 7) and FTEE projections derived for it must be regarded with caution.

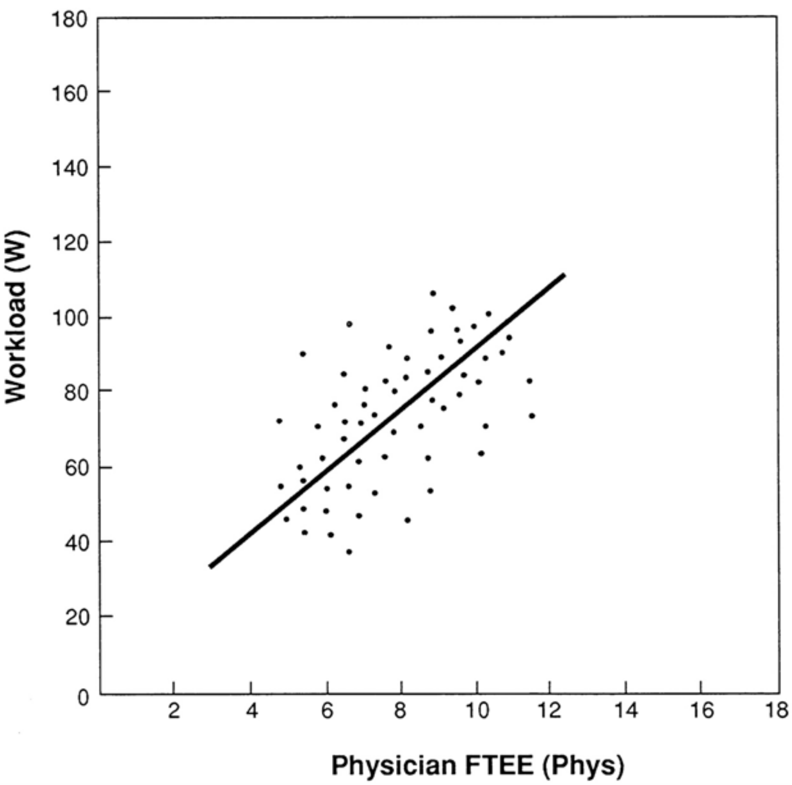

Figure 4.1 PF with Workload Linearly Related to Physician FTEE

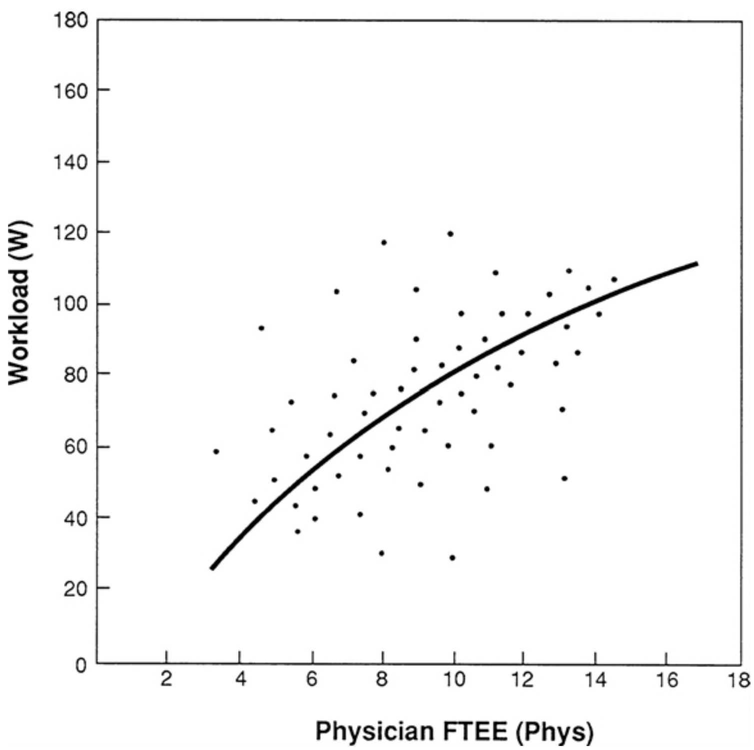

Figure 4.2 PF with Nonlinear Relationship between Workload and Physician FTEE

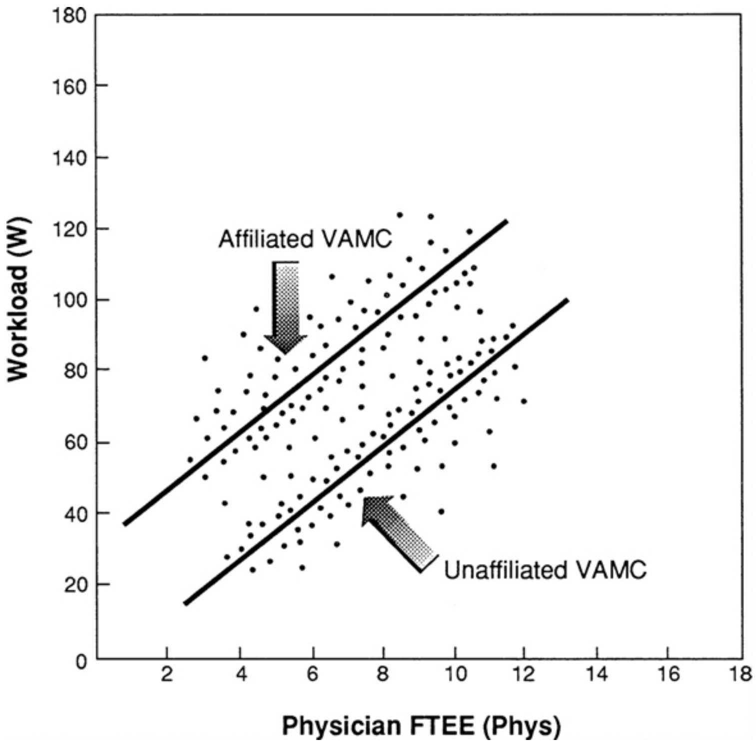

Figure 4.3 PF with Affiliation Status and Physician FTEE Having Distinct (Independent) Effects on Workload

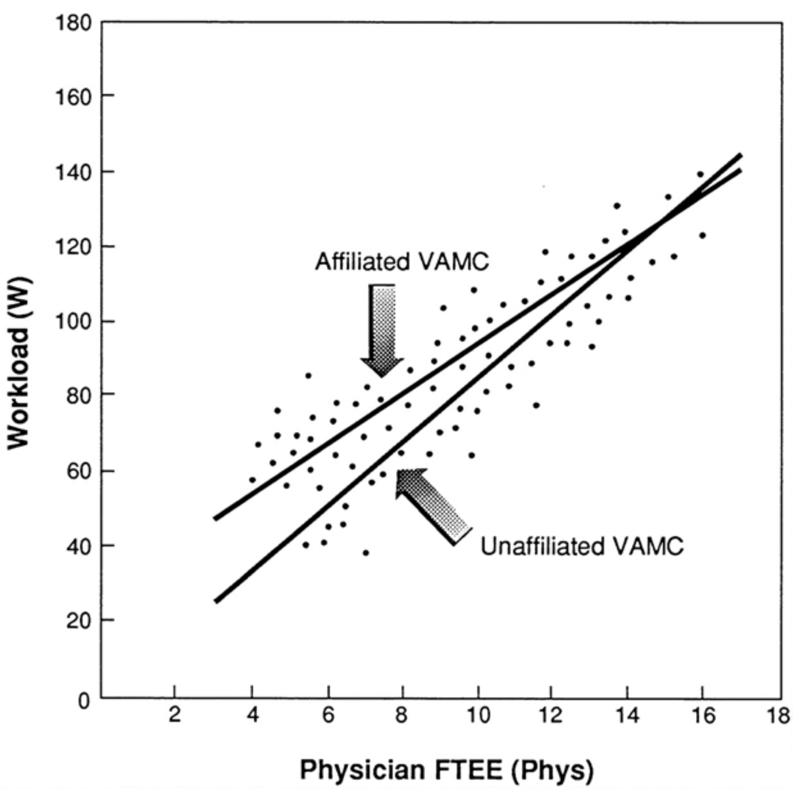

Figure 4.4
PF with Affiliation Status and Physician FTEE Having an Interactive Effect on Workload

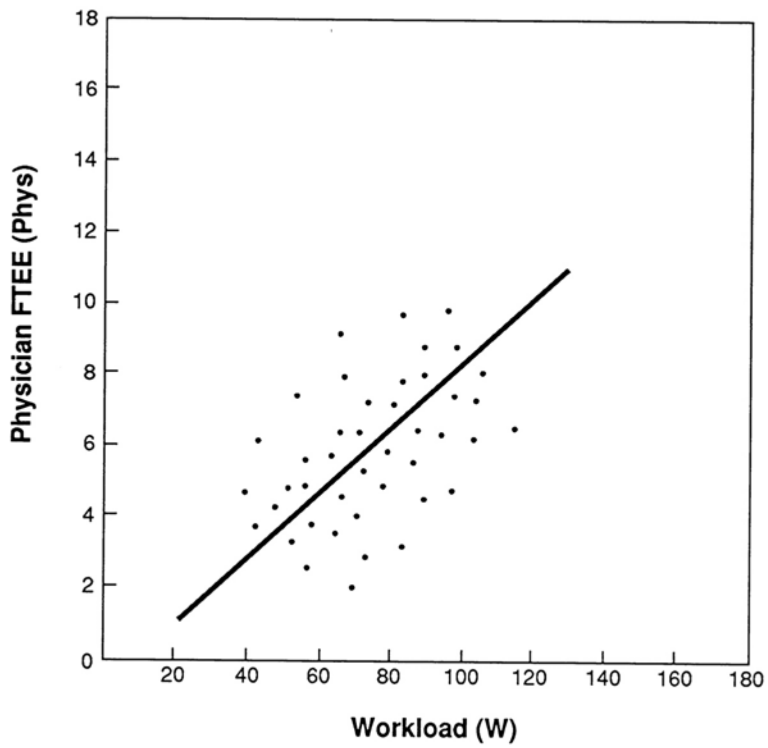

Figure 4.5
IPF with Physician FTEE Linearly Related to Workload

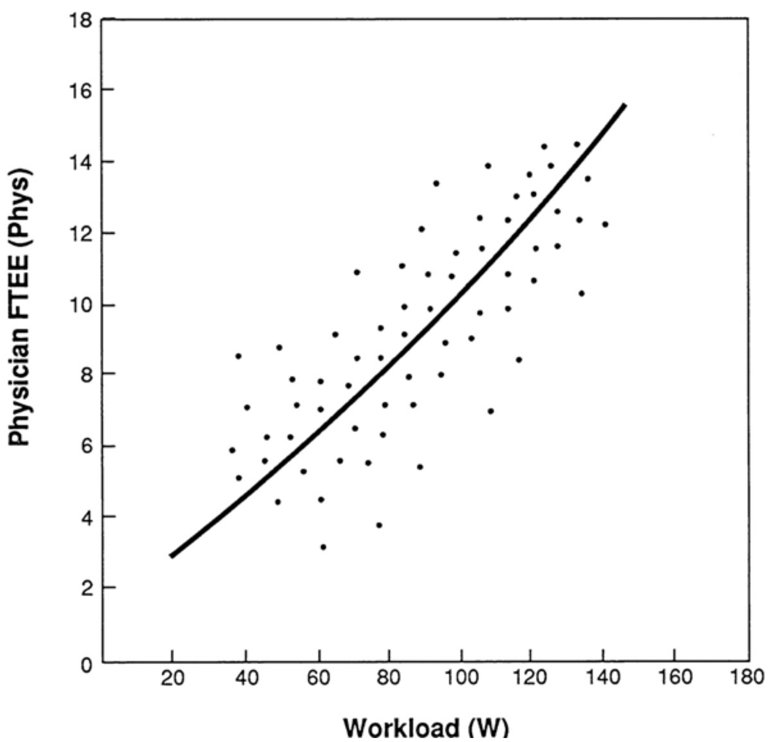

Figure 4.6
IPF with Nonlinear Relationship between Physician FTEE and Workload

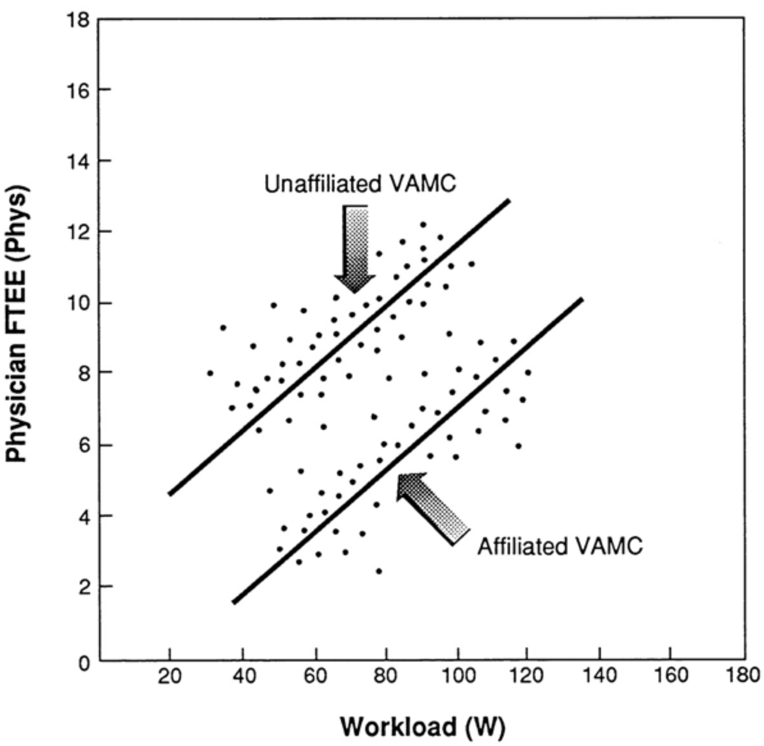

Figure 4.7
IPF with Affiliation Status and Workload Having Distinct(Independent) Effects on Physician FTEE

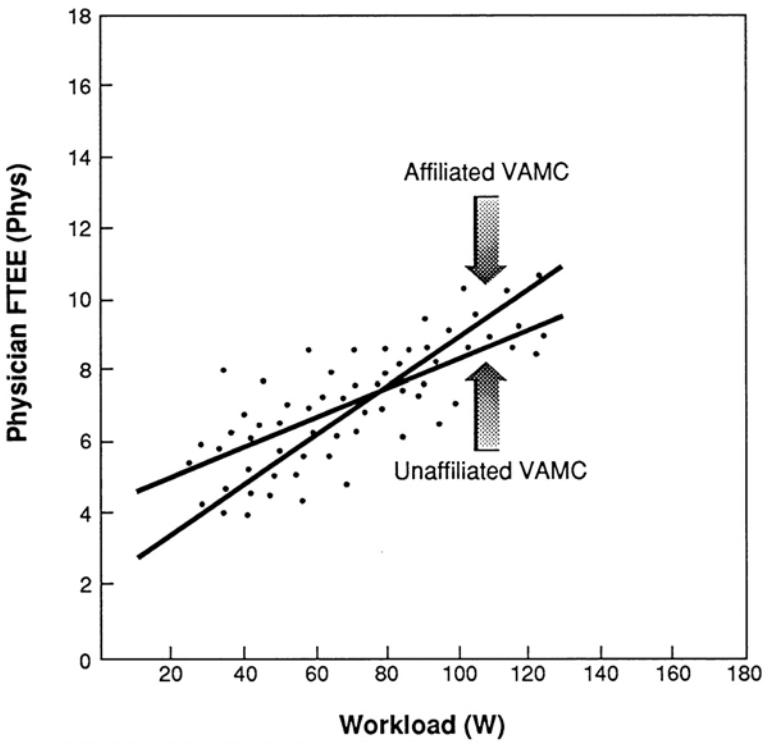

Figure 4.8
IPF with Affiliation Status and Workload Having an Interactive Effect on Physician FTEE

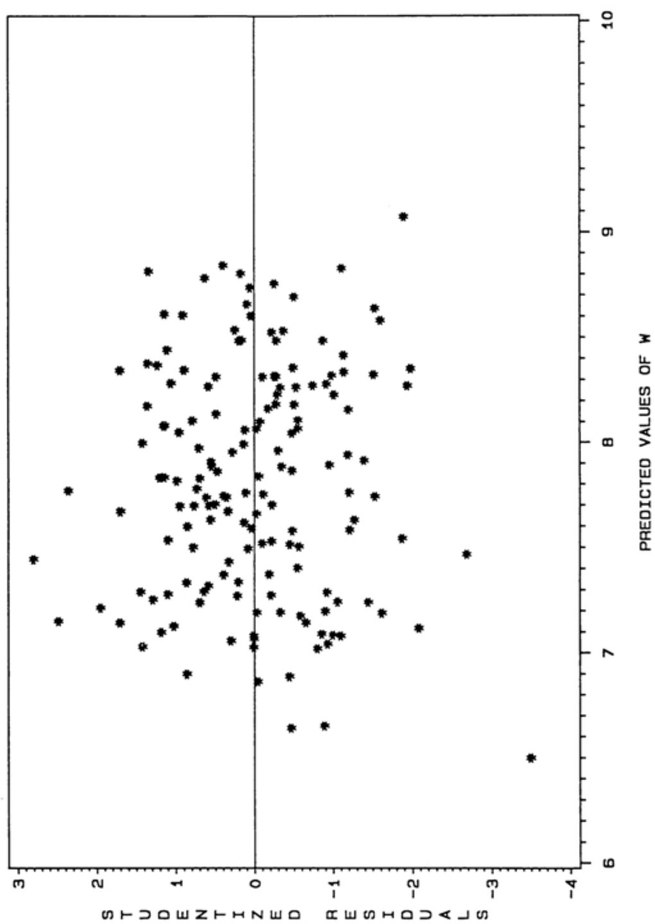

Figure 4.9
Inpatient Medicine PF Residuals Scatterplot

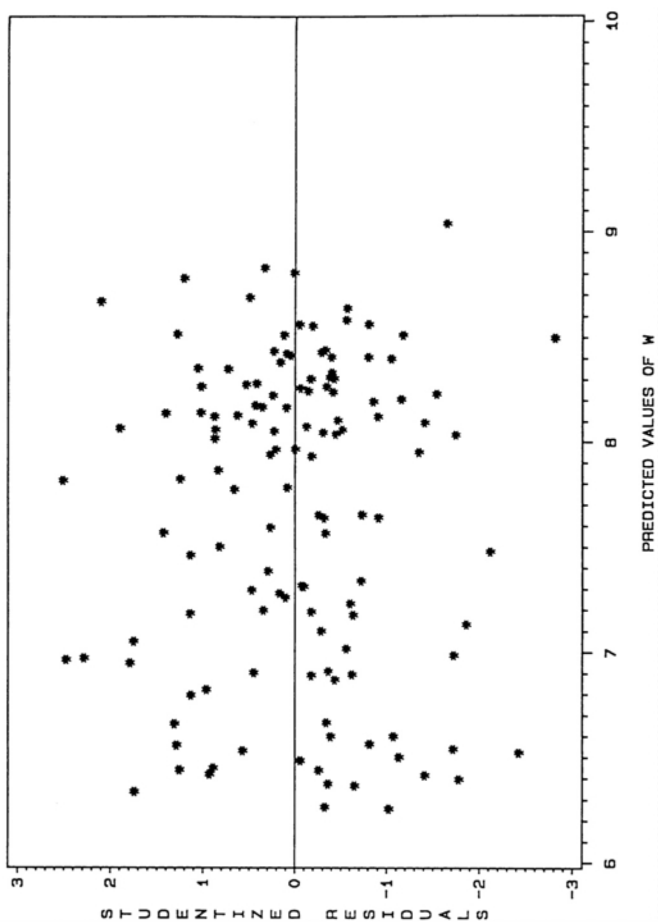

Figure 4.10
Inpatient Surgery PF Residuals Scatterplot

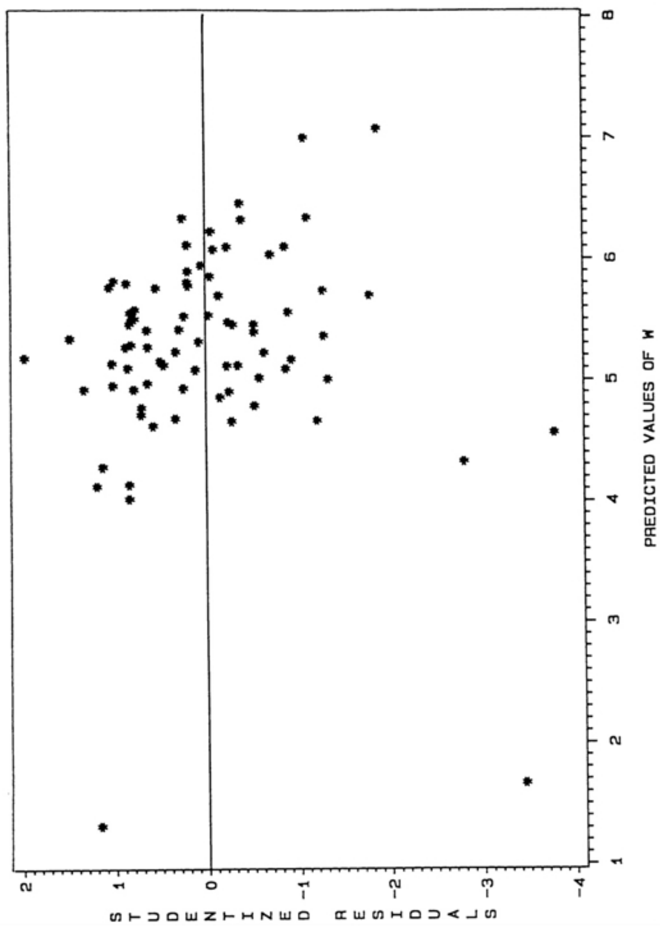

Figure 4.11
Inpatient Rehabilitation Medicine PF Residuals Scatterplot

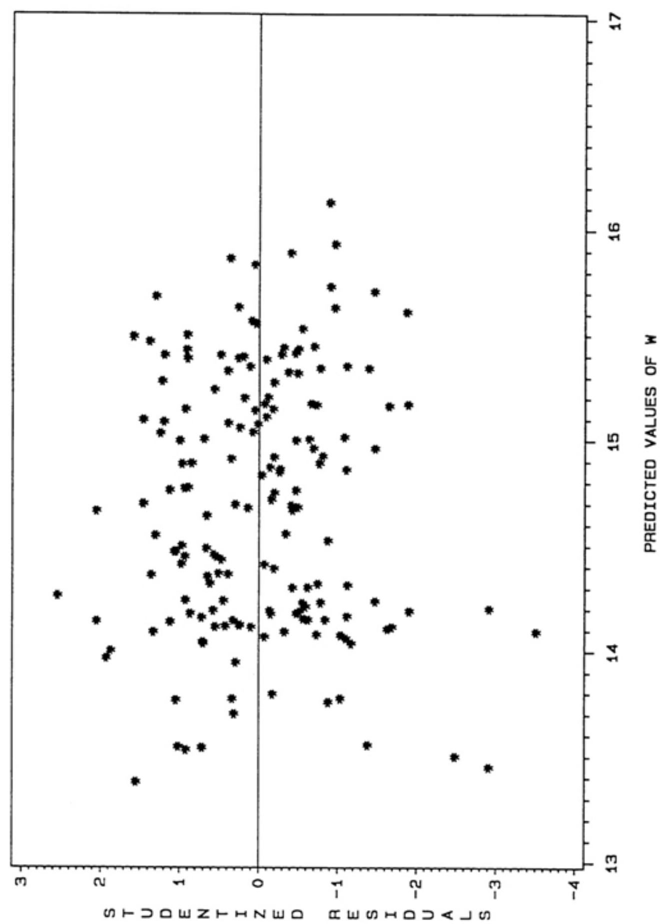

Figure 4.12
Ambulatory Medicine PF Residuals Scatterplot

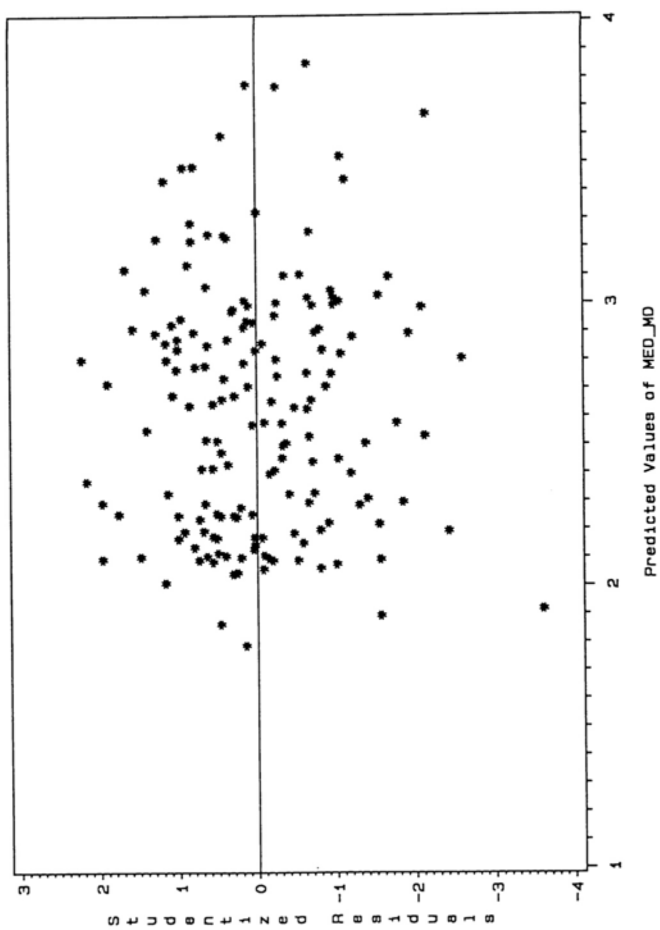

Figure 4.13
Medicine IPF Residuals Scatterplot

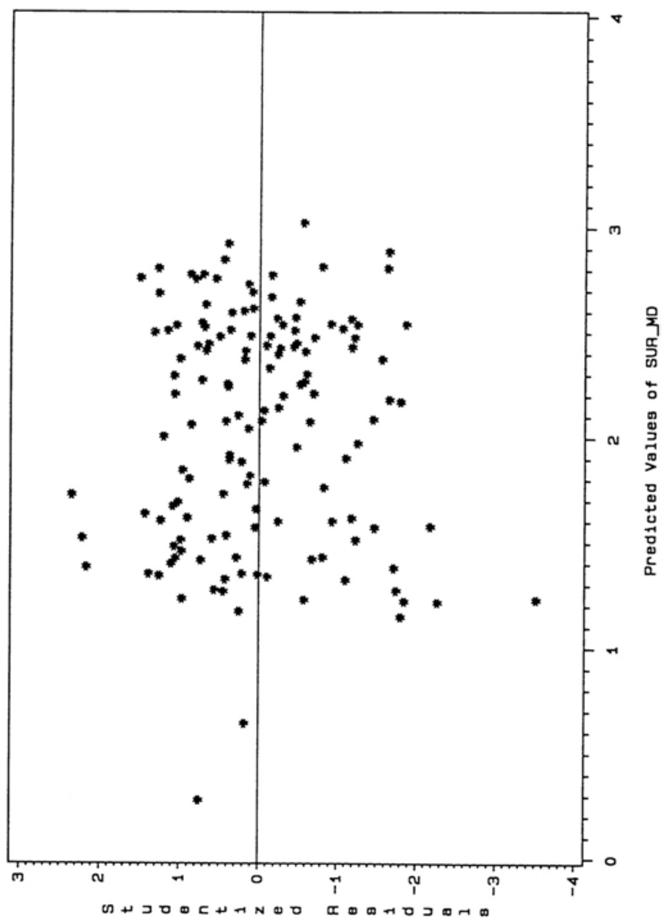

Figure 4.14
Surgery IPF Residuals Scatterplot

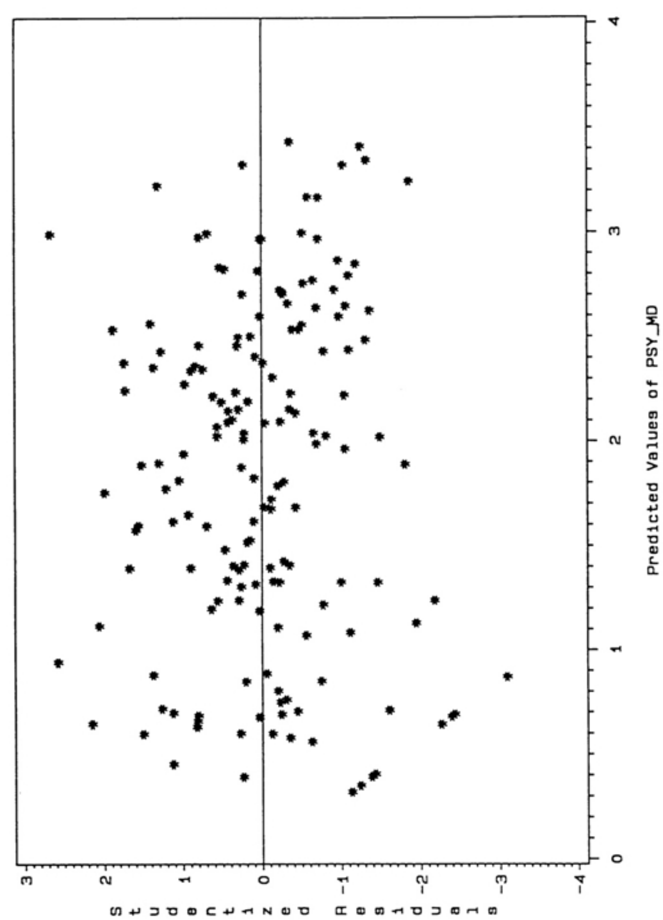

Figure 4.15
Psychiatry IPF Residuals Scatterplot

5

Expert Judgment Approaches to Physician Staffing

INTRODUCTION

Since the study's inception, it has been clear that expert judgment would be important in the formal development of a VA physician requirements methodology.

The original statement of work noted that "Because the available empirical data base alone is not adequate for driving the development effort or generating quantifiable estimates by purely mechanical numerical exercises, relevant informed professional judgments will be required throughout . . . and may well be an integral component of the physicians' requirements methodologies itself" (Institute of Medicine, 1987). To implement this mandate, the committee was to appoint "advisory panels to broaden the base and range of experience and competence" brought to bear in the development of the methodology.

In response, the committee established 11 advisory panels: data and methodology (central to the analyses in chapters 4, 7, and 8); affiliations (see chapter 9); nonphysician practitioners (see chapter 10); and six specialty and two clinical program panels, to serve as sources of professional judgment in the methodology's development. The six specialty panels were medicine, surgery (including also anesthesiology), psychiatry, neurology, rehabilitation medicine (including also spinal cord injury), and other physician specialties (encompassing laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology). The committee also appointed two multidisciplinary clinical program panels in the areas of ambulatory care and long-term care. Each panel was composed of VA as well as non-VA representatives, with the former never constituting a majority.

A central issue for the committee was determining the scope of the charge given to the specialty and clinical program panels. Two general approaches were considered:

1. In a physician requirements methodology relying primarily on the Empirically Based Physician Staffing Models (EBPSM), the panels would be asked to *react* to the estimated statistical models presented to them, evaluating their specification from a clinical perspective, and possibly modifying either the models themselves or their staffing recommendations.
2. In a physician requirements methodology calling for a more balanced reliance on statistically based and expert judgment-based approaches, the panels would serve as the principal source of *independently derived quantitative assessments of appropriate physician staffing*.

Under this second approach, the panels would not simply be critiquing and modifying statistical models, but would be rendering their own professional judgments about physician staffing levels consistent with high-quality medical care in particular clinical settings. These Full-Time-Equivalent Employee (FTEE) levels could then be compared with those emerging from the EBPSM for those same clinical settings.

Under either interpretation, the panels would seek to develop external (to the VA) physician staffing norms, which would aid in the interpretation of statistically based as well as expert judgment-based results.

The committee decided that the second, more expansive, interpretation of the panels' charge was the more appropriate.

The committee could envision a structured process in which panel members (1) are shown either a statistical model, its physician staffing implications, or both; (2) are asked to determine whether the model leads to staffing consistent with high-quality care; and (3) if not, are asked to "manipulate" the model's estimated coefficients in some fashion to generate appropriate staffing results. However, there were several concerns about proceeding this way.

First, with a single exception, the panels were constituted of expert clinicians with varying amounts of experience with formal statistical techniques; such a coefficient manipulation process would not make the best use of the collective expertise represented on the panels.

Second, given only the estimated equations (as shown in chapter 4), on what basis would panel members be able to judge whether the resulting physician staffing levels were "appropriate?" That is, can a staffing level be judged as appropriate, or not, in the absence of facility-specific information to establish a concrete backdrop—a context for evaluation?

Third, the methodological foundations for a coefficient manipulation approach have not been well established in the social science or statistical literatures. In contrast, the conceptual underpinnings and assumptions of the statistical analyses in chapter 4 are clear and well known. The expert judgment methods of decision making detailed later in this chapter, although not based on a rigorous, axiomatic approach, are nonetheless clear and unambiguous in their assumptions and implications. To enmesh the two approaches through a coefficient manipulation process is to proceed down a methodological path whose theoretical underpinnings are not well established.[1]

The committee's recommendation for how to combine, or reconcile, the empirically based and expert judgment staffing results is a *choice process* model termed the *Reconciliation Strategy* (see chapter 6).

Thus, each of the eight panels—in the course of two meetings in Washington, D.C., an extended conference call, and numerous mail and telephone communications with study staff—accomplished the following:

- Critiqued the empirically based models, offering recommendations about the choice of variables, data sets, and mathematical specification of the equations;
- Developed and evaluated external (to the VA) physician staffing norms; and
- Derived its own independent estimations of appropriate physician staffing in specific VA medical centers (VAMCs). The panels compared these results with those from the empirically based models and some external norm analysis. At that point, on the basis of the totality of evidence, the panels revised their staffing estimates accordingly.

To accomplish the latter task, the committee had to define a panel process that was methodologically sound and capable of being implemented by the eight panels in a consistent, yet flexible, way. In the health arena alone, there have been a number of recent efforts to use expert judgment processes, in scholarly analyses as well as in forums for public decision making. In the next section, the most prominent recent applications of these approaches are reviewed, and their implications for an expert judgment methodology appropriate for determining physician requirements are discussed.

In addition, details are given about what the specialty and clinical program panels accomplished in their approximately eight months of analyses in 1990. There is some discussion of their critiques of the empirically based models, which proved substantive and useful to the committee. However, this chapter focuses principally on the development of two alternative expert judgment approaches to estimating physician requirements: the *Detailed Staffing Exercise* (DSE) and the *Staffing Algorithm Development Instrument* (SADI). In addition, the process for constructing and evaluating external staffing norms is described.

[1] In Volume II, *Supplementary Papers*, the committee discusses an alternative approach—Bayesian econometric modeling—for formally combining expert judgment and empirically based results to derive, through an integrated mathematical formula, physician staffing requirements. This Bayesian approach was not pursued in this study for important practical reasons; it remains of theoretical interest and could be implemented under certain circumstances.

THE PANEL PROCESS—IN THEORY

In designing a process by which the six specialty and two clinical program panels would operate, the committee faced two major methodological questions. By what means and in what form would expert judgment be elicited? How would the judgments of individual panel members be combined to reach consensus positions? Before the committee's own choices are discussed, the strategies of others in this area are reviewed.

There is a growing literature on the formal use of expert opinion in health care policy and research. These applications sometimes involve the estimation of model parameters for which objective data are either missing or inappropriate. More often, expert judgment is used to reach decisions either about the advisability of particular decisions that are intermediate to a final policy outcome, or about the advisability of the outcome itself.

Scheme For Eliciting Judgments

Although there are a number of variations on the theme, methods to elicit expert judgment in a way that leads (eventually) to consensus positions can be grouped into three broad categories: the "pure" Delphi method, group interactive methods, and modified Delphi approaches.

"Pure" Delphi Method

Panel members render judgments individually and anonymously, typically through self-administered questionnaires. The elicitation continues through several iterations. After each elicitation, the individual judgments are collected, analyzed, and fed back to all members so that each can see where he/she stands in relation to the others. The elicitations continue until, in the judgment of the analyst, either a consensus has been reached or a "point of diminishing returns is reached" (Fink et al., 1984).

The Delphi method offers several advantages. It encourages individual members to express views freely and impersonally; the opportunity is diminished for strong personalities to dominate the decision or for "group think" to lead to an artificial or premature consensus. Because the method does not require panel members to meet face to face, it can be conducted relatively efficiently and inexpensively by mail with spatially separated participants completing questionnaires on a flexible schedule.

The major disadvantage with the "pure" Delphi method is that, because panel members do not interact, there is no opportunity for each to probe the positions of others, defend his/her own position, and thus gain a richer understanding of the problem (unless they are able to communicate informally).

Fink and colleagues (1984) cite a number of Delphi method applications in health. More recently, the Harvard-based team producing the Resource-Based Relative Value Scale (RBRVS) (Hsiao et al., 1990) has experimented successfully with several methods (including the Delphi) in developing a more efficient approach to estimating relative-value weights for surgical procedures.

Group Interactive Methods

Connoted here is any process in which panel members meet together, discuss information pertinent to the decision (including possibly their individual viewpoints and interpretations), and then attempt to reach a consensus.

There are several variations on this theme. Panel members may be shown background materials in advance, as with the consensus development conferences sponsored by the National Institutes of Health (Kosecoff et al., 1987). Alternatively, information for the discussion may be first revealed, or even developed, during the meeting, as in applications of the nominal group process (see Fink et al., 1984). The discussion may be wide open, so that individuals and their viewpoints are easily linked, or structured so that viewpoints are elicited anonymously and discussed without attribution.

The strengths and weaknesses of such group interactive methods are the reverse of the Delphi. The opportunity to exchange ideas can lead synergistically to conclusions in which more information has been brought to bear, in sum, than if participants had voted in isolation. But there is a risk that the outcome will be influenced by personality, meeting adjournment deadlines, and other factors that ought not to bear on the problem's resolution (although several variations of this method are designed to prevent this).

Modified Delphi Approaches

Several recent expert judgment applications have drawn selectively from both the Delphi and the group interactive approaches to evolve hybrid processes for eliciting information toward consensus development.

Most of these can be usefully characterized as estimate-talk-estimate processes (see Gustafson et al., 1973; Ludke et al., 1990). Prior to their first meeting, panel members typically are asked to render initial judgments, anonymously and independently, based on information transmitted by the analyst. These results are submitted and displayed at the first meeting. Each panel member knows his/her position relative to the group as a whole but may or may not know how other individuals, by name, have voted.

Following discussion, the group votes again; depending on the format, this poll may or may not be anonymous. Again, the results are analyzed and displayed. The process continues until the analyst determines that either a consensus has been reached or else the costs of continuing outweigh the benefits.

Such an approach draws strength from Delphi as well as group interactive methods. By first eliciting judgments anonymously, the analyst maximizes the amount of independent (judgmental) information brought to bear on the question. The opportunity to discover plausible "outlier" positions is enhanced, which reduces the chance that the subsequent consensus will be predicated on an overly restrictive conception of possible outcomes. By discussing these initial assessments in a group setting, each panel member can benefit from the views of others, thus bringing the maximum amount of (judgmental) information to bear on his/her upcoming reassessment.

On the other hand, there is the concomitant risk that personality factors, adjournment deadlines, group-think pressures, or other extraneous matters will contaminate the group interaction part of the process. The effects of these factors can be reduced by maintaining the anonymity of the panel members' positions and by such practical steps as pacing the meetings so that ample time is allowed for discussion and voting.

Studies in which a modified Delphi method has been applied include the assessments of U.S. physician requirements, by specialty, conducted initially by the Graduate Medical Education National Advisory Committee (GMENAC) (U.S. Department of Health and Human Services, 1981) and currently by the Council on Graduate Medical Education (COGME) (Buerhaus and Zuidema, 1990); the Effectiveness Initiative conducted by the Institute of Medicine to assist the Health Care Financing Administration in setting priorities for medical practice analyses (Institute of Medicine, 1989); a series of analyses to project faculty needs as well as the manpower required to care for the elderly in future decades, based at the University of California at Los Angeles and RAND (Reuben et al., 1990, 1991); a project conducted at the Iowa City VAMC examining the appropriateness of certain nonacute inpatient admissions to VA facilities across the country (Ludke et al., 1990); a portion of the RBRVS study cited earlier (Hsiao et al., 1990); and analyses conducted by RAND in recent years to determine appropriate clinical indications for performing various medical and surgical procedures (see, e.g., Park et al., 1986).

Reaching an Consensus

There are basically two ways of arriving at a group consensus. The participants may be formally polled and the votes aggregated in some fashion to yield a group choice, or the group may agree to hammer out a consensus position following discussions in which the relevant data and views of individuals have been aired. Such a consensus may be explicitly declared to be unanimous, the impression may be left that it is unanimous, or dissenting statements or minority reports may be filed.

The most prominent forum utilizing the second approach is the program of consensus development conferences sponsored by the National Institutes of Health (Fink and Kosecoff, 1984). A recent survey (McGlynn et al., 1990) indicates that government-sponsored consensus development conferences in eight other industrialized nations also shy away from formal procedures for achieving agreement.

On the other hand, all other expert judgment applications cited earlier do use explicit decision rules to map individual judgments into a consensus position. Nearly all decision rules apply to one of three types of choice problems. The group must either (1) agree or disagree, or determine the extent of its agreement or disagreement, with one or more propositions; (2) develop a preference ranking for a set of items; or (3) produce quantitative estimates of variables or parameters for use in subsequent calculations, leading eventually to some research or policy conclusion.

An interesting example of (1) arises in the RAND studies on clinical indications for intervention (Park et al., 1986). In this modified Delphi approach, panelists were asked, prior to their first meeting, to rate each possible clinical indication for a given intervention (e.g., endoscopy) on a scale of 1 to 9, with 9 meaning "extremely appropriate" and 1 meaning "extremely inappropriate." When the panelists met, they were shown the resulting frequency distribution of their ratings; each panelist could see where his/her score fell relative to the group. Following discussion, they were then asked to reevaluate the indications on the same 1 to 9 scale.

Finally, whether the panel was in "agreement" or "disagreement" that a given clinical indication was appropriate was determined as follows: The high and low extreme scores were discarded, and the median of the remaining scores was computed. If these remaining scores fell within any three-point range on the nine-point scale, the panel was said to be in "agreement," with the median score indicating the relative degree of appropriateness/inappropriateness of the indication for the intervention in question. On the other hand, if at least one rating fell in the 1-3 range and at least one in the 7-9 range, the panel was said to be in "disagreement." Otherwise, the panel's position was said to be "equivocal."

An interesting, though not unexpected, result in three separate evaluations was that a panel's second ratings were closer to one another than the initial ratings, whether measured by the percentage of agreement, percentage of disagreement, or average dispersion of scores.

An index of the latter is the mean absolute deviation (MAD) statistic, defined as $\Sigma\ (X_i\text{-}X_{med}/N$, where X_i is the score of the *i*th panel member, is the panel median score, and *N* is the number of panel scores used in the decision process.

A broadly similar approach to decision making was used in the VA study examining the appropriateness of acute inpatient admissions (Ludke et al., 1990).

An example of the second type of consensus choice problem is found in the IOM's Effectiveness Initiative study (Institute of Medicine, 1989), in which certain scoring rules were used to derive a priority ranking of clinical conditions for further research.

When a panel is asked to derive a best estimate of a variable or parameter that can take on many (sometimes an infinity of) possible values, how should a consensus be defined? As it turns out, this is precisely the choice problem arising in the expert judgment models developed for the present study.

In the GMENAC and COGME studies, expert panels estimated a number of parameters used in the calculation of the "adjusted need" for physicians (Buerhaus and Zuidema, 1990; U.S. Department of Health and Human Services, 1981). In GMENAC, the consensus value of any given parameter was the panel median estimate; to lend perspective, the high and low values were also reported. In COGME, a range of values are reported for each estimate of physician need or supply, and calculations involving these variables typically use the range midpoint values.

In the small group judgment study recently conducted by the RBRVS project (Hsiao et al., 1990), panels of surgeons used a magnitude estimation technique to rate the relative amount of work required to perform a number of services. At each juncture in the process of rating each service, a median score was computed. A consensus was declared whenever all scores fell within a predetermined acceptable range of the median.

Committee's Proposed Approach To Eliciting Expert Judgments and Reaching Consensus

In light of these studies and policy applications, the committee initially determined that the specialty and clinical program panels' own estimates of appropriate physician staffing levels would be obtained through a process with the following operating characteristics.

A modified Delphi approach would be developed in which panel members would independently estimate appropriate physician staffing levels (in the applicable specialty or program area only) at a selected set of actual VA facilities. These estimates would be tabulated by study staff and displayed anonymously to panel members when they next convened. In the course of discussions, it might become natural, or necessary, for individuals to become identified with their estimates, but this should evolve only as needed.

Following discussion of the first round of estimates, the panel would be asked to reassess physician requirements (in its specialty or program area only). These results likewise would be tabulated and displayed. In principle, the reassessments would continue until the members' physician FTEE estimates had —by some criterion—stabilized sufficiently that a panel consensus estimate could be declared.

But how should a consensus be defined?

Following each iteration of physician FTEE assessments by the panel, the median value would be computed and the high and the low values noted. By one reasonable definition, a consensus emerges when the median stabilizes. More formally, a consensus is declared on the *i*th iteration if the resulting median is within an acceptable range of the median obtained at the (*i*-1) iteration (the previous one).

A stronger definition of consensus would require that both the median and the MAD statistic, measuring here the average dispersion of physician FTEE responses around the median, not change appreciably between assessment iterations. All else equal, this more stringent definition—requiring stability in the dispersion of assessments as well as their central tendency—is preferred.

As will be seen shortly, the concepts underlying both the committee's preferred scheme for eliciting expert judgment and its preferred definition of consensus undergird the operations of the eight panels.

Given this study's developmental nature and time constraints, however, the panels' consensus assessments of appropriate physician staffing—via both the DSE and the SADI—must be regarded as approximations of what would be obtained had these expert judgment processes been able to proceed through several iterations. Again, the panels' charge in this regard was to help the committee develop methods for staffing, not to render the final numbers on VA physician requirements.

THE PANEL PROCESS—IN PRACTICE

In this section the operation of the six specialty and two clinical program panels is described in terms of what turned out to be their major functional responsibilities: evaluating the EBPSM, developing and testing the DSE, developing and testing the SADI, and evaluating external (non-VA) norms to guide physician staffing decisions.

The primary focus here will be on the DSE and SADI because they are new vehicles for deriving expert judgment estimates of appropriate physician staffing; as such, they played central roles in most of the panels' recommendations for how the VA ought to determine physician requirements.

Although the planning for panel operations began early in the study and their interactions with the committee and the staff continued through the first six months of 1991, the bulk of the activities described below occurred during the first 10 months of 1990. For expository purposes, it is useful to divide this period roughly into three phases: preparation for and conduct of the first panel meetings (January through April); preparation for and conduct of the second panel meetings (May through mid-August); and postmeeting activities (mid-August through October), culminating in a panel chairmen's session at the November 1-2, 1990, meeting of the committee.

Before the panels' accomplishments are discussed, the procedures for appointing panel members are reviewed briefly.

Appointment of Specialty and Clinical Program Panels

The committee intended that the membership of each panel reflect a broad spectrum of clinical knowledge, professional judgment, and special technical expertise. Collectively, the physicians on each panel were selected to bring perspectives spanning a variety of clinical practice settings.

It was understood from the beginning that the study would focus on the major specialty and program areas prominent in the VA; hence, the committee was constituted so as to have representation in these areas. It was natural that the chairs of the six specialty and two clinical program panels be drawn directly from the committee membership.

The study's workplan called for each panel to consist of VA as well as non-VA members, with the latter constituting a voting majority in each case.

In response, the committee asked the Department of Veterans Affairs to nominate VA staff candidates for panel membership. The VA liaison committee proposed candidates for each panel, and a list of nominees was subsequently submitted to the IOM by the VA chief medical director.

Non-VA panel nominees were initially solicited from members of the study committee. Additional nominees were drawn from the IOM membership, in consultation with the director of the Division of Health Care Services and the IOM executive office.

After all nominations were received, a tentative panel roster (of non-VA and VA candidates) was submitted to each panel chairman for review. Each chair could propose additional nominees. The final selection of VA and non-VA members was made by the panel chairman in consultation with the chairman of the committee. (A complete set of panel rosters is contained in Appendix A of this report.)

Evaluating the EBPSM

The specialty and clinical program panels provided important critical advice to the data and methodology panel and the committee about several aspects of the EBPSM:

Selection of Variables For Multivariate Regression Equations

At its first and second meetings and during the postmeeting period, each panel was shown various specifications of empirically based models pertinent to its specialty domain or program area. Each was asked to address several questions:

- Is workload defined appropriately?
- Are the physician FTEE variables properly constituted?
- Do the variables included in the equations make clinical and organizational sense?
- Did the variables perform as expected statistically?
- For coefficient estimates that are not statistically significant, or that are significant but with the "wrong" algebraic sign (indicating "perverse causality"), what factors might be at work?
- Are there variables currently omitted from the equations that should be tested on clinical or organizational grounds?

During the first and second panel meetings, the panels' empirically based model critique focused entirely on the production function (PF) variant. The inverse production functions (IPFs) did not begin emerging until the postmeeting period and were then evaluated by the panels at two junctures: first, via mail communications with study staff during late August; and, second, during the conference calls with staff in late October.

In the course of these meetings, written communications, and phone calls, panel members contributed numerous suggestions on improving the empirically based models (including the sentiment, expressed on occasion, that the models be discarded entirely in favor of an expert judgment approach). There was not a panel whose empirically based models were not significantly modified as a result of these give-and-take discussions.

Plausibility and Desirability of Physician Requirement Estimates from Empirically Based Models

During both its first and its second meetings, each panel examined the model-derived physician FTEE level and the corresponding level for three selected VAMCs (four for psychiatry in its second meeting), as recorded in their cost distribution reports (CDR). The panel could compare these estimates with those it derived for the same facilities using the DSE. During the postmeeting period, panel members were also shown the physician requirement estimates for these facilities as derived from both the IPF and the SADI.

Given this array of alternative FTEE estimates, each panel member was asked to state (during the postmeeting period via mail survey) what he/she regarded as the most appropriate physician FTEE level for each facility. Among other questions posed was whether the VA should adopt a physician requirements methodology whose centerpiece is an empirically based approach (either the PF or the IPF).

The panels' responses to these questions, and many more, are summarized in the appendix to chapter 6. A complete description of each panel's activities and policy recommendations is found in Volume II, *Supplementary Papers*.

Development of the DSE

In developing an approach for determining physician requirements solely on the basis of the consensus judgment of designated experts, the committee had to resolve several issues:

- How should the experts be selected?
- How should a consensus judgment about physician staffing be defined?
- How does one characterize an "ideal" mechanism for obtaining expert judgment on physician staffing?
- Can a *practical* mechanism be developed for eliciting expert judgment so that resulting FTEE estimates approximate the ideal? Can these estimates be obtained with sufficient specificity that physician requirements can be validly computed for *any* specialty or program area at *any* VAMC?

An "Ideal" Mechanism

Suppose an expert panel is charged with determining physician requirements for a given specialty or program area at some VAMC. An ideal expert judgment mechanism is one that yields the same staff physician FTEE levels that would be derived if the panel had made the assessment with "complete information" about the volume and the severity of patient workload, the number and the type of residents and nonphysician personnel, other facility-specific data, and the relationship between staffing patterns and indicators of the quality of care.

Search For an Practical Response

In preparation for the first round of specialty and clinical program panel meetings, study staff developed first-generation versions of the physician staffing instruments that would evolve into the DSEs. For each panel, three distinct (though generically similar) instruments were constructed for each of three VAMCs; the VAMCs were selected to reflect diversity in geographic location and affiliation status (as indexed by bed size, residents, and scope of services offered).

Each panel analyzed the same three VAMCs. Prior to the first panel meeting, members were mailed the instrument for one of the facilities and asked to complete it as a "homework exercise." The identity of the facility was not revealed. At the first meeting, staff presented a summary of these homework results, they were discussed, and the panel completed the other two exercises. For one of the latter, the panel was divided into small groups of two to three members each; for the other, the panel worked together as a single group. In neither case was the identity of the VAMC revealed until the exercises were completed.

Because these first-generation instruments were indeed transitional documents soon to be revised (into what later became the DSE), they are not discussed in depth here. Similarly, because the panels' staffing analyses during the first meeting were entirely exploratory, the resulting physician FTEE estimates are sufficiently experimental that policy inferences are not meaningful.

At the May 1-2, 1990, meeting of the committee, each panel presented a brief progress report. After discussions, the committee concluded two things: First, determining physician requirements by an expert judgment process was feasible, from a cognitive as well as a group dynamics standpoint. Second, the initial instruments needed revision, aimed primarily at providing enough context-specific information that panel members could assess, with confidence, physician requirements for a given ward, clinic, or program at a given VAMC.

Revised Instrument For Second Round of Panel Meetings

Specifically, at the May 1-2 meeting, the committee directed each panel to work with staff to develop and test a revised instrument, subsequently termed the DSE. Each DSE consists of an A and a B section. Section A provides a ward-by-ward, clinic-by-clinic description of the patient care environment at an actual

VAMC. For each patient care area (PCA, as defined in chapter 4), information is provided on the volume and diagnosis-related group (DRG) mix of workload, number of residents by specialty and postgraduate year (PGY), number of nonphysician practitioners by type, general information about the adequacy of nursing and support staff, and other contextual details.

For each ward, clinic, and procedure, the expert is asked to assess the amount of physician time—in hours—required per day, per visit, or per unit, respectively, to produce good-quality care.

The B section contains questions on the amount of physician time required for night and weekend coverage on the PCAs, educational activities not occurring on the PCAs, research, administration, other facility-related activities, and leaves of absence.

For each panel member, time estimates for all patient care and non-patient-care activities are summed and converted to FTEE—assuming one FTEE translates into a 40-hour/week commitment.

The *panel consensus estimate* is defined as the median of the members' estimates.

The format for the second panel meetings was as follows: Staffing instruments for two VAMCs, hereafter identified as I and II, were mailed to panel members in advance. Neither facility was identified by name at this point. As before, each panel assessed physician requirements for its specialty or program area only. With some exceptions, panel members did complete and return both instruments to staff prior to the meeting. (Also prior to the meeting, each member received by mail a briefing book, containing the meeting's agenda, background reading, and staffing analyses relevant to the upcoming discussion.)

The members' (initial) physician staffing assessments were tabulated, checked for arithmetic errors, and presented at the panel meeting in a way that kept the members' assessments anonymous. (During subsequent group discussions, however, members typically revealed their assessments.) For VAMCs I and II, in turn, the panel was shown each member's physician activity time assessments for the component parts of sections A and B and for total physician FTEE required at the facility. Also presented were some summary statistics: the panel's high, low, mean, and median estimates of total physician FTEE.

Following discussion of these results, the panels reassessed physician requirements for VAMCs I and II, working from copies of the staffing exercises they originally submitted. For seven of the eight panels, members reassessed independently; the results were tabulated with mean and median computed, then discussed. The surgery panel determined that it could derive consensus time estimates most efficiently through a group interactive process, in which the panel as a whole discussed each FTEE component of the DSE, arriving in each instance at an estimate agreeable to the group. Such an approach leads directly to consensus estimates for total surgeon and anesthesiologist FTEE required at

VAMCs I and II; the panel's high, low, mean, and median converge to a single FTEE estimate.

At this point, each panel was shown the names of VAMCs I and II; their actual, CDR-recorded physician FTEE levels for FY 1989 for the specialties or programs within the panel's domain; and the corresponding calculation of physician requirements derived from the PF variant of the empirically based model.[2]

Next, the panel was asked to assess physician requirements at another VAMC, hereafter known as VAMC III, using a DSE prepared for the task. (The psychiatry panel also analyzed a fourth facility, VAMC IV.) For all panels except surgery, the assessments were again completed independently, the results were tabulated, and the mean and median were found. The surgery panel again elected to reach consensus directly through structured group discussion.

Following these assessments, staff revealed the identity of VAMC III (and, for psychiatry, VAMC IV), its CDR-recorded physician FTEE level in FY 1989, and the corresponding FTEE calculation derived from the PF model. As time permitted, there was general discussion about determining physician requirements through the DSE approach.

A Closer Look

The best way to gain a clear understanding of how the DSE works is to examine a completed instrument in some depth. In Figure 5.1, the medicine panel's DSE is presented as constructed expressly for VAMC II.

The physician time estimates shown to illustrate the process are the initial "homework" assessments of a medicine panel member who was particularly conscientious about documenting his assumptions and reasoning. This panel member's calculations and accompanying commentary serve to make Figure 5.1 reasonably self-explanatory.[3]

[2] However, recall from chapter 4 that PF estimates were derived only for those specialties assumed to play the dominant role on one or more specific PCAs. Hence, no PF estimates were available for laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and anesthesiology. Physician FTEE for these specialties can be derived via the IPF model, but this empirically based variant was not adequately developed until after the second panel meeting.

[3] For many section A responses, this member found it useful to conceptualize total physician time as the product of the frequency with which a function is performed and the time required per performance. This presages the basic approach later adopted throughout section A of the SADI.

Application To an VAMC

Tables 5.1 and 5.2 indicate how physician requirements at a VAMC can be determined via application of the DSE. Table 5.1 summarizes each panel's initial (premeeting) assessments of FTEE requirements for VAMC II; Table 5.2 summarizes each panel's reassessed values following discussion of the initial results at its second meeting.

In both cases, the high and low estimates made by panel members, the panel median, and the MAD statistic indexing the relative dispersion of individual estimates about the median are presented.[4] For some panels (e.g., ambulatory), considerable dispersion may remain.

Committee Evaluation

In surveys completed during the postmeeting period, a majority of the members of all eight panels concluded that the DSE offers a technically feasible and methodologically acceptable expert judgment approach for deriving physician requirements. (See the appendix to chapter 6 for the panels' concluding statements and Volume II, *Supplementary Papers*, for each panel's full report to the committee.)

But the committee notes, as did some panel members, that the DSE is also cumbersome, labor intensive, and not well suited in its current form (as depicted in Figure 5.1) for probing what physician staffing ought to be under alternative assumptions about workload, nonphysician resources, and other factors.

To remedy the latter is straightforward but would likely require ever larger, more complex DSE instruments, with corresponding increases in respondent burden. Moreover, for a systemwide application of the methodology, each VAMC would require its own set of DSEs, which would have to be individually evaluated by panels convened each time a new assessment was required. Building a streamlined, efficient physician requirements methodology around the DSE approach appears to be problematic.

[4] For every panel, the reassessed estimates have a smaller MAD statistic than the initial estimates. This is consistent with findings elsewhere (Hsiao et al., 1990; Lomas et al., 1988; Park et al., 1986) that an iterative process of driving toward a group consensus tends to reduce the dispersion of individual assessments.

The SADI

In response, work began in August 1990 on an alternative expert judgment approach within each panel. The committee wanted to build upon, formalize, and strengthen some of the rules of thumb for staffing evident during the second panel meetings. Ideally, this new approach would retain much of the DSE's specificity, while being more streamlined and less labor intensive in application.

By late August, first-generation versions of the SADI had been developed for experimental application by each of the eight panels. By early September, the members of each panel, working separately and independently, had completed and returned their SADIs by mail to study staff. The results were processed, and first-generation SADI-based estimates of physician requirements were computed for VAMCs I, II, III, and (for psychiatry) IV.

An overview of the SADI approach and how it was applied by the panels follows. For illustration, the medicine panel's SADI is presented, and that panel's physician activity and time estimates are summarized. Following that, the SADI approach is applied to derive physician requirements in medicine at a given facility (VAMC I). Next are presented the FTEE levels that emerged when each panel's SADI estimates were applied, in turn, to determine physician requirements at VAMC II. Finally, the committee evaluates the SADI approach and offers recommendations for its further development.

Overview

Several specific steps were involved in applying this new expert judgment approach within each panel. As will be seen, the SADI (like the DSE) has two sections, A and B, focusing on patient care and non-patient-care activities, respectively.

In section A, panel members were asked to estimate the amount of physician time required to perform each of an array of functions and tasks in a way consistent with achieving good-quality care. Patient workload categories for which physician time estimates (typically expressed in hours) were sought include inpatient admission workup, routine daily care on the wards of that specialty's or program's "dominant" PCA (if applicable), consultations on all other PCAs, certain diagnostic and therapeutic procedures, and outpatient visits. In each category, physician time can be estimated as a function of the availability of residents by type, nonphysician practitioners by type, and other contextual factors.

In section B, panelists were asked to determine the total amount of physician time (again, for physicians in the panel's domain) that ought to be devoted to the following non-patient-care activities: research, education of residents in the classroom, continuing education, administration, other hospital-related activities, and leaves of absence. The format in section B of the SADI is virtually identical to that used in the final version of the DSE.

In deriving group consensus SADI estimates from individual member estimates, each physician task or function in section A was considered in turn: the individual estimates were arrayed, and the median was designated as the panel's consensus estimate. Likewise, for each FTEE component of section B, the panel median was declared the consensus estimate.

To determine physician requirements at a given VAMC, the panel median for each type of patient care activity was applied, in turn, to the volume of such activities associated with the facility's projected workload, and the results were summed across activities to derive total physician hours for patient care. Physician times for all non-patient-care activities were assessed separately using the relevant median estimates. The sum of physician hours estimated from sections A and B was then converted into FTEE using the 40-hour/week equivalence assumption.

A Closer Look

As with the DSE, the best way to understand the SADI is to examine a completed instrument, then study how it can be applied to determine physician requirements at some VAMC.

In Figure 5.2, the medicine panel's SADI is presented in its entirety, indicating for each function or task that panel's high, low, mean, and median estimates of the amount of physician time required for good-quality care. The instrument presented here is a slightly compact version of the one completed by seven of the panel's eight members; it is intended to be self-explanatory.[5]

Although each panel's SADI is tailored specifically to the main activities associated with that specialty or program area, all SADIs are basically similar both in structure and the logic of application; to understand the medicine instrument and how it is applied is to understand the SADI approach.

The application of this medicine SADI to determine physician requirements at VAMC I is summarized in Figure 5.3, which is intended to be a relatively self-contained walk-through of how the SADI works. However, several general points deserve emphasis.

[5] Note that the "overall median" values calculated under Charts 2-4 within part A (Patient Care Activities) of the Routine Daily Patient Care section and under both the A and B parts of Non-Patient-Care Activities are not equal, in general, to the sum of the median values of the components comprising the total in each instance. Rather, the overall median is properly computed as the median of the sum of all component time estimates.

Overall Idea

For each physician activity (e.g., admission workup), the panel consensus estimate of the time required per unit (e.g., per workup) is multiplied by the projected number of units of the activity per day. One exception is the time required for routine daily patient care on the wards, which comes packaged as a total that varies with the average daily census (ADC) and other contextual factors.

Total physician hours required per day is the sum of hours required for all patient care and non-patient-care activities. A final step is converting hours into an FTEE equivalent.

In the SADI (and the DSE, too), the whole is defined as the sum of the parts; hence, the parts must successfully encompass all physician activities at (or associated with) the VAMC.

Data Required from the VAMC. To apply the SADI in its current form to determine physician requirements at a VAMC, the facility itself must generate certain workload and other data; the VA's central information systems do not generally supply information at the level of detail required by the SADI (or the DSE). These information requirements can be inferred from Figure 5.3, but are summarized here as well.

• Patient Care Activities—inpatient:

Admissions per day in the specialty's dominant PCA (if applicable), with and without resident;

For each ward in the dominant PCA, the ADC, the average length of stay (LOS), and the number and type of residents as a function of ADC;

For each special care unit where the specialty is a major participant (e.g., ICU/CCU for medicine), the ADC, the LOS, and number and type of residents as a function of ADC;

For all other wards, including intermediate care and nursing home, the number of initial as well as followup consultations per day, with and without resident;

The number of special procedures (e.g., cardiac catheterizations in medicine) performed per day, with and without resident; for both surgery and anesthesiology, the number of operations per day distinguished, as the surgery panel has recommended, by level of complexity.

• Patient Care Activities—ambulatory:

The number of patient visits per day by ambulatory PCA, with and without resident, and with and without physician assistant or nurse practitioner.

• Non-Patient-Care Activities:

Sufficient information about total research funding at the VAMC that it can be classified as either a high-, medium-, or low-volume research facility—the overall proxy for affiliation status used in section B of all current SADIs (see Figure 5.3).

As it turns out, all of this information (and then some) is required for constructing the DSEs; thus, the facility-specific data for implementing the SADIs here were extracted directly from the existing DSEs.

Interpolation or Extrapolation. The projected ADC for a given ward at a VAMC may not match exactly any of the ADC levels for which time estimates are available in the SADI, as evident in the Routine Daily Patient Care portion of Figure 5.2. For example, if the projected ADC is 35 and the highest ADC shown in the SADI is 30, an extrapolation is required to estimate physician time for 35. Similarly, if the projected ADC is 22 and the nearest ADC levels included are 20 and 25, physician time for 22 must be interpolated.

In both cases, the simplest approach would assume a linear relationship between ADC and physician time. This may or may not be warranted. For example, suppose the estimated median times for the ADCs of 20, 25, and 30 are 4, 5, and 5.5 hours, respectively. For an ADC of 22, an interpolated estimate of 4.4 hours—i.e., 4 + [(22-20)/(25-20)]—seems reasonable. But given the nonlinear way physician time responds as ADC goes from 20 to 25 to 30, it seems unreasonable to calculate the time for an ADC of 35 as (35/30)5.5 = 6.4 hours; rather, something less than this is more plausible.

If SADI estimates are directly available for a sufficiently dense set of ADC levels, the issue becomes moot. Not surprising, there is a trade-off between the level of detail built into the SADI—and thus the resources required to produce and maintain the SADI—and the likelihood of having to estimate physician times from those explicitly available in the instrument.

Estimation of Physician Times for Activities Not Considered in the SADI. For example, at VAMC I there is a bone marrow transplant unit (BMTU), but the current medicine SADI includes no such activity category. Therefore, physician time estimates for the ICU/CCU unit were applied to the ADC levels projected for the BMTU. As indicated in Figure 5.3, this type of approximation was required in several instances.

Again, if the SADI is constructed in great enough detail—if all relevant activity categories are included—such approximations are not needed.

Uncertainty in SADI Activity Time Estimates. All time estimates from Figure 5.2 are treated in Figure 5.3 as if they are deterministic (nonprobabilistic) values. In reality, the amount of physician time required to perform a given activity will fluctuate for a host of reasons: differences in patient mix and acuity levels, differences in the quality and availability of nursing and support personnel, variations in patient scheduling, and variations in physician skills and pace of work. Moreover, even if these attributes were fully known and specified in a given instance, there would remain a residual amount of uncertainty about the amount of physician time required.

One response is to conduct a form of sensitivity analysis in which one or more activity performance times are systematically varied across their ranges, from high to low, and the net effect on total physician time is noted. It would not be difficult (only laborious) to extend Figure 5.3 to accommodate a sequence of such analyses.

A second approach is to acknowledge the uncertainty formally through a rigorous statistical analysis.

Assuming (as has been done throughout) that the only data sources for activity time estimates are the panel members' experience-based judgments, this new analysis would require that:

- Each panel member express each activity time estimate not as a simple point estimate, but as a (subjectively) estimated probability distribution;
- The members' individual distributions be combined to derive a corresponding panel consensus probability distribution for the time required to perform the activity;
- This consensus distribution be combined with the projected workload rate associated with the activity at a given VAMC to produce a probability distribution for the physician time required for the activity at the VAMC; and
- These activity time distributions be combined across all activities at the VAMC to derive a final distribution for the total amount of physician time, and hence FTEE, required (as always, in a given specialty or program area).

In Volume II, *Supplementary Papers*, this process is illustrated using the probability distribution assessments of two members of the Medicine Panel to derive the probability distribution of total physician FTEE requirements in Medicine at VAMC I. Also discussed in the *Supplementary Papers* is how to combine (through Bayesian statistical analysis) the panel members' subjective probability distributions with other, "objective" data on activity times from time-motion studies (or other sources) to produce new distributions reflecting both types of information. Similarly, physician time estimates from the DSE can be treated in a probabilistic fashion.

Application To an VAMC

To illustrate the SADI process, the medicine instrument has been used exclusively; but the other seven panels also produced SADIs, tailored to the specialties or VA program areas within their domains. The physician FTEE levels obtained from applying these SADIs to the workload data from VAMC II in FY 1989 are summarized in Table 5.3. With few exceptions, these SADI estimates are roughly comparable to the median DSE reassessments reported in Table 5.2. There appears to be no tendency for one approach to be consistently above or below the other, across specialties.

Committee Evaluation

Considering the factors noted thus far, the committee concurs with its specialty and clinical program panels that any expert judgment component in the VA physician requirements methodology should be built around application of the SADI approach, across specialties, programs, and facilities. The SADI is capable of capturing almost as much clinical detail as the DSE and is better suited for systemwide application. Given the analyses presented in the appendix to chapter 6 and the full panel reports in Volume II, *Supplementary Papers*, the committee regards these initial SADIs as first-generation instruments, requiring additional exploration and development.

Correspondingly, physician FTEE levels emerging at the moment should be regarded as first-generation estimates, which may change as the SADI evolves. In particular, because the SADI approach emerged late in the study, it was not feasible to use a modified Delphi process to derive physician activity time estimates. Instead, these SADI estimates are based on staffing judgments elicited through one mail survey of all panel members; in a sense, they can be viewed as the results from the initial iteration of a modified Delphi process.

To improve this first-generation model, the committee recommends the following:

The VA should proceed immediately to apply these SADIs experimentally to all VAMCs, or at least a large representative sample. For the four VAMCs analyzed in this study, staff members were able to obtain the required facility-specific workload and related data by phone and mail in a matter of days. The facilities agreed to participate voluntarily, without a formal directive from the VA Central Office.

Following an evaluation of these applications, each SADI would be considered for revision. The focus would be on

- Appropriate designation of activity time categories, with special attention to new programs and services (e.g., hospital-based home care);

- Appropriate specification of the type and range of workload for each activity category, with special attention to whether case acuity is sufficiently differentiated;
- Adequate delineation of the most salient factors influencing physician productivity, such as residents (by specialty and PGY), nonphysician practitioners (by type), nursing and support staff, and certain items of capital equipment; and
- Distinguishing among physicians by type: full time or part time; staff or contract or non-VA consulting.

Following an evaluation of these revised SADIs, they should be considered for formal application in the methodology, in ways described in chapter 6. In each case, the challenge is to construct a SADI with enough detail to capture significant distinctions, while omitting factors that have little influence on physician time allocations.

External Norms

One other major issue that the committee asked the specialty and clinical program panels to investigate was whether there exist non-VA physician staffing standards or patterns that could be usefully applied to help determine appropriate VA physician staffing.

Types of Staffing Standards

Working with study staff, each panel developed over the course of its deliberations external norm information of two types:

- Explicit physician staffing standards, primarily from a few large organizations which, like the VA, plan and deliver health care through a centralized decision-making process. The prime examples in this study were the U.S. Department of Defense (DoD, 1989) and the Indian Health Service (IHS, 1988).
- Implicit physician staffing standards, as inferred from existing secondary data, that describe the ongoing relationship between workload and physician staffing in any health care organization selected for comparison with the VA, such as an HMO or a large public hospital system.

In addition, some panels were able to bring to bear existing (though sometimes dated) physician staffing guidelines developed within the VA. Where they existed, these internal norms provided a potentially useful basis for comparison.

Data Sources

All committee and panel members were asked to recommend health care organizations that might provide data relevant to the construction of norms. Several criteria were relevant: the perceived quality of care provided by the organization; the comparability of the organization's patient population and patterns of care, relative to the VA; and the quality and accessibility of its data on patient workload and physician FTEE. Guided by these factors, the study staff also pursued possible data sources.

The major organizations contacted are listed in Table 5.4; in addition, data were obtained from a number of individual hospitals, long-term care units, and clinics. The particular set of organizations analyzed by each panel is discussed in its full report to the committee, found in Volume II, *Supplemental Papers*.

Application of External Norms: An Illustration

Given the nature of (a) explicit staffing guidelines at organizations such as DoD or IHS and (b) secondary data on staffing available from other types of providers, the process for calculating VA physician requirements on the basis of external norms was technically straightforward and basically similar for all panels.

Specifically, an organization's staffing standard for inpatient or long-term care was generally defined in terms of its ADC per physician FTEE (ADC/phy) —either as posited by the organization or as observed there. An organization's standard for ambulatory care was based on either its posited or its observed ratio of patient visits per physician FTEE per year (visits/phy/yr).

As one example, consider the DoD, where explicit standards for workload per physician per year are specified separately by specialty category and by type of hospital (teaching versus nonteaching). For a facility with an ADC of 100 and 60,000 ambulatory visits per year, the physician staffing standards in medicine for inpatient and ambulatory care are, respectively, 10.3 ADC/phy and 5,808 visits/phy/yr (DoD, 1989). Applying these staffing ratios to the assumed workload data, it is calculated that

Inpatient FTEE	=	100 ADC/(10.3 ADC/phy) = 9.7
Ambulatory Care FTEE	=	(60,000 visits/yr)/(5,808 visits/phy/yr)=10.3
Total FTEE Required	=	9.7 + 10.3 = 20.0.

On the basis of data supplied by the New York Health and Hospitals Corporation (1989), study staff derived the following implicit physician staffing standards for Medicine: 7.0 ADC/phy for inpatient and 4,270 visits/phy/yr for ambulatory care. When these ratios are applied to the fictitious workload data above, the physician FTEE required for inpatient and ambulatory care are 14.3 and 14.1, respectively, for a total FTEE requirement of 28.4.

When the DoD and New York Health and Hospitals Corporation ratios were in fact applied to the FY 1989 workload data (suitably aggregated) at VAMC II, the implied physician staffing in medicine was 53.0 and 56.0 FTEE, respectively. (For a description of these and all other external norm calculations, see the panels' reports in Volume II, *Supplementary Papers*.) These estimates can then be compared with physician requirements in medicine at VAMC II as assessed through the SADI (54.0, from Table 5.3) and the DSE (49.9, from Table 5.2), as well as with the medicine staffing actually there (45.7, as recorded in its CDR).

The committee notes, however, that external norms of the type illustrated here are easy to use precisely because they involve simple (unconditional) staffing ratios. There is no control for differences in case mix, case acuity, the precise definition of an FTEE, and other factors distinguishing the source of the norm from its site of application (the VAMC). In the next chapter, the committee discusses how these factors combine to limit the usefulness of external norms at present; proposals for further development are recommended.

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Table 5.1 Specialty and Clinical Program Panels' DSE-Based Initial Assessments of Physician FTEE Requirements at VAMC II: Summary Statistics

Panel	Median	Mean	High	Low	MAD[1]	Panelists Completing DSE
Medicine	38.6	43.8	74.2	27.8	12.1	7
Surgery	54.7	63.8	127.2	33.8	21.8	5
Anesthesiology	19.3	19.3	22.2	16.4	2.9	2
Psychiatry	56.4	60.4	87.9	40.8	27.6	4
Neurology	7.1	7.3	9.7	5.5	1.8	4
Rehab. Medicine	9.2	8.9	13.3	5.1	2.5	6
Other Physician Specialties						
Laboratory Med.	5.8	5.8	5.8	5.8	0.0	1
Diagnostic Radiol.	18.2	18.2	18.2	18.2	0.0	1
Nuclear Med.	3.6	3.6	4.9	2.3	1.3	2
Radiation Oncol.	4.3	4.3	4.3	4.3	0.0	1
Ambulatory Care	71.0	81.4	129.4	20.4	41.9	6
Long-Term Care	12.4	13.9	22.3	8.7	3.8	4

[1] Mean absolute deviation about the median.

Table 5.2 Specialty and Clinical Program Panels' DSE-Based Reassessment of Physician FTEE Requirements at VAMC II: Summary Statistics

Panel	Median	Mean	High	Low	MAD	Panelists Completing DSE
Medicine	49.9	46.9	58.2	33.7	6.6	6
Surgery[2]	34.2	34.2	34.2	34.2	0.0	5
Anesthesiology[2]	23.9	23.9	23.9	23.9	0.0	2
Psychiatry	52.7	53.4	55.8	51.8	1.3	3
Neurology	7.1	7.2	9.4	5.2	1.7	4
Rehab. Medicine	9.9	9.4	12.0	5.3	1.5	6
Other Physician Specialties						
Laboratory Med.	5.8	5.8	5.8	5.8	0.0	1
Diagnostic Radiol.	21.0	21.0	21.0	21.0	0.0	1
Nuclear Med.	3.6	3.6	4.3	2.9	0.7	2
Radiation Oncol.	4.3	4.3	4.3	4.3	0.0	1
Ambulatory Care	95.7	93.1	108.8	72.1	9.9	4
Long-Term Care	2.7	2.9	3.4	2.4	0.4	4

[1] Mean absolute deviation about the median.

[2] Panel consensus assessment.

Table 5.3 Specialty and Clinical Program Panels' SADI-Based Assessments of Physician FTEE Requirements at VAMC II

Panel	Total Physician[1] FTEE	Panelists Completing SADI
Medicine	54.0	7
Surgery	37.8	6
Anesthesiology	36.9	2
Psychiatry	55.6	6
Neurology	8.6	4
Rehabilitation Medicine	6.4	5
Other Physician Specialties		
Laboratory Medicine	5.2	1
Diagnostic Radiology	25.0	1
Nuclear Medicine	3.1	3
Radiation Oncology	3.1	1
Ambulatory Care	52.8	8
Long-Term Care	3.1	6

[1] Based on panel median estimates for all SADI-included physician activities.

Table 5.4 Major Organizations for External-Norm Exploration

American Board of Internal Medicine	Group Health Cooperative of Puget Sound
American College of Physicians	Harvard Community Health Plan
American College of Surgeons	Health Insurance Plan of Greater New York
American Group Practice Association	Henry Ford Health System
American Health Planning Association	Humana
American Hospital Association	Indian Health Service
American Medical Association	Joint Commission on Accreditation of Healthcare Organizations
American Society of Internal Medicine	Kaiser Permanente Medical Care Program
Association of American Medical Colleges	Marsh field Clinic
Association of American Physicians	Matthew Thornton Clinic (Dartmouth Health Plan)
Association of Professors of Medicine	Mayo Clinics
Cleveland Clinic Foundation	Mercy Health Services-Professional Services
Commission on Professional and Hospital Activities	National Association of Public Hospitals
Department of Defense	New York City Health and Hospitals Corporation
Good Samaritan Health System	Ochsner Clinic
Group Health Association of America	Palo Alto Medical Clinic
	RAND

Figure 5.1: Detailed Staffing Exercise (DSE) for the Medicine Panel and One Member's Response[1]

What follows is the medicine panel's DSE, slightly compressed to focus illustratively on the physician requirement estimates of one panel member· All of the panel member's responses, numerical and narrative, appear in italic type.

INSTRUCTIONS FOR STAFFING EXERCISE TWO MEDICINE SECOND PANEL MEETING

In the previous meeting of the medicine panel, we asked you to estimate physician staff requirements in your specialty, for a real VA Medical Center (VAMC), in a number consistent with good quality of care. This new staffing exercise repeats the process, but we have provided a more specific description of the facility including the type of patients, number of admissions, and length of stay. We have also provided more details on the number and types of residents (including level of experience and specialty) available, and the numbers of any nonphysician practitioners (NPP) that may be present. While obtaining your numerical estimates for this facility, we also will be probing the thought processes used in determining physician staffing.

This highly affiliated VAMC participates in a moderate amount of research and is large with total operating beds of 978 and an average daily census of 772.

Your task in section A is to calculate the physician hours required from the Medicine Service for each Patient Care Area (PCA) for an average weekday.

Do include in section A:

- Physician time spent on direct patient care
- Physician time spent on patient-care-related activities such as:

- chart documentation
- related telephone communication
- patient and family teaching and counseling

[1] Included below are his actual physician time estimates and paraphrases of his explanations for how these were derived.

- time spent interactively with residents in patient care and/or teaching on the PCA

Do NOT include in section A:

- Night call and weekend coverage
- Physician time spent in non-patient-care-related activities such as:

- research off the PCA
- educational activities that are not related to direct patient care (such as teaching residents, or delivering lectures off the PCA)
- quality assurance
- mortality and morbidity meetings or studies
- administrative activities
- any other function that is not directly related to the care of the patients on the PCA.

In the first part of section A, you must estimate the physician hours spent by medicine service physicians for an average weekday. Next, you must estimate time spent by physicians from the Medicine Service on other PCAs in the hospital, usually as a consultant. You may assume that the Medicine Service receives adequate consultative support from all other services at this VAMC.

You may assume that the level of nursing staff and support staff is adequate for this VAMC.

Appendix 1 [not included here] provides you with a list of the top DRGs and frequency of their occurrence for each individual PCA at this hospital, so that you may get a sense of the facility's case mix.

In section B, you will assess the amount of physician time that is not addressed in section A, such as non-patient-care-related activities off the PCA, night and weekend coverage, and administrative functions.

Section A

PATIENT CARE AREA 1: MEDICINE SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR AN AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY

WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS			
Total Operating Medicine beds:	233	Total Residency Positions			47
Average Daily Census (ADC):	205	Total Fellows	19		
Occupancy Rate:	88.3 %	Total NPP	5		
Length of Stay:	7				
Daily Admissions:	15	DAILY ADMISSIONS AND CARE: 10 teams, each with 1R (PGY 2 or 3) and 2 PGY ls. These teams are not assigned to wards; they accept new patients on a rotating basis (no more than 24 new patients per team).			
Total Operating Intermediate Beds that Float Among Medicine wards:	20	CONSULTATIONS: Residents in the following specialties respond to all consult requests throughout the hospital;			
		Infectious Disease	1	Cardiology	1
Average Daily Census:	11	Renal	1	Hematology	1
Occupancy Rate:	55.0%	Pulmonary	1	Rheumatology	2
Length of Stay:	27	General Medicine	1	GI	2
Daily Admissions	0.2	Endocrine	1	Geriatrics	1
Intermediate beds are staffed by the same residents and attendings that cover the Medicine wards.		FELLOWS: Assigned to research or to specialty areas as listed.			

* Staff physician time/patient/day (Mon-Fri) = 7 min care + 2 min documentation + 3 rain communicating with family + 4 min teaching = 16 min

UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED (Worksheet)
WARD 4:	GENERAL MED Beds 33, ADC 27	*ADC 27 × 16 min = 432 min*
WARD 5:	GENERAL MED Beds 29, ADC 26	*ADC 26 × 16 min = 416 min*
WARD 6:	CARDIOLOGY (Step-down, Telemetry) Beds 16, ADC 14	*ADC 14 × 16 min = 224 min*
WARD 7:	ONCOLOGY Beds 30, ADC 25	*ADC 25 × 16 min = 400 min*
WARD 8:	PULM/RHEUM Beds 18, ADC 16 1 physician assistant assigned	*ADC 16 × 16 min = 256 min*
WARD 9:	CCU Beds 6, ADC 5 1 fellow assigned	*ADC 5 × 20 min*[1] *= 100 min*
WARD 10:	MICU Beds 10, ADC 91 fellow assigned	*ADC 9 × 20 min = 180 min*
INTERMEDIATE FLOATING BEDS:	Beds 20, ADC 11	*ADC 11 × 3 min = 33 min*
		New Admissions: *15/day × 38 min/patient = 570 min*
SPECIAL PROCEDURES:		
Cath Lab[2]: 1.3 caths per weekday	[1/3 are percutaneous transluminal coronary angioplasty (PTCA)] Staff = 1 fellow, 1 resident	*0.9 caths/day × 50 min = 45 min* *0.4 PTCAs/day × 70 min = 28 min*
Endoscopy Lab: 13 procedures per weekday	Staff = 1 fellow, 1 resident, 1 tech	*13 procedures/day × 30 min = 390 min*
Bronchoscopy Lab: 2 bronchos per weekday	Staff = 1 fellow, 1 resident, 1 tech	*2 bronchos/day × 45 min = 90 min*
TOTAL MEDICINE PHYSICIAN HOURS REQUIRED FOR PCA 1:		*4,492 min/60 min/hr = 74.87 hr*

[1] Staff physician time/critical patient/day (Mon-Fri) = 10 min care + 5 min documentation and communication + 5 min teaching = 20 min.

[2] Assumes that one-third of caths are interventional PTCAs, so that PTCAs/day = 1.3 × 0.33 = 0.4. Assuming the typical PTCA requires 70 minutes, 0.4 × 70 = 28 rain/day allocated to PTCAs. It follows that there are 1.3-0.4 = 0.9 diagnostic caths/day. Assuming 50 minutes each, 0.9 × 50 = 45 rain/day allocated to diagnostic caths.

We are interested in exactly how you used the available information to derive internist requirements for this PCA. Please explain in this workspace any rule of thumb you used or any assumptions that will help us to understand your reasoning. Feel free to illustrate your response with sample calculations showing how you arrived at one or more of your estimates on the previous page.

Patients are primarily cared for by house officer teams (attending staff are consultants and teachers).

All patients are seen daily Monday through Saturday (Sunday for critical ones) by attending staff. New patients are examined within 24 hours of admission.

New patients require longer examination and more documentation.

- *a. New patients average 38 minutes 10 min for care, 6 min for documentation and communication ...*
- *b. Old patients average 16 minutes 7 min for care, 5 min for documentation and communication, 4 min for teaching*

All procedures are performed or staffed by the attending physician (all require the presence of the attending staff).

Consults are seen by residents and staffed by attendings:

- *a. 30 minutes on the PCA 20 min for care, 10 min for teaching*
- *b. 30 minutes off the PCA teaching and didactic activity*

Patient Care Area 2: Surgery Service

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR AN AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY

WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS			
Total Operating Surgery Beds:	175	Total Residency Positions	=		38
Average Daily Census (ADC):	121	Anesthesia Residents	=		11
Occupancy Rate:	69.2%	Residents are not assigned to specific wards. Admissions are taken on a rotating basis, according to specialty.			
Length of Stay:	9				
Daily Admissions:	20	Resident Specialties:			
Total Intermediate Surgery Beds that Float Among Surgical Wards:	15				
Average Daily Census:	6	General Surgery	13	Plastic Surgery	1
Occupancy Rate:	40%	Neurosurgery	2	Thoracic Surgery	2
Length of Stay:	27	Ophthalmology	5	Vascular Surgery	1
Daily Admissions:	0.2	Orthopedics	5	Urology	4
		Otolaryngology	5		5

UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED (**Worksheet**) Consults/Day
WARD 1:	GENERAL SURG, PLASTIC, GYN Beds 31, ADC 31	2.*0*
WARD 2:	GENERAL SURG Beds 30, ADC 17	*1.0*
WARD 3:	CARDIAC SURG Monitored step-down unit Beds 18, ADC 15	*3.0*
WARD 4:	UROLOGY Beds 28, ADC 22	*2.0*
WARD 5:	OTOLARYNGOLOGY Beds 14, ADC 7	*0.2*
WARD 6:	OPHTHALMOLOGY Beds 15, ADC 5	*0.1*

UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED
		(**Worksheet**)
WARD 7:	NEURO-ORTHO	Consults/Day
	15 Ortho beds with 10-bed Neurosurgery step-down unit. Beds 25, ADC 18	*2.0*
WARD 8:	Surgery ICU Beds 14, ADC 10	*3.0*
INTERMEDIATE FLOATING BEDS: Beds 15, ADC 6		
These patients are attended by the same surgical staff as regular surgery beds.		*0.2*
OPERATING ROOM:		
26 cases per weekday; assume average length of case is 2.3 hours. Ambulatory surgery requiring local anesthesia is done in the ambulatory care area. Open heart regional center: 250 cases per year.		*0.1*
		Total Consults: 13.6 Assume 30 min/consult. Total min = 13.6 × 30 = 408 min
TOTAL MEDICINE PHYSICIAN WEEKDAY HOURS REQUIRED FOR PCA 2:		*408 min/60 = 6.8 hr*

PATIENT CARE AREA 3: NEUROLOGY SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR AN AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY

WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Operating		TOTAL RESIDENCY POSITIONS = 6
Neurology Beds:	26	1 PGY 4, 1 PGY 3, 3 PGY 2s, and
Average Daily Census (ADC):	23	1 PGY 1. Residents may be assigned to any of the following: inpatient ward, outpatient clinic, consultations, EEG clinic, and EMGs.
Occupancy Rate:	87.3 %	
Length of Stay:	7	
Daily Admissions:	4	
UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED (**Worksheet**) <u>Consults/Day</u>
WARD 1:	GENERAL NEUROLOGY Beds 26, ADC 23	*1.0*
INTERMEDIATE BEDS ON WARD 1: ALZHEIMER'S UNIT 124 patient evaluations done in FY 89 (about 0.5 patient per weekday)		0.2
CONSULTATIONS PERFORMED IN 1989:		*0*
Inpatient: (for other services)	998	
Outpatient: (in General Med Clinic or Adm & Screen Area)	948	
SPECIAL PROCEDURES: EEG + EVOKED POTENTIAL LAB: 10/day		*0*
EMG LAB:	(Separate from RMS) 0.4/day	*Assume 30 min/consult*
		Total min = 1.2 × 30 = 36 min
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 3:		*36 min/60 = 0.60 hr*

PATIENT CARE AREA 4: PSYCHIATRY SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR AN AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY

WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Operating		TOTAL RESIDENCY POSITIONS = 12
Psychiatry Beds:	281	All residents are PGY 2; PGY 1
Average Daily Census (ADC):	220	residents start at County Hospital.
Occupancy Rate:	78.3 %	Each ward is run by a team that
Length of Stay:	25	includes I psychologist, 1 social
Daily Admission:	13	worker, and 1-3 psych aides. The number of residents per ward varies and will be listed in the unit descriptions.
UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED (**Worksheet**) <u>Consults/Day</u>
WARD 1:	CLOSED; PSYCHOTIC, SCHIZ, BIPOLAR, ORGANIC Beds 42, ADC 31, plus 2-Bed Psych Evaluation and Admission Unit, ADC 2	*1.0*
WARD 2:	CLOSED; This ward is identical to Ward 1. Beds 38, ADC 34 plus 2-Bed Psyeh Evaluation and Admission Unit, ADC 1	*1.0*
WARD 3:	CLOSED; GERIATRIC, Variety of diagnoses 1 resident Beds 42, ADC 32	*2.0*
WARD 4:	OPEN; AFFECTIVE AND ANXIETY DISORDERS 3 residents, 2 or 3 students Beds 44, ADC 33	*1.0*

UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED
		(Worksheet) Consults/Day
WARD 5:	DETOXIFICATION No residents Beds 26, ADC 28	0.8
WARD 6:	OPEN; ALCOHOL REHAB 1 resident, half-time Beds 34, ADC 30	0.1
WARD 7:	OPEN; DRUG REHAB 1 resident, half-time Beds 41, ADC 34	0.2
SPECIAL PROCEDURES: ECT PROCEDURES: 33 done in 1989 in the OR.		
		Assume 30 min/consult *Total min = 6.1 × 30 = 183 min*
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 4:		*183 min/60 = 3.05 hr*

PATIENT CARE AREA 5: REHABILITATION MEDICINE SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR THE AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY		
WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Operating		TOTAL RESIDENCY POSITIONS = 6
RMS Beds:	36	3 PGY ls for the RMS Ward
Average Daily Census (ADC):	23	2 PGY 2s or 3s for Consults
Occupancy Rate:	62.3 %	1 PGY 4 for EMG Service
Length of Stay:	24	
Daily Admissions:	1	
UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED **(Worksheet)** <u>Consults/Day</u>
WARD 1:	GENERAL REHAB; AMPUTEE, MUSCULAR DYSTROPHY, HEAD INJURY Beds 26, ADC 23	0.4
SPECIAL PROCEDURES: EMG SERVICE: 5/weekday		
		Assume 30 min/consult *Total min = 0.4 × 30 = 12*
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 5:		*12 min/60 = 0.20 hr*

PATIENT CARE AREA 6: SPINAL CORD INJURY SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR THE AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY

WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Operating		TOTAL RESIDENCY POSITIONS = 2
SCI Beds:	26	(physiatry residents)
Average Daily Census (ADC):	19	These residents share call
Occupancy Rate:	72.2%	and EMG work with RMS residents.
Length of Stay:	51	
Daily Admissions:	0.35	
UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED **(Worksheet)** Consults/Day
WARD 1:	GENERAL SCI Beds 26, ADC 19	*0.6*
		Assume 30 min/consult Total rain = 0.6 × 30 = 18 rain
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 6:		*18 min/60 = 0.30 hr*

PATIENT CARE AREA 7: LONG-TERM CARE SERVICE

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR THE AVERAGE WEEKDAY FROM THE MEDICINE SERVICE ONLY		
WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Operating Nursing Home		TOTAL RESIDENCY POSITIONS = 1 1 geriatric fellow assigned to the geriatric and intermediate wards. No residents in the NHCU.
Care Unit Beds:	103	
Average Daily Census (ADC):	96	
Occupancy Rate:	92.8 %	
Length of Stay:	109	
Daily Admissions:	0.54	
Total Operating Intermediate and Geriatric Beds:	51	
Average Daily Census:	40	
Occupancy Rate:	78 %	
Length of Stay:	27	
Daily Admissions:	1	
UNIT DESCRIPTIONS		PHYSICIAN HOURS REQUIRED (**Worksheet**)
WARD 1:	GERIATRIC MEDICINE Beds 22, ADC 19	*ADC 19* ×* 8 min = 152 min
WARD 2:	INTERMEDIATE Included are a mix of services; however, all patients *are* managed by Long-Term Care. Beds 33, ADC 27	*ADC 27 × 8 min = 216 min One new patient/day: (1 × 20 min) = 20 min*
NURSING HOME CARE UNIT		
WARD 1:	NHCU Beds 78, ADC 74	*ADC 74 × 8 min = 592 min*
WARD 2:	NHCU These patients may include those less stable, or more acutely ill than the others. Beds 25, ADC 22	*ADC 22 × 12 min = 264 min*
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 7:		*1,244 min/60 = 20.73 hr*

* Staff physician time/patient/day (Mon-Fri) = 3 rain care + 3 rain communication + 2 rain documentation = 8 min.

PATIENT CARE AREA 8: AMBULATORY CARE PROGRAM

PLEASE ESTIMATE THE NUMBER OF PHYSICIAN HOURS REQUIRED FOR THE AVERAGE WORKDAY FROM THE MEDICINE SERVICE ONLY		
WORKLOAD DESCRIPTION		RESIDENT STAFF AND NONPHYSICIAN PRACTITIONERS
Total Number of Visits Per Year:	325.000	TOTAL RESIDENCY POSITIONS = 2 These are medicine residents who work in the Admitting & Screening Clinic usually 4 p.m. -12 midnight shift ER is open 24 hr/day, Admitting & Screening is open 8 a.m. to 12 midnight..
Total Number of Emergency, Admitting & Screening Per Year:	37,000	
Satellite Clinic Visits Per Year:	20,000	
Ambulatory Care physicians are hired for the Emergency, Admitting & Screening Area only.		Clinics are run by each respective inpatient service with staff obtained by that service. A general description of clinics is listed below.
One-Third of Admitting & Screening Visits Are Psych Related.		
CLINIC DESCRIPTIONS		PHYSICIAN HOURS REQUIRED **(Worksheet)** Individual Physicians Required at Clinics × Clinic Hr/Wk
GENERAL MEDICINE: 1,079 per week 5 days per week, all day 7 residents		*4 staff phys × 40 hr/wk = 160 hr*
PULMONARY: 53 per week 1 half-day per week 1 fellow, 1 resident		*2 staff phys × 4 hr/wk = 8 hr*
ENDOCRINE: 23 per week 1 half-day per week 1 fellow, I resident		*1 staff phys × 4 hr/wk = 4 hr*
METABOLISM: 27 per week 1 half-day per week 1 fellow, 1 resident		*1 staff phys × 4 hr/wk = 4 hr*
CARDIOLOGY: 96 per week 1 day per week 10 residents		*5 staff phys × 8 hr/wk = 40 hr*
GASTROENTEROLOGY: 48 per week 1 half-day per week 3 residents		*2 staff phys × 4 hr/wk = 8 hr*

CLINIC DESCRIPTIONS	PHYSICIAN HOURS REQUIRED
	(Worksheet) Individual Physicians Required at Clinics × Clinic Hr/Wk
HEMATOLOGY: 18 per week	
1 half-day per week	
1 fellow, I resident	*1 staff phys × 4 hr/wk = 4 hr*
HYPERTENSION: 56 per week	
5 half-days per week	
1 nurse practitioner	*1 staff phys × 20 hr/wk = 20 hr*
RENAL: 22 per week	
1 half-day per week	
2 residents	*1 staff phys × 4 hr/wk = 4 hr*
DIALYSIS: 16 per week	
5 days per week	
1 resident	*0.1 staff phys × 40 hr/wk = 4 hr*
RHEUMATOLOGY: 114 per week	
1 day per week	
2 residents	*2 staff phys × 8 hr/wk = 16 hr*
ONCOLOGY: 70 per week	
1 day per week	
1 resident	*2 staff phys × 8 hr/wk = 16 hr*
NEUROLOGY: 126 per week	
3 half-days per week	———
5 residents	
GEN SURGERY: 103 per week	
1 day per week	———
10 residents	
ORTHOPEDIC: 169 per week	
5 half-days per week	———
3 residents	

CLINIC DESCRIPTIONS	PHYSICIAN HOURS REQUIRED
	(Worksheet) Individual Physicians Required at Clinics × Clinic Hr/Wk
UROLOGY: 187 per week 5 days per week 5 residents	______
ENT: 164 per week 5 half-days per week 3 residents	______
SCI HOME CARE: 22 enrolled Home visits as needed No resident	______
SCI CLINIC: 90 per week 3 half-days per week 1 resident	______
RMS CLINIC: 60 per week 1 day per week 6 residents	______
AMPUTEE CLINIC: 15 per week 1 half-day per week 3 residents	______
CHRONIC PAIN CLINIC: 10 per week 2 half-days per week No residents	*1 staff phys × 8 hr/wk = 8 hr*
CARDIAC REHABILITATION: 20 per week 2 hours per day No residents	*0.2 staff phys × 10 hr/wk = 2 hr*
MENTAL HYGIENE: 61 per day Daily, all day 3 residents	______
DAY HOSPITAL (PSYCH): 29 per day Partial hospitalization, skills for daily living, higher turnovers 1 resident	______

CLINIC DESCRIPTIONS	PHYSICIAN HOURS REQUIRED
	(Worksheet) Individual Physicians Required at Clinics × Clinic Hr/Wk
PSYCH DAY TREATMENT: 53 per day	
Day-care program with activities, low turnover.	———
No residents	
ALCOHOL DEPENDENCY: 14 per day	———
Daily	
No resident, 1 psychologist, 2 social workers, 3 techs, 1 nurse practitioner, 2 counselors	
DRUG DEPENDENCY: 114 per day	———
Daily	
No resident, 1 psychologist, 1 social worker, 1 physician assistant, 1 nurse practitioner, 2 pharms, 1 policeperson	
COMP AND PENSIONS: 8 per day	———
Daily	
SATELLITE CLINIC (OFFSITE): 80 per day	
35 visits are walk-in (admitting & screening)	———
30 visits are scheduled (medicine follow-up referrals)	
15 visits are psychiatric	
No specialty clinics are held	
No residents	
EMPLOYEE HEALTH: 29 per day	———
Daily, all day	
No residents	
TOTAL MEDICINE PHYSICIAN AVERAGE WEEKDAY HOURS REQUIRED FOR PCA 8:	*298 hr per week ÷ 5 days = 59.60 hr*

SECTION B

1. Since this hospital requires coverage by physician staff on nights and weekends, either the actual presence of a physician or the on-call availability is necessary. Estimate the number of hours that would be required from medicine service in order to cover this facility:

Weeknight Coverage	*48 hr*
(Physician present)	(*Two wards/ICUs and consults × 16 hr*)
Weeknight "On-Call"	*48 hr*
Weekend Coverage	*180 hr*
(Physician present)	(*Two wards/ICUs and consults × 60 hr*)
Weekend "On-Call"	*180 hr*

2. In many facilities, this night and weekend coverage is provided without actually hiring extra FTEE because of the use of residents and backup staff physicians. However, in some cases, the number of residents may not be sufficient, necessitating the "purchase" of coverage through contracting or hiring FTEE either full-time or part-time.

After evaluation of the number of residents in this facility, how many of the total hours calculated above do you believe would need to be "purchased?"

Purchased Coverage in Hours	
Weeknight Coverage and On Call	*0*
Weekend Coverage and On Call	*0*
PURCHASED COVERAGE HOURS:	*0*

3. Obtain a subtotal of estimated physician hours by adding the total Purchased Coverage Hours from question #2 above, to the hours you estimated from each PCA in section A.

Purchased Coverage Hours (question #2)	*0. 0*
PCA 1: Medicine	*74.87*
PCA 2: Surgery	*6.80*
PCA 3: Neurology	*0.60*
PCA 4: Psychiatry	*3.05*
PCA 5: Rehab Med	*0.20*
PCA 6: SCI	*0.30*
PCA 7: Long-Term Care	*20. 73*
PCA 8: Ambulatory Care	*59.60*
TOTAL MEDICINE HOURS	*166.15*
4. Now convert these Total Medicine Hours into Medicine FTEE	*166.15 ÷ 8.00 = 20.77 FTEE*

5. Some hospitals have access to Consulting and Attending (C&A) or Without-Compensation (WOC) physicians from the community or neighboring medical school. Some of this C&A-WOC FTEE is desirable in order to provide additional patient care that cannot be obtained inhouse. Other C&A-WOC FTEE is desirable in order to enhance the quality of care through teaching, research, or quality assurance activities.

How many C&A-WOC FTEE would be desirable in your opinion as additional resources to the medicine service for this facility?

A: Direct Patient Care C&A-WOC FTEE (e.g., patient consultations, ambulatory clinics, reading tests, teaching residents on the PCA):	0.0
B: Non-Patient-Care-Related C&A-WOC FTEE (e.g., classroom education for staff or residents, quality assurance activities, research):	0.0

6. Now add the Direct Patient Care C&A-WOC FTEE from question #5A to the Medicine FTEE that you calculated in question #4.

Subtotal Patient-Care-Related FTEE	20. 77

7. The FTEE that you have calculated in question #6 should be related to direct patient care only. Now, consider some of the work physicians do that does not take place on any PCA and that does not directly relate to the care of the individual patients.

These activities generally do not occur every day, but may be time-consuming when looked at over a period of one month. How many hours of physician time would be required at this facility in an average month to fulfill these functions?

Education of residents (didactic, classroom, not on the PCA):	<u>*280 hr*</u> *(1 hr/day × 20 days = 20 1 hr/day/resident consulting = 13 × 20 = 260, assuming 13 consulting residents)*
Continuing education for physicians:	<u>*160 hr*</u> *(individual or conferences) (2 hr/week × 4 weeks/month × 20 MDs)*
Hospital-related activities (mortality and morbidity, QA, staff meetings):	<u>*160 hr*</u> *(2 hr/week × 4 weeks/month × 20 MDs)*
Administration:	<u>*160 hr*</u> *(4 hr/week × 4 weeks/month × 20 MDs) 40% of all MDs*
Research (off the PCA):	<u>*128 hr*</u> *(4 hr/week × 4 week × 8 MDs)*
TOTAL Non-Patient-Care-Related Hours:	<u>*888*</u>

8. Convert the hours in question #7 into FTEE (remember that these hours were conceived for a month rather than for one day).

Non-Patient-Care-Related FTEE	*5.55* *(888 hr ÷ 160 hr)*

9. Now add the Non-Patient-Care-Related FTEE that you calculated in question #8 to the Non-Patient-Care-Related C&A-WOC FTEE that you calculated in question #5B.	
Non-Patient-Care-Related FTEE: (question #8)	*5.55*
Non-patient-Care-Related C&A-WOC FTEE: (question #5B)	*0.0*
Subtotal Non-patient-Care-Related FTEE:	*5.55*
10. Now create your Grand Total Medicine FTEE:	
Subtotal Patient-Care-Related FTEE: (from question #6)	*20. 77*
Subtotal Non-patient-Care-Related FTEE: (from question #9)	*5.55*
GRAND TOTAL MEDICINE FTEE	*26. 32*

Figure 5.2: The Staffing Algorithm Development Instrument (SADI) for Medicine: The Complete Instrument with Statistical Summary of Panel's Assessments

INTRODUCTION AND INSTRUCTIONS (APPREVIATED)

The purpose of the SADI is to gather the data needed to construct, test, formalize, and enhance the algorithms and rules of thumb for staffing that emerged from prior meetings of each specialty program panel. The ultimate intention is to develop algorithms that could be applied to estimate staffing requirements at VA medical centers (VAMCs), presumably duplicating the results that specialty panelists themselves would have derived.

Section A of the SADI requests time estimates in some cases by workload unit. In other cases, it requests time estimates by major job elements (tasks). These elements had previously been indicated by some panel members as accounting for the bulk of the work of VA internists. For the latter cases, we seek your estimates of how physician requirements vary with respect to such variables as the volume of patients and the availability of residents and nonphysician practitioners. By systematically varying the levels of workload and nonphysician personnel, we hope to infer from your numerical responses the implicit formulas you used to relate physician time to these variables as well as the nature of the relationship between workload and staffing, e.g., linear or nonlinear.

Section B requests your response to a series of questions for the time spent in activities other than direct patient care.

Instructions: Section A: For each cell of each table, please estimate the number of physician hours required from the Medicine Service to deliver good-quality care under the specified circumstances. Section B is self-explanatory.

SECTION A: PATIENT CARE ACTIVITIES

Admissions

Please fill in the average time in hours required by a staff physician in your service to accomplish an admission work-up, either with or without a resident in your service.

Chart 1

	Time per Admission Work-Up Without Resident	Time per Admission Work-Up With Resident
High	2.50	0.75
Low	0.75	0.33
Mean	2.13	0.50
Median	1.00	0.50

Routine Daily Patient Care

For each workload factor and alternative average daily census (ADC) level below, please fill in the average number of physician hours required from the Medicine Service. Keep in mind that the daily rounds do not include new admission work-ups, since they are covered in Chart 1.

Assume No Residents

Chart 2

Medicine Ward Average LOS = 7		ADC 1	ADC 5	ADC 10	ADC 15	ADC 20	ADC 25
Daily Rounds	High	0.25	1.25	2.50	3.75	5.00	6.25
	Low	0.17	0.50	1.00	0.50	2.00	2.50
	Mean	0.22	0.92	0.83	0.33	0.08	3.67
	Median	0.23	1.00	1.50	2.00	2.50	3.00

Medicine Ward Average Los = 7		ADC 1	ADC 5	ADC 10	ADC 15	ADC 20	ADC 25
Charting, Phone, and Paperwork	High	0.33	1.25	2.50	3.75	5.00	6.25
	Low	0.10	0.50	0.50	0.75	1.00	1.00
	Mean	0.23	0.80	1.50	2.00	2.75	3.25
	Median	0.25	1.00	1.50	2.00	3.00	3.00
Patient and Family Contacts, plus Teaching	High	0.25	1.25	2.50	3.75	5.00	6.25
	Low	0.00	0.17	0.67	0.25	0.33	0.33
	Mean	0.13	0.82	0.92	1.42	1.75	2.18
	Median	0.08	0.25	0.67	0.75	1.00	1.50
Supervision and Teaching (Residents/ Staff)	High	0.10	1.00	1.50	1.50	2.00	2.00
	Low	0.00	0.00	0.00	0.00	0.00	0.00
	Meanan	0.02	0.27	0.67	0.70	0.60	0.60
	Median	0.00	0.05	0.25	0.25	0.30	0.50
Overall Mean Time		0.61	2.25	4.51	6.59	8.16	9.71
Overall Median Time		0.65	2.35	4.35	7.00	7.00	8.00

For ADC of 15 or less, assume one PGY 1 resident and one PGY 2 or 3 resident. For ADC greater than 15, assume two PGY 1 residents and two PGY 2 or 3 residents.

Chart 3

Medicine Ward Average Los = 7		ADC 1	ADC 5	ADC 10	ADC 15	ADC 20	ADC 25
Daily Rounds	High	0.50	1.25	2.00	3.00	3.50	4.00
	Low	0.17	0.42	0.83	1.25	1.67	2.00
	Mean	0.28	0.82	0.33	1.75	2.33	2.75
	Median	0.25	1.00	1.25	1.50	2.25	2.75
Charting, Phone, and Paperwork	High	0.20	0.42	0.83	1.25	1.67	2.00
	Low	0.00	0.08	0.25	0.25	0.25	0.50
	Mean	0.12	0.25	0.42	0.77	0.75	0.75
	Median	0.12	0.25	0.25	0.50	0.50	0.50
Patient and Family Contacts, plus Teaching	High	0.13	0.33	0.33	0.50	0.50	0.50
	Low	0.00	0.00	0.25	0.25	0.25	0.25
	Mean	0.08	0.12	0.28	0.37	0.42	0.42
	Median	0.08	0.08	0.25	0.42	0.50	0.50
Supervision and Teaching (Residents/ Staff)	High	0.50	1.00	1.25	1.25	1.50	2.00
	Low	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.52	0.67	0.75	0.80	1.00	1.00
	Median	0.50	0.75	1.00	1.00	1.00	1.00
Overall Mean Time		0.85	1.78	2.66	3.45	4.41	4.92
Overall Median Time		0.54	1.50	2.75	3.38	4.44	4.89

Assume One PGY 1 and One PGY 2 or 3 Resident Per ICU/CCU

Chart 4

ICU/CCU UNIT Average Los = 5		ADC 1	ADC 5	ADC 10	ADC 15	ADC 20	ADC 25
Daily Rounds	High	0.50	1.00	2.00	2.50	3.00	3.25
	Low	0.25	0.50	0.75	1.50	2.00	2.50
	Mean	0.37	0.80	1.30	2.08	2.25	2.75
	Median	0.33	0.83	1.25	1.50	2.25	2.50
Charting, Phone, and Paperwork	High	0.25	0.50	0.50	0.75	1.00	1.50
	Low	0.08	0.00	0.00	0.00	0.00	0.00
	Mean	0.13	0.23	0.30	0.45	0.62	0.72
	Median	0.12	0.25	0.42	0.50	0.50	0.75
Patient and Family Contacts, plus Teaching	High	0.17	0.50	0.50	0.75	0.75	0.00
	Low	0.00	0.00	0.25	0.25	0.50	0.50
	Mean	0.10	0.23	0.35	0.50	0.53	0.58
	Median	0.10	0.25	0.28	0.50	0.50	0.50
Supervision and Teaching (Residents/ Staff)	High	1.00	1.00	1.25	1.50	2.00	2.00
	Low	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	0.50	0.45	0.58	0.75	0.83	0.92
	Median	0.50	0.50	0.83	0.75	0.75	1.00
Overall Mean Time		0.94	1.82	2.70	3.54	4.29	4.95
Overall Median Time		0.99	1.75	2.63	3.50	4.50	5.00

Time Per Initial Consultation Off Your Pca

Fill in the average time in hours required by a staff physician in your service for each initial (new) consult on another service, noting the presence or absence of a resident in your own service. (When the resident is present, assume that he/she is performing the consult under the supervision of an attending physician.)

Chart 5

	Time per Consult Without Resident				Time per Consult With Resident			
Consultation off your PCA	High	Low	Mean	Median	High	Low	Mean	Median
Neurology	1.00	0.50	0.73	0.75	0.75	0.25	0.47	0.50
Surgery	1.00	0.75	0.83	0.75	0.75	0.50	0.53	0.50
Nursing Home	1.00	0.50	0.73	0.75	0.75	0.25	0.47	0.50
Intermediate	1.00	0.50	0.63	0.50	0.75	0.25	0.37	0.25
Rehab Medicine	1.00	0.50	0.70	0.67	0.75	0.25	0.40	0.37
Psychiatry	1.00	0.50	0.73	0.50	0.75	0.25	0.47	0.50

Time Per Follow-Up Consultation Off Your Pca

Fill in the average time in hours required by a staff physician in your service for each follow-up consultation visit on another service, noting the presence or absence of a resident from your service.

Chart 6

	Time per Consult Without Resident				Time per Consult With Resident			
Consultation off your PCA	High	Low	Mean	Median	High	Low	Mean	Median
Neurology	0.50	0.13	0.25	0.25	0.50	0.12	0.40	0.25
Surgery	0.50	0.17	0.28	0.25	0.50	0.17	0.45	0.25
Nursing Home	0.33	0.08	0.23	0.25	0.25	0.08	0.20	0.25
Intermediate	0.25	0.08	0.20	0.25	0.25	0.08	0.20	0.25
Rehab Medicine	0.25	0.08	0.22	0.25	0.25	0.08	0.20	0.25
Psychiatry	0.25	0.08	0.20	0.25	0.25	0.08	0.22	0.25

Special Procedures

Please fill in the average time in hours required by a staff physician in your service for each of the special procedures listed on the left, noting the presence or absence of a resident.

Chart 7

	Time per Consult Without Resident				Time per Consult With Resident			
Special Procedures	High	Low	Mean	Median	High	Low	Mean	Median
Cardiac Catheterization	2.00	0.42	1.25	1.00	3.00	0.50	1.67	1.50
Bronchoscopy	1.00	0.42	0.77	0.92	2.00	0.50	1.08	0.87
Endoscopy	1.00	0.42	0.62	0.30	2.00	0.33	0.92	0.70
Others (Specify)	1.00	0.25	0.53	0.42	1.00	0.33	0.53	0.42

Ambulatory Care

Please fill in the average time in hours required by a staff physician in your service for the average ambulatory care clinic visit by a typical patient to one of your specialty program clinics, noting the presence or absence of residents and nonphysician practitioners (e.g., a physician assistant [PA] or a nurse practitioner [NP]), and whether the visit is by a new or returning patient.

Chart 8

	Physician Time per Visit			
Type of Visit	High	Low	Mean	Median
New Patient Visit No Resident	1.00	0.67	0.92	1.00
New Patient Visit with Resident	1.00	0.25	0.53	0.50

	Physician Time per Visit			
Type of Visit	High	Low	Mean	Median
New Patient Visit with NP or PA	1.00	0.33	0.67	0.70
Follow-Up Visit No Resident	0.33	0.25	0.30	0.33
Follow-Up Visit with Resident	0.33	0.08	0.22	0.25
Follow-Up Visit with NP or PA	0.33	0.08	0.25	0.25

Section B: Non-Patient-Care Activities

Part 1. The activities listed below generally do not occur every day, but may be time-consuming when looked at over a longer period, such as a week or month. List the time in hours that you would add to each physician's average workday to allow for the types of work other than direct patient care listed below.

Chart 9

Assume the amount amount of research accomplished at this VAMC is:	High[1]				Medium[1]				Low[1]			
Physician Hours/Workday:	High	Low	Mean	Median	High	Low	Mean	Median	High	Low	Mean	Median
Education of residents (didactic, classroom, not on the PCA):	1.00	0.30	0.42	0.45	1.00	0.30	0.42	0.45	1.00	0.12	0.32	0.45
Administration by Chief (time required to manage your whole service by a Chief and/or Assistant Chief):	7.00	3.00	4.00	3.30	7.00	2.30	3.55	3.30	7.00	1.00	3.25	3.30

Assume the amount amount of research accomplished at this VAMC is:	High[1]				Medium[1]				Low[1]			
Physician Hours/ Workday:	High	Low	Mean	Median	High	Low	Mean	Median	High	Low	Mean	Median
Administration by Others (time required for individual physicians):	1.00	0.05	0.25	0.40	1.00	0.05	0.25	0.40	1.00	0.05	0.25	0.40
Hospital-Related Activities (mortality and morbidity, quality assurance, staff meetings):	1.00	0.35	0.40	0.35	1.00	0.25	0.40	0.35	1.00	0.25	0.35	0.30
Total Hours per Average Workday:	For Chief		For Non-Chief		For Chief		For Non-Chief		For Chief		For Non-Chief	
Overall Mean	4.0		1.8		3.9		1.9		3.4		1.6	
Overall Median	3.5		1.5		3.5		1.8		3.5		1.5	

[1] Examples of research level by total amount of funding (VA plus non-VA) in fiscal year 1988: High—VAMC I with $8.8 million in total funding; Medium—VAMC II with $2.75 million in total funding; Low—VAMC III with about $176,000 in total funding.

Part 2.

In order to determine the actual staffing in this hospital, the number of FTEE must be adjusted to allow for continuing medical education, research, and leaves of absence. What do you believe to be the appropriate percentage of time the "average" (typical) member of your service should devote to each of the following categories of non-patient-care-related activities?

Chart 10

Assume the amount amount of research accomplished at this VAMC is:	High[1]				Medium[1]				Low[1]			
Percentage of Physician Time:	High	Low	Mean	Median	High	Low	Mean	Median	High	Low	Mean	Median
Continuing Education:	15.0	1.5	7.4	8.0	15.0	1.5	7.4	8.0	10.0	1.5	6.2	6.0
Research (off the PCA):	50.0	30.0	36.3	34.0	30.0	20.0	23.3	23.0	15.0	0.0	7.5	7.5
Vacation, Administrative Leave, Sick Leave, Other:	15.0	8.0	12.5	13.0	15.0	8.0	12.5	13.0	25.0	8.0	14.0	13.0
Total Percentage of Time:												
Mean	55.6				43.3				27.9			
Median	54.0				44.3				26.8			

[1] Examples of research level by total amount of funding (VA plus non-VA) in fiscal year 1988: High—VAMC I with $8.8 million in total funding; Medium—VAMC II with $2.75 million in total funding; Low—VAMC III with about $176,000 in total funding.

Figure 5.3 Application of the SADI to Compute Physician Requirements in Medicine at VAMC I[1]

For Section A: Patient Care Activities Medicine Inpatient PCA

Admissions Physician hours is the product of admissions per day and the panel's median estimate of physician time per admission, given resident availability. The former is supplied by the VAMC; the latter is from Chart 1 of Figure 5.2.

15 Adm/day × 0.50 hr/Adm	=	7.50 hr (Wards)
1 Adm/day × 0.50 hr/Adm	=	0.50 hr[2] (Intensive Care)
Subtotal for Admissions	=	8.00 hr
Routine Care Based on the overall median estimates from Charts 3 and 4 of Figure 5.2. In each instance below, the required physician time estimate could not be read directly from the charts, but had to be derived by interpolation, extrapolation, or some other mapping process.		
Ward 1:	ADC = 26:	5.08 hr[3]
Ward 2:	ADC = 31:	5.10 hr[3]
Ward 3:	MICU w/ADC = 6:	3.07 hr[4]
Ward 4:	CCU w/ADC = 6:	3.07 hr[4]
Ward 5:	Bone Marrow Transplant Unit (BMTU) w/ADC = 5:	2.63 hr[5]

[1] Since VAMC I is a highly affiliated, research-intensive facility, all physician time estimates assume resident availability. All workload-related data are taken from the medicine DSE developed for VAMC I and are based on information reported to study staff by officials at the facility.

[2] Assumes admission work-up time same as for medicine wards. Admission times taken from Chart 1 of Figure 5.2.

[3] Estimate based on extrapolation of overall median values found in Chart 3 under Routine Daily Patient Care in Figure 5.2.

[4] Estimate based on linear interpolation of overall median values found in Chart 4 under Routine Daily Patient Care in Figure 5.2.

[5] Estimate derived from ICU/CCU times found in Chart 4 under Routine Daily Patient Care in Figure 5.2, since neither the BMTU nor the GEU is included in the current medicine SADI.

Intermediate Care:	ADC = 1:	0.54 hr[6]
Geriatric Evaluation Unit (GEU):	ADC = 6:	3.07 hr[5]
Subtotal for Routine	**Care =**	**22.56 hr**
Special Procedures Physician hours is the product of procedures per day and the panel's median estimate of physician time per procedure, given resident availability. The former is supplied by the VAMC; the latter is from Chart 7 of Figure 5.2.		
Cardiac Caths:	1.5 Caths/day × 1.50 hr/cath =	2.25 hr
Endoscopies:	6 Endos/day × 0.70 hr/endo =	4.20 hr
Bronchoscopies:	3.5 Bronchos/day × 0.87 hr/broncho =	3.03 hr
Subtotal for Special Procedures =		**9.48 hr**
***Subtotal for Medicine Inpatient PCA*:**		***40.04 hr/day***
Consultations Physician hours is the product of consults per day and the panel's median estimate of physician time per consult, given resident availability. The former is supplied by the facility; the latter is from either Chart 5 or Chart 6 of Figure 5.2, depending on whether the consult is "initial" or "follow-up."		
Surgery Inpatient PCA: 18.50 consults/day[7]		
Initial:	9.25 visit[8]× 0.50 hr/visit	= 4.63 hr
Follow-up:	9.25 visit × 0.25 hr/visit	= 2.31 hr
	Subtotal	**6.94 hr/day**

[6] Assumes Routine Daily Patient Care time same as for medicine wards in Chart 3 of Figure 5.2.

[7] Average daily consult or visit rate by medicine service physicians, as reported by VAMC I. Consults or visits on a given day may be above or below this average figure.

[8] Assumes 50 percent of visits are "initial" consults and 50 percent are "follow-up." Physician times per initial consult are found in Chart 5 and Chart 6, respectively, of Figure 5.2.

Neurology Inpatient PCA: 1.85 consults/day[7]		
Initial:	0.92 visit[8]× 0.50 hr/visit	= 0.46 hr
Follow-up:	0.92 visit × 0.25 hr/visit	= 0.23 hr
	Subtotal	**0.69 hr/day**
Psychiatry Inpatient PCA: 5.54 consults/day[7]		
Initial:	2.77 visit[8]× 0.50 hr/visit	= 1.39 hr
Follow-up:	2.77 visit × 0.25 hr/visit	= 0.69 hr
	Subtotal	**2.08 hr/day**
Rehabilitation Medicine Inpatient PCA: 1.85 consults/day[7]		
Initial:	0.92 visit[8]× 0.37 hr/visit	= 0.34 hr
Follow-up:	0.92 visit × 0.25 hr/visit	= 0.23 hr
	Subtotal	**0.57 hr/day**
Spinal Cord Injury PCA: 0.58 consults/day[7]		
Initial:	0.29 visit[8]× 0.50 hr/visit[9]	= 0.15 hr
Follow-up:	0.29 visit × 0.25 hr/visit[9]	= 0.07 hr
	Subtotal	**0.22hr/day**
Nursing Home PCA: VAMC I reports 0 consults		
Subtotal for Consultations: 10.50 hr/day		
Ambulatory Visits Physician hours is the product of visits per day and the panel's median estimate of physician time per visit. The former is supplied by the VAMC; the latter is from Chart 8, expressed as a function of whether the particular clinic operates with or without residents and with or without physician assistants and nurse practitioners.		

[9] Based on median consult times to surgery service, since SCI not included in current medicine SADI.

General Medicine: 100 visit/day[7]		
	Residents and NPs available.	
Initial:	20 visit[10]× 0.50 hr/visit	= 10.00 hr
Follow-up:	80 visit × 0.25 hr/visit	= 20.00 hr
	Subtotal	**30.00 hr/day**
General Medicine Follow-up: 18 visit/day[7]		
NPs available.		
Initial:	3.6 visit[10]× 0.70 hr/visit	= 2.52 hr
Follow-up	14.4 visit × 0.25 hr/visit	= 3.60 hr
	Subtotal	**6.12 hr/day**
Cardiology: 13.6 visit/day[7]		
Initial:	2.72 visit[10] × 0.50 hr/visit	= 1.36 hr
Follow-up:	10.88 visit × 0.25 hr/visit	= 2.72 hr
	Subtotal	**4.08 hr/day**
Dermatology: 17 visit/day[7]		
Initial:	3.40 visit[10] x 0.50 hr/visit	= 1.70 hr
Follow-up:	13.60 visit x 0.25 hr/visit	= 3.40 hr
	Subtotal	**5.10hr/day**
Endocrine: 6.4 visit/day[7]		
Initial:	1.28 visit[10] × 0.50 hr/visit	= 0.64 hr
Follow-up:	5.12 visit × 0.25 hr/visit	= 1.28 hr
	Subtotal	**1.92 hr/day**

[10] Assume 20 percent of ambulatory care visits involve new patients and 80 percent are for follow-up. Physician times per ambulatory visit are in Chart 8 of Figure 5.2.

Gastrointestinal: 8.4 visit/day[7]		
Initial:	1.68 visit[10]× 0.50 hr/visit	= 0.84 hr
Follow-up:	6.72 visit × 0.25 hr/visit	= 1.68 hr
	Subtotal	**2.52 hr/day**
Hypertension: 8.4 visit/day[7] NPs available		
Initial:	1.68 visit[10] × 0.70 hr/visit	= 1.18 hr
Follow-up:	6.72 visit × 0.25 hr/visit	= 1.68 hr
	Subtotal	**2.86 hr/day**
Pulmonary: 12.6 visit/day[7]		
Initial:	2.52 visit[10] × 0.50 hr/visit	= 1.26 hr
Follow-up:	10.08 visit × 0.25 hr/visit	= 2.52 hr
	Subtotal	**3.78 hr/day**
Renal: 4.8 visit/day[7]		
Initial:	0.91 visit[10] × 0.50 hr/visit	= 0.48 hr
Follow-up:	3.84 visit × 0.25 hr/visit	= 0.96 hr
	Subtotal	**1.44 hr/day**
Dialysis: 10.6 visit/day[7]		
Initial:	2.12 visit[10] × 0.50 hr/visit	= 1.06 hr
Follow-up:	8.48 visit × 0.25 hr/visit	= 2.12 hr
	Subtotal	**3.18 hr/day**
Rheumatology: 7.6 visit/day[7]		
Initial:	1.52 visit[10] × 0.50 hr/visit	= 0.76 hr
Follow-up:	6.08 visit × 0.25 hr/visit	= 1.52 hr
	Subtotal	**2.28 hr/day**

Oncology: 8.6 visit/day[7]		
Initial:	1.72 visit[10] × 0.50 hr/visit	= 0.88 hr
Follow-up:	6.88 visit × 0.25 hr/visit	= 1.72 hr
	Subtotal	**2.60 hr/day**
	Subtotal for Ambulatory Visits (excluding Comp & Pensions Exams[11]):	***65.88 hr/day***
Total Section A Hours:		**116.42 hr/day**
Total Section A FTEE (assuming 40 hr/week equivalence): 116.42 hr/day ÷ 8 hr/day/FTEE		**14.6 FTEE**
At its second meeting, the medicine panel agreed that no additional FTEE need be purchased for night and weekend coverage.		

[11] At VAMC I, Compensation and Pension Examinations are not performed by VA staff physicians, but externally through contract arrangements.

For Section B: Non-Patient-Care Activities

Didactic instruction of residents (not on PCAs), administration, and other hospital-related, non-patient-care activities:

For Service Chief[12]	**For All Other Staff Physicians**[13]
3.5 hr/day	1.5 hr/day × (14.6-1) = 20.4 hr/day

Subtotal = 3.5 + 20.4 = 23.9, which implies 23.9/8 = 3.0 FTEE
Total (to this point) = 14.6 + 3.0 = 17.6 FTEE.
Next, the panel's median estimates for percentage of time to be devoted to continuing education (8%), research (34%), and vacation, administrative leave, sick leave, and other (13%) lead to an overall median estimate of 54% for the percentage of total medicine service time allocated to these activities.[14]
Hence, total FTEE for the medicine service at VAMC I = 17.6/(1-0.54) = 38.3
This implies that about 38.3 × 0.34 = 13.0 FTEE would be devoted to research, and 38.3 × 0.08 = 3.1 FTEE to continuing education.
At its second meeting, the panel's median estimate of additional FTEE desired from Consulting & Attending and Without-Compensation physicians was 1.5. If these are included, the desired FTEE total is 38.3 + 1.5 = 39.8.

[12] Estimate assumes that, among the three FTEE categories of administration, resident classroom instructions, and other hospital-related non-patient-care activities, the service chief's time is concentrated in administration and only minimally devoted to the other two. See Chart 9 in Part 1, under Non-Patient-Care Activities, in Figure 5.2.
[13] Estimate derived by multiplying the median estimate of total time for the three categories (i.e., 1.5 hr/day) by the number of patient-care-related FTEE, minus the assumed full-time service chief [i.e., by (14.6-1) = 13.6]. See Chart 9 in Section B, Part 1, under Non-Patient-Care Activities, in Figure 5.2. There are other plausible ways to compute this.
[14] See Chart 10 in Part 2 under Non-Patient-Care Activities in Figure 5.2.

6

Choosing Among Alternative Approaches to Determining Physician Staffing

The central issue facing the VA decision maker is *how* to determine physician requirements—that is, which methodological approach(es) should be adopted.

Three general approaches have been introduced. The analyses in chapter 4 demonstrated how physician requirements can be derived from *statistical models* that incorporate existing VA data. Specifically, the committee has developed Empirically Based Physician Staffing Models (EBPSM) with two, complementary variants: the production function (PF) and the inverse production function (IPF). In chapter 5, two alternative *expert judgment models* for physician staffing were introduced—one based on the Detailed Staffing Exercise (DSE) and the other on the Staffing Algorithm Development Instrument (SADI). A third approach also discussed in that chapter would involve using non-VA physician staffing criteria, or *external norms*, for guiding the decision about physician requirements in the VA.

(A fourth approach is to adopt no new methodology. Rather, the VA decision maker would hold to the status quo; there would be no new guidelines or requirements for physician staffing. The committee rejects this option—and all others not based on operating principles that are clearly specified, logically correct, and appropriate for policy making by some reasonable criteria.)

STRATEGIES FOR RECONCILING THE APPROACHES

Over the final months of the study, the committee examined four alternative decision strategies for using these staffing approaches (singly or in combination) to derive the *total physician FTEE, by specialty, required for a given E4 medical center* (VAMC). For each specialty (e.g., medicine) or program area (e.g., ambulatory care) the strategies called, in turn, for the VA decision maker to:

A. *Adopt one dominant approach*. For example, the core of the methodology could be an empirically based model, but expert panels would be appointed to evaluate results. Or, the core of the methodology could be an expert judgment approach, for example, based on the SADI, but these judgments would be tempered by reference to external norms and the results from the EBPSM. Or, the core of the methodology could be external norms, as developed and revised by expert panels.

Whether or not all specialties and program areas would be guided by the *same* dominant approach would be a separate decision.

B. *Use two or more approaches in conjunction to derive a range of physician staffing estimates*. There would be no formal model or algorithm for either justifying or reconciling differences among the approaches, or any formal procedure (e.g., mathematical weighting scheme) for merging their FTEE recommendations. Instead, the VA decision maker would have a menu of physician staffing estimates, each defensibly derived. This strategy would serve to reject physician FTEE levels falling outside the boundaries established by the menu but would be effectively neutral about levels within the boundaries.

C. *Use two or more approaches in conjunction to derive a range of physician staffing estimates sensitive to assumptions about budgetary and other constraints*. This strategy differs from the previous strategy (B) only in its advocacy of sensitivity analysis, optimization models, and related techniques to help the VA decision maker investigate important "what if" questions. For example,

- Suppose a VAMC wanted to have physician FTEE in 1995 at levels recommended by the SADI methodology. What would be the budgeted cost of this (in real terms)? Clearly, similar calculations could be performed for the DSE and both variants of the EBPSM.
- But suppose the VAMC could spend no more on physicians overall (in real terms) than it did in 1989. Suppose this amount is insufficient to pay for all of the SADI-recommended FTEE. How many staff physicians, in each specialty, should the VAMC seek to employ in 1995 if it wanted, for example, to (1) adhere to the interspecialty ratios implied by the SADI, or (2) equalize the percentage by which each specialty's FTEE level is below that recommended by the SADI?
- Suppose the VAMC wanted to minimize 1995 expenditures on physicians, subject to meeting important constraints: (1) staffing levels would be high enough (according to the PF model) to handle the projected workload and (2) the FTEE ratios between certain specialties and between staff physicians and residents would lie within prescribed bounds on each PCA. What is the resulting implied physician FTEE level in each specialty at the VAMC?

Clearly, there are many such inquiries that relate physician staffing to budget.

D. *Through some integrative process (e.g., mathematical weighting scheme), combine physician staffing results from two or more approaches to produce either a single FTEE estimate or a range of estimates*. In the committee's terminology, this combining either could be done "holistically" (Strategy D. 1) to produce, in a single weighted-average calculation, an overall FTEE total for each specialty or program area, or it could be implemented in a "disaggregated" format (Strategy D.2), which allows for different weights to be applied to the different component parts of physician FTEE; the total required FTEE in a specialty or a program area would be the sum of these weighted components. The sensitivity analyses described above could be conducted as well under either variant of this strategy.

THE RECONCILIATION STRATEGY

Committee's Recommended Approach

As an overall framework for determining VA physician requirements (given workload and other factors), the committee endorses Strategy D.2, the "disaggregated weighted-average" variant of D. Henceforth, this is termed the *Reconciliation Strategy*. There are many possible formulations of this strategy, but the committee prefers the following one for reasons discussed shortly. (For the purpose of illustration, the medicine service is referenced and the reconciliation is assumed to focus largely on the following two approaches: the PF variant of the EBPSM and the SADI.)

Physician FTEE

$$\begin{aligned}\text{Requirements in Medicine} = {} & [X_1 + b(X_2 - X_1)] \\ & + [R_1 + c(R_2 - R_1)] \\ & + [C_1 + d(C_2 - C_1)] \qquad (6.1)\end{aligned}$$

where

X_1	=	total internist FTEE (staff, contract, non-VA consultants), as derived from the PF and other facility-specific data, for direct care on medicine inpatient and outpatient PCAs; consultations on all other PCAs; resident training on PCAs and in classroom; administration by chief and others; and leaves of absence of all types;
X_2	=	the same as X_1, but derived from the SADI;

R_1	=	internist research FTEE, as derived from an empirically based approach;
R_2	=	the same as R_1, but derived from the SADI;
C_1	=	internist FTEE for continuing education, as derived from an empirically based approach;
C_2	=	the same as C_1, but derived from the SADI; and
b, c, d	=	weighting parameters, each lying on the [0,1] interval.

Two technical points should be noted:

First, by varying the parameters *b, c*, and *d* jointly across their ranges (the unit interval in each case), corresponding ranges of physician FTEE estimates are generated.

Second, in this specification of the strategy, physician FTEE is disaggregated into three components. By far, the most significant as a percentage of total FTEE is that denoted by *X*. It is the component for which there is the greatest amount of empirically based and expert judgment information. However, for completeness, it is important that all FTEE components be reflected in Equation 6.1.

Although it is conceptually possible to disaggregate *X* further into patient care, resident education, administration, and leaves of absence subcomponents—and to break these out by PCA—the committee has not done so. Although both the SADI and the DSE can accommodate this detailed level of breakout, neither the IPF nor the PF can because of limitations in the VA's Cost Distribution Report (CDR) (see chapter 4). In particular, the IPF is structured precisely at the level of aggregation (i.e., at the facility level) reflected in the operational definition of *X*; this is not the case for the PF, but it is still not possible to separate out the administration and leaves-of-absence portion of FTEE in the PF.

Specifying the Reconciliation Strategy as shown in Equation 6.1 allows all four of these FTEE estimation procedures (SADI, DSE, IPF, and PF) to be applied in a parallel fashion, so that their implications for well-defined pieces of total FTEE can be validly compared.

Interpretation of the Strategy

The committee emphasizes the following substantive points:

1. The formula for deriving FTEE in each of the three components of Equation 6.1 consists of two terms, which will be called, respectively, the *Empirically Driven Baseline* and the *Modifier*. Thus, for patient care, resident education, administration, and leaves of absence, the Empirically Driven Baseline is X_1, and the Modifier is $b(X_2\text{-}X_1)$.

This configuration of the Reconciliation Strategy conveys a particular policy perspective. In determining physician requirements for each specialty or program area, the first step is to derive FTEE estimates from a variant of the EBPSM. This Baseline estimate could be obtained from either the IPF or the PF, but the important point is that it emerges from a model driven by data reflecting (subject to measurement error) the current reality of medical practice in the VA.

But, the physician requirements analysis does not stop there. The second step is to investigate whether the Baseline FTEE estimate should be modified in light of factors threatening the validity of the EBPSM. As implied by discussions in chapters 3 and 5, these factors fall into one of two broad groups of data-related problems: (1) simple measurement and recording errors and (2) observations relating physician FTEE and workload that are "clinically inappropriate," because of current VA resource constraints and other factors. To the *degree* that the validity of the Baseline estimate is threatened, one applies the Modifier. At the extremes, the Modifier can dominate entirely or have no influence at all, as discussed shortly.

This articulation of the Reconciliation Strategy reflects the committee's view that there are clear advantages, organizational and methodological, to building a physician requirements methodology around the EBPSM—if the important statistical and clinical assumptions are met. If they are not met, then modification of the empirically driven estimates, whether through expert judgment staffing assessments or the application of external norms, is in order.

2. Implementing this Reconciliation Strategy requires two types of policy choices from the VA decision maker. For each FTEE component (i.e., *X, R*, and *C*), which empirically based approach should be selected? Likewise, what expert judgment approach (SADI or DSE) should be used in calculating the Modifier? Given these, what are the most appropriate values for the weighting parameters *b, c*, and *d*? Once these parameters are set, the "compromise" between the Baseline and the Modifier is effectively accomplished.

For example, if the VA decision maker determines that physician requirements should be derived *entirely* on an empirically driven basis, then *b, c,* and *d* would all be set to 0 in Equation 6.1. But if, after due consideration, it is determined that the Baseline estimate is *entirely* unacceptable, the Modifier would be adopted in full by setting $b = c = d = 1$. For each FTEE component, the Modifier would be constructed by choosing an appropriate expert judgment or external norm FTEE estimate, in turn, for X_2, R_2, and C_2.

Parameter values between the 0-1 endpoints would reflect the VA decision maker's view that "due weight" should be accorded to both the Empirically Driven Baseline and the Modifier. For example, if $X_1 = 14$ and $X_2 = 18$, a determination that equal weight be given to both approaches would imply that $b = 0.5$ and the recommended FTEE is 16 for this component of the total.

3. Hence, the Reconciliation Strategy offers considerable flexibility in determining physician requirements across specialties and program areas. For specialty A, the *X* component of FTEE might be computed as a weighted average of results from the PF model and the DSE. For specialty B, the "core" approaches to staffing reflected in the weighted average might be the IPF and the SADI. Even assuming the VA decision maker were to select the same core approaches for both specialties, the weighting parameters *b, c*, and *d* could vary between the two.

It follows that the Reconciliation Strategy should not be viewed as a preset staffing formula, but as a *framework for choosing* FTEE requirements.

The choice is a structured one, framed essentially by whatever core approaches to staffing the decision maker selects for computing the Baseline FTEE estimate and the Modifier. From rigorous analyses involving the PF, the IPF, or other empirical data come estimates of X_1, R_1, and C_1. From rigorous analyses involving the SADI, DSE, or external norms come estimates of X_2, R_2, and C_2. In sum, these analyses define the permissible FTEE range for each of the three components in Equation 6.1.

Note that for any of the three FTEE components, this range may or may not include the status quo level of physician FTEE, as indicated in the VAMC's current CDR. That is, it is possible for the Empirically Driven Baseline FTEE recommendation to be either greater or less than the current FTEE allocation, and likewise for the Modifier's recommended level.

An underlying assumption is that EBPSM, expert judgment-based models, and external norms are all "advisory" to the VA decision maker. Each provides some evidence for adjudicating appropriate physician staffing levels. Each will have its proponents and opponents. (For a clear indication of this, see the Conclusions generated by the study's six specialty and two clinical program panels in the appendix to this chapter.)

Hence, the specification of parameter values in the Reconciliation Strategy is an administrative decision, in which the VA decision maker evaluates the strengths and weaknesses of the alternative approaches and renders a judgment about appropriate staffing in light of all pertinent information. The Reconciliation Strategy requires that these judgments (necessarily subjective in most cases) be made explicit, and the weighting parameters are devices for helping to achieve this.

There are, in fact, two dimensions to this decision problem.

Establishing Appropriate FTEE Targets, by Specialty and Program Area

For each component of FTEE in Equation 6.1, the decision maker certainly could conclude that either the Empirically Driven Baseline or the Modifier estimate should be adopted in its entirety. However, there are plausible circumstances in which other conclusions may be more reasonable.

For example, within a given specialty the FTEE estimates from both the PF and the IPF could seem too low, whereas those from both the SADI and the DSE could appear too high. In such a case, parameter values between 0 and 1 are logically required by the Reconciliation Strategy. That is, by appropriately selecting *b, c*, and *d* values *within* the 0-1 interval, the decision maker can arrive at an appropriate physician FTEE estimate.

If each parameter is assigned a point value, all three FTEE components in Equation 6.1 will be uniquely determined, as will total FTEE for that specialty.[1] If one or more parameters is assigned a range of permissible values, there will be correspondingly a range of permissible values for total FTEE.

In the final section of this chapter, a numerical example is provided to illustrate the calculation of physician FTEE targets under various specifications of the Reconciliation Strategy.

Establishing a Transition Policy to Phase in New Physician Staffing Levels

It frequently would not be practical for a VAMC to realize instantaneously its new target level of staffing in a given specialty, if a change were identified by the Reconciliation Strategy. As the analyses by the specialty and clinical

[1] Note that the physician FTEE levels emerging at any moment from the EBPSM and the expert judgment models are contigent on assumptions about the prevailing FTEE levels for nurses and other nonphysician personnel. If the FTEE levels for these nonphysicians are assumed to change, for whatever reason, calculated physician requirements may change accordingly.

Because the PF, SADI, and DSE models all permit one to investigate the potentially interactive relationship between physicians (by specialty) and nonphysicians (by type), they permit physician requirements to be calculated conditional upon nonphysician FTEE levels. The IPF models, estimated here at the facility (not PCA) level, typically do not permit one to explore these interactive relationships (see chapter 4). Rather, there is an implicit assumption in these IPFs that as physician FTEE is adjusted in response to projected changes in workload, nonphysician personnel will be adjusted (by the VAMC) —as required—to maintain the physician-workload relationship purportedly captured in the estimated equation. As noted in chapter 4, this is one disadvantage of using the IPF within the Reconciliation Strategy.

As suggested in chapter 7, there are good reasons why the VAMC might wish to consider changing physician and nonphysician personnel *in concert* in response to some projected change in workload. In particular, suppose the goal of the VAMC was to minimize cost, subject to the constraints that (1) patient workload demands must be met and (2) the quantity and mix of physicians (by specialty) and nonphysician personnel must be consistent with meeting or exceeding certain quality-of-care standards. Then, as the linear programming analysis in chapter 7 demonstrates, the FTEE levels of *all* inputs (explicitly being modeled) must be coordinated in order to produce an "optimal" staffing pattern.

program panels suggest, this target could differ substantially from the current FTEE level.

To illustrate, suppose there are now 8 FTEE physicians in a specialty at some VAMC and that the target level emerging from the Reconciliation Strategy is 12. To achieve this full 50 percent increase, at least four physicians will have to be recruited (given that each would contribute at most one FTEE to the VAMC). To accommodate this increase, there might need to be substantial expansions in staff, equipment, or space. The transition could not be accomplished immediately. Its net effect on the VAMC's budget could be considerable.

In such instances, a policy of phasing in these FTEE targets permits the decision maker to achieve feasible, incremental changes in physician staffing. For example, if there are now 8 FTEE physicians in a specialty and the Reconciliation Strategy target level is 12, the VA decision maker might judge that an appropriate *intermediate target* is 10 FTEE, to be achieved (say) over the next 12 months.

Factors at the VAMC that ought to influence either the *level* at which the intermediate target is set, the *timetable* for phasing it in, or both, include:

- The capability for acquiring adequate nursing, technical, and all other nonphysician personnel to complement the new level of physician staffing;
- The capability for acquiring the necessary space, equipment, and other physical resources;
- Whether the new physicians would be involved in program initiatives requiring, for viability, some critical mass of physician FTEE in that specialty; and
- Whether the proposed change in staffing levels from the current FTEE level affords a realistic opportunity for determining if the hypothesized improvements in access, quality of care, and other outcome variables do occur over time; that is, there may need to be some minimum increment in physician FTEE before one would expect to find *measurable* improvements in system performance.

Hence, where there is a significant difference between the current staffing level and the target derived through the Reconciliation Strategy, the committee recommends that the VA consider phasing in the target by establishing an intermediate target.

An intermediate target should not be viewed as a vehicle for making merely cosmetic or symbolic changes in staffing; rather, it is intended to be a level as close to the target as material considerations permit. The implication is that a VAMC should proceed toward its staffing targets as rapidly as possible, subject to resource and organizational constraints.

These increments (or decrements) in staffing would provide the VA with natural experiments for analyzing prospectively and rigorously whether the new physician FTEE levels lead to the hypothesized changes in access to care, indicators of the quality of care, and other measures of system performance. Such evidence is critical in the development of a dynamic VA physician requirements methodology—one that evolves and improves over time.

Using the Reconciliation Strategy to Calculate Physician FTEE

Among the responsibilities assigned by the committee to each of its eight specialty and clinical program panels, the final and arguably most difficult was to render advice on three related issues:

- From the perspective of the specialties or VA program areas represented by the panel, is the committee's proposed Reconciliation Strategy a viable and appropriate mechanism for determining physician requirements?
- If so, what specific form should it take? That is, what should serve as the core empirically driven and expert judgment approaches to staffing from which the Baseline and Modifier terms in Equation 6.1 can be derived? What are appropriate values for the weighting parameters *b, c*, and *d*? What role should external staffing norms play? As an explicit part of the Modifier term? As supplementary data to lend perspective to the calculus of Equation 6.17 Or, because of interpretive difficulties, little role at all?
- For the specialties or activities within its purview, could the panel render an advisory judgment, either quantitatively or qualitatively, about whether physician staffing in the VA is currently appropriate?

The panels' responses to these inquiries (and much more) are contained in their final reports to the committee, which are reproduced in full in Volume II, *Supplementary Papers*. These eight specialty and clinical program panel reports, taken together, constituted the principal advisory information available to the committee on how best to implement the Reconciliation Strategy, by specialty and VA program area.

To put the committee's recommendations below in perspective, the Conclusions section from each of the eight panel reports is presented in the appendix to this chapter. For each panel, this excerpt has been supplemented with a table summarizing the physician staffing levels obtained in the relevant specialties for FY 1989 by applying the various methodological approaches developed in this study to three (or in the case of psychiatry, four) illustrative VAMCs.

The committee's own recommendations about determining physician requirements under the Reconciliation Strategy, using the FTEE component definitions specified in Equation 6.1, are presented and discussed below.

Total Physician FTEE (VA and Non-VA) for Direct Care, Resident Education, Administration, and Leaves

The discussion of this major component of total physician FTEE (denoted by X in Equation 6.1) focuses on the following: (1) how its FTEE subcomponents ought to be derived, assuming either an empirically based or expert judgment-based approach to staffing; (2) the specialty and clinical program panel recommendations to the committee on how best to compute X; and (3) the committee's own recommendations about important aspects of this issue.

(1) Computing the Subcomponents of ***X* Within the Empirically Based and Expert Judgment Approaches**. Consider the following FTEE subcomponents, in turn:

Staff Physicians for Direct Care (*all PCAs)* Under an empirically based approach, these FTEE are derived from either the PF or the IPF models, using data from the CDR (i.e., the FTEE allocations to direct care), the Patient Treatment File (to obtain workload), and other secondary VA sources (see chapter 4).

Under an expert judgment approach, these FTEE are derived from that part of either the SADI or the DSE that estimates physician time requirements across all PCAs. FTEE for resident education is jointly determined in the process (see chapter 5).

Resident Education by Staff Physicians Physician FTEE are allocated to this subcomponent through the "Education and Training/Instructional Costs" line items in the CDR. [A minor, but unavoidable, complication is that those line items also reflect time devoted to training nonphysician staff.]

In the IPF variant of the EBPSM, staff physician FTEE for resident education is added directly to direct-care FTEE to form the model's dependent variable.

In the PF model, the resident education FTEE variable was typically not a statistically significant factor explaining workload and was not included in the final equations. Thus, when determining physician requirements under PF, the resident education FTEE applicable to a given specialty at a given facility must be added in separately; a reasonable approach is to use the most recently available estimate from the facility's CDR (see chapter 4).

Under an expert judgment approach, there is no distinct estimate of FTEE for resident education in the PCAs. Rather, it is determined jointly with the FTEE required for direct care, as noted above. However, both the SADI and the DSE provide separate estimates of FTEE required for resident education *in the classroom*. On the other hand, the CDR's "Education and Training/Instructional Costs' line item, used in both EBPSM variants, is intended to represent staff physician FTEE allocated to resident training both in the PCAs and the classroom.

Administration by Staff Physicians There is no general line item for administration in the CDR worksheets submitted by the physician-related cost centers at a VAMC. Instead, the time devoted to most administrative tasks, large and small, must be incorporated implicitly in FTEE estimates for other physician activities explicitly recognized in the CDR; the direct-care line items are the most likely repositories for administrative FTEE. [The one significant exception is that FTEE for "Education and Training/Administration," pertaining primarily to resident education, is collected explicitly and can be analyzed separately.] Hence, the physician FTEE variables used in both the IPF and the PF models include, as an implicit subcomponent, the time devoted to administrative tasks.

In both expert judgment models, the time required for administration (by the service chief and all others) is estimated separately; there is an effort to keep these FTEE distinct from those devoted to patient care and resident education.

Miscellaneous Other Staff Physician Activities There are a few CDR line items (e.g., District, Regional, or National Support) that do not fall under direct care, education, or research. They constitute a very small fraction of physician FTEE and do not lie within the purview of either the PF or the IPF model.

Under either empirically based approach, FTEE for these miscellaneous activities must be estimated separately, then added to the FTEE estimated for all else to derive a total for staff physicians. A reasonable procedure for a given specialty or program at a given VAMC is to adopt the previous year's allocation of FTEE to these various activities.

In the expert judgment models, there is no FTEE "residual" to estimate. Both the SADI and the DSE are designed to encompass a mutually exclusive and exhaustive set of mission-related activities.

Leaves of Absence for Staff Physicians The committee acknowledges the various categories of leave to which VA staff physicians are entitled: annual, sick, administrative, and others. But it also appreciates that most VAMCs can adjust to these absences through the flexible scheduling of patients, other physicians, and nonphysician personnel.

In the EBPSM, this issue resolves itself, in a sense, because the CDR-recorded FTEE level in a specialty presumably reflects the total requirements for staff physicians *after* allowing for the effect of leaves of absence on productivity. Thus, under the behavioral and data-related assumptions imposed by such models (see chapters 3 and 4), there is no need to adjust either the PF or the IPF for leave-related productivity losses.

But explicit adjustments are required in the expert judgment models. In both the SADI and the DSE, the FTEE estimates that emerge from simply summing the time required for all physician activities make no allowance for leave-related losses. In response, both instruments elicit separate judgment about the appropriate percentage of total FTEE to be devoted to leaves of all types.

After reviewing the issue, the committee concludes the following: The panels' various leave-time assessments (see Volume II, *Supplementary Papers*) are generally defensible. But, given the typical VAMC's ingenuity at flexible scheduling, to translate all potential hours of physician leave into an equivalent loss in FTEE is to overstate the true loss in physician productivity—and thus to overstate the FTEE supplement required to compensate for the loss.

In response, the committee recommends that, in the expert judgment staffing models, the leave component of total physician FTEE be calculated as the FTEE equivalent of the *annual* leave to which the VA physician is entitled.

Currently, full-time VA physicians earn 30 days of annual leave per year. Part-time physicians accrue annual leave at a rate of 1 hour per 13 hours worked; for example, a half-time ("4/8") physician would earn 80 hours (or 20 half-days) of annual leave per year. Hence, the fraction of total FTEE that could be allocated to annual leave is about 0.12 for full-time physicians and 0.08 for part-time. It follows that the "average fraction" of total FTEE allocatable to annual leave is $f(0.12) + (1 - f)(0.08)$, where f is the proportion of full-time physician FTEE in total physician FTEE.

The procedure for upwardly adjusting expert judgment-derived FTEE to allow for annual leave is as follows: Suppose the derived total for all mission-related activities is T and that f is defined as above. The adjusted total FTEE for full-time physicians is $fT/(1-0.12)$. For part-time physicians, the adjusted total is $(1 - f)T/(1-0.08)$. In the illustrative calculations in the last section of the chapter, the intuition behind the formulas is demonstrated. Although the committee realizes that not all VA physicians elect to use the full leave to which they are entitled—in many cases, because of work demands—it does not wish to build this downward bias into the physician requirements calculations.

Contract Physicians As noted in chapter 4, FTEE estimates for physicians under contract to the VA are not available in the CDR but have been estimated in recent years through a systemwide survey.

Given the assumptions of the EBPSM (see chapters 3 and 4), staff and contract physician FTEE are basically additive; both are valid parts of total

FTEE at the VAMC. In the IPF model, the dependent variable includes contract physician FTEE for all specialties in which it is a nontrivial fraction of total FTEE. Hence, staffing predictions derived from the IPF are able to reflect jointly the required FTEE for staff and contract physicians taken together.

In the PF model, a variable for contract physician FTEE can be included on the right-hand side as an hypothesized determinant of workload production. In fact, such contract variables were rarely statistically significant and were omitted from the final versions of these PF equations. (This is not a surprising result since the specialties for which contract FTEE play the largest role, e.g., anesthesiology, laboratory medicine, diagnostic radiology, have no associated production functions.)

The patient care and resident education FTEE estimates from the expert judgment models are intended to be comprehensive assessments of physician requirements, irrespective of the particular mix of VA staff and contract physicians. (In fact, the SADI and DSE instruments purposely never distinguish between these two.) Thus, when using these approaches, no separate adjustment is required *vis à vis* contract physicians.

Purchased Physician FTEE for Night and Weekend Coverage Although there are particular PCAs in particular VAMCs where additional physician FTEE are hired to handle patient care during evening and weekend hours, the committee infers that typically this coverage is provided by a combination of residents and existing staff physicians assigned on-call duties. The major exception appears to be the emergency and admitting areas within the ambulatory care program, where around-the-clock physician coverage is the norm.

Thus, the committee recommends that when computing physician requirements through either the SADI or the DSE expert judgment approach, additional FTEE for off-hour coverage be incorporated only for the emergency and admitting & screening functions of ambulatory care.

In recommending this conservative approach within the expert judgment models, the committee urges the VA, in its subsequent evaluations of the overall methodology, to target this issue for special attention. The focus should be on whether VAMCs with relatively small services or few residents should be allocated additional FTEE for off-hour coverage in order to provide a reasonable work schedule for its staff physicians.

On the other hand, for either the PF or the IPF variant of the EBPSM, hours purchased for nights and weekends are already implicitly included in FTEE estimates to the extent that these hours are provided either by staff physicians (whose FTEE are already in the CDR) or by contract physician (see chapter 4). Hence, no further FTEE adjustments to either empirically based model is required to account for night and weekend coverage.

Consulting and Attending (C&A) and Without-Compensation (WOC) Physicians Without exception, the specialty and clinical program panels noted that C&A and WOC physicians enhance the quality of clinical and education programs at the VAMC. But whether these non-VA providers ought to be factored explicitly into the physician requirements calculations depends on whether an expert judgment approach or an empirically based model is being used.

The patient care and resident education portions of both the SADI and the DSE are designed for deriving *total* physician requirements, irrespective of whether services are rendered by in-house staff or outside consultants. The C&A and WOC estimates computed (in a second procedural step) under either expert judgment approach refer expressly to physician support desired, as a quality enhancement, over and above that required to meet day-to-day patient care and teaching responsibilities.

Given the logic of the staffing exercises, to add these desired non-VA FTEE to the quantity already asserted as the *total* for patient care and resident education may serve to overstate physician requirements.

Because of data limitations, C&A and WOC FTEE are omitted entirely from both the PF and the IPF variants of the EBPSM (see chapter 4). Information on the hours contributed by these non-VA physicians is not collected routinely at any VAMC. There are several related implications.

First, if C&A and WOC contribute significantly to workload in a given specialty and VAMC (all else equal), actual workload *may* exceed predicted workload in PFs for PCAs where that specialty has a significant presence. Similarly, actual (measured) FTEE *may* be less than predicted by that specialty's IPF. Such results would reflect the "omitted variable" bias discussed in chapter 4.

Second, to get a valid estimate of total physician staffing requirements in such a situation, one would want to add in sufficient FTEE to account for the productive contributions of C&A and WOC physicians. An empirically based inference about the latter could not be derived from either the PF or the IPF model but would have to come from another source—such as the VAMC itself. The C&A and WOC survey conducted by the study's affiliations panel demonstrates the feasibility of collecting this information by specialty within the VAMC (see Volume II, *Supplementary Papers*).

(2) Specialty and Clinical Program Panel Recommendations on FTEE for Component *X*. The panels analyzing the specialties of laboratory medicine, neurology, nuclear medicine, radiation oncology, diagnostic radiology, rehabilitation medicine, spinal cord injury, and surgery all recommended that the FTEE target for this component be derived from application of the SADI.

Likewise, the ambulatory care and long-term care panels endorsed the SADI for this purpose. In Equation 6.1, this is tantamount to setting $b = 1$.

The medicine panel concluded that the PF variant of the EBPSM ought to be the basis for estimating staff physician FTEE for the patient care subcomponent of *X*. Additional facility-specific data would be required to capture (1) FTEE devoted to resident education and miscellaneous activities and (2) other FTEE not in the CDR and, hence, not in the PF. Included in the latter are FTEE representing contract physicians and C&A and WOC physicians. This empirically based orientation implies $b = 0$ in Equation 6.1.

For psychiatry and anesthesiology, a (nontrivial) weighted-average version of the Reconciliation Strategy was invoked to derive FTEE targets. With the IPF and the SADI as the designated core approaches establishing the FTEE boundaries of the weighted average, an overall *b* value of about 0.35 appeared reasonable in psychiatry; for anesthesiology, *b* ranged from 0.38 to 0.49, depending on the VAMC being staffed. *Both the psychiatry and the surgery panels emphasized that these particular estimates emerged from an analysis of only a few VAMCs (four and three, respectively); a different sample of sites might have yielded different assessments of the weighting parameter*.

Each panel regarded its analysis of external norms to be of some interest but sufficiently weakened by data difficulties to preclude inclusion in the Reconciliation Strategy calculus.

(3) Committee Conclusions About FTEE Component *X*. The six specialty and two clinical program panels have demonstrated on a small scale the types of analyses that the VA decision maker ought to undertake to determine physician requirements across the system for this important component of FTEE. For each VAMC studied in depth, the current physician staffing level (including physician FTEE not in the CDR) was noted; the PF and the IPF variants of the EBPSM were applied; and the DSE and SADI expert judgment models were brought to bear. Only after considering the current FTEE level *and* the empirically based estimates *and* the expert judgment-based estimates did each panel reach a conclusion about appropriate staffing methodology.

Although the panels' conclusions varied, all eight groups operated within the framework of the Reconciliation Strategy; so should the VA decision maker. However, the main purpose of these panel deliberations and analyses was to develop a methodology—not to implement it. *When the Reconciliation Strategy is applied to a significantly larger sample of VAMCs, there will exist the breadth of empirical information required to reach generalizable conclusions about whether the PF, the IPF, the DSE, the SADI, or some weighted combination of these is preferred for a given specialty or program area.*

Each panel arrived at its positions through well-defined processes (see chapter 5). The committee believes that the panels' recommendations provide the best available insights into how VA physician staffing levels should be calculated. But, as new methodologies are applied to an expanded sample of VAMCs, new data will emerge—and with them, additional insights about *determining how to determine* physician FTEE.

A study of the panel analyses suggests the following technical points germane to future applications of the Reconciliation Strategy:

• *The PF and the IPF are potentially complementary variants of the EBPSM (see chapters 4 and 7), and either is a viable candidate for helping generate the Baseline estimate for patient care, resident education, administration, and leaves in Equation 6.1.*

The PF allows physician FTEE to be derived by PCA within the VAMC, while taking explicit account of the productive contributions of residents and nonphysician personnel. The degree to which these substitute for VA staff physicians can be examined.

However, an acceptable PF cannot be estimated for specialties lacking a well-defined PCA (see chapter 4). Hence, for laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and anesthesiology, no PF model is presented.

In addition, physician FTEE is acknowledged in the PF model only to the extent that it is associated with the production of workload. If a given specialty renders care on a given PCA but is not shown statistically to contribute to patient throughput, that specialty's FTEE variable will not be included in the PCA's PF—even though it may have contributed significantly to the quality of care. When total required FTEE for that specialty is subsequently derived for the facility, none will be shown associated with that PCA.

The IPF (as specified in this study) generates a more direct estimation of physician requirements at the facility level; because of this higher level of aggregation, it is less vulnerable than the PF to measurement errors due to misclassification of FTEE within the VAMC's CDR. The IPF permits statements about statistical confidence to be constructed around physician FTEE predictions (in contrast to the PF, which permits confidence statements about the workload expected from a given set of physician and nonphysician inputs).

However, no acceptable IPF model can be estimated for VA PCAs that are multidisciplinary. Hence, there is no IPF presented for either ambulatory care or long-term care. Moreover, physician-nonphysician substitution relationships cannot be inferred from the facility-level IPFs reported in chapter 4.

In contrast to the PF, the IPF acknowledges all FTEE recorded in a given specialty at the VAMC *regardless* of the degree to which it is associated with the production of workload. In fact, the workload variables were statistically significant in all estimated IPF models (see chapter 4); but if that had not been the case for a given specialty's IPF, that equation would still tend to prescribe a nonzero amount of FTEE for that specialty at a given VAMC.

The IPF permits examination of actual-versus-predicted physician FTEE, by specialty, at a given VAMC, whereas the PF permits analysis of actual-versus-predicted workload, by PCA, at that same VAMC. Hence, the IPF and the PF can provide complementary insights into the relationship between workload and the physician staffing required to meet it (see chapter 7).

• *To derive expert judgment FTEE estimates for use in the Modifier term in Equation 6.1, the most promising approach is a methodology built around the SADI.*

The specialty and clinical program panel analyses indicate, in sum, that it is feasible to develop SADIs for all specialties and VA program areas. Likewise, it is possible to derive physician task-time estimates exhibiting strong face validity and yielding physician requirement totals for the VAMC that are generally plausible and acceptable to panel participants (see chapter 5 and the appendix to this chapter).

Although a methodology structured around the DSE would likely prove to be an excellent vehicle for examining staffing at an individual VAMC, there are several advantages to the SADI. Because the SADI focuses on the time required by physicians to perform specific tasks and functions, it is particularly suitable for the procedure-oriented specialties and compatible with all specialties. These task-or function-time estimates can be periodically reassessed, either through additional expert judgment, observations from time-motion studies, or both.

Like the DSE, the SADI permits the derivation of physician FTEE requirements for VA programs, services, or procedures that are either in the planning stage or sufficiently new that valid empirical data are not available (e.g., a hospital-based home care program in which the physician has substantial responsibility for patient care as well as administration).

Because DSEs would have to be individually crafted for each VAMC assessed, applying this instrument across the system would be labor intensive—perhaps requiring an ongoing set of expert panels working periodically to evaluate physician FTEE facility by facility. Reevaluating and revising the SADIs periodically would also require data analyses involving experts, but the overall resource commitment by the VA would be far less than with the DSE approach (see chapter 5).

Consistent with the views of virtually all of its specialty and clinical program panels, the committee recommends the following: The VA, without delay, should apply the SADIs either across the board or to a representative sample of VAMCs; analyze the results; revise the instruments on the basis of what is learned; reapply the SADIs to VAMCs across the system; and, finally, integrate the resulting FTEE estimates into a Reconciliation Strategy-based assessment of physician requirements via Equation 6.1.

• Regarding parameter *b*, denoting the relative weight accorded the Empirically Driven Baseline versus the Modifier in the Reconciliation Strategy, the committee recommends that it be determined on a facility-specific or facility-group basis. This contrasts with a policy of establishing, for each specialty, *one* value of *b* (or *one* range of values) to be applied to all VAMCs.

At any point in time, facilities will differ substantially both in how well staffed they are relative to the system norm and in the accuracy of the CDR data allocating physician FTEE to activities and PCAs. Allowing *b* to vary gives the VA decision maker the flexibility to translate knowledge of such local factors into the overall determination about the relative emphasis accorded the Baseline and the Modifier terms in Equation 6.1.

As discussed in chapter 7 and elsewhere in this report, any staffing *model* will offer, by definition, a simplified representation of a complex reality. Not all factors pertinent to staffing at a given VAMC will be incorporated, and there is no built-in safeguard to detect or correct many data measurement errors.

Thus, it is important that the VA decision maker be alert to idiosyncratic factors affecting physician requirements. It is also important that efforts to adjust for these factors not be ad hoc, but rather be achieved through a process that is systematic, understandable, and reasonable. The Reconciliation Strategy, with its capability of weighting the alternative approaches to staffing in terms of their perceived applicability, is a vehicle for implementing such a process in the VA.

With the discussion of the dominant component (*X*) of the Reconciliation Strategy complete, a discussion of the remaining two components of physician FTEE def'med in Equation 6.1 begins. The committee's recommendations below apply, with the necessary adjustments, to all specialties and both clinical program areas (ambulatory and long-term care) studied.

Staff Physician FTEE for Research

The committee's decision here was premised on the following principle: The amount of research FTEE built into overall physician requirements should be related to measurable indicators of research productivity and excellence. Not all VAMCs merit the same level of research FTEE.

Possible indicators—all potentially computable at the facility level and also by specialty—include the amount of VA and non-VA research funding obtained, the quantity of peer-reviewed papers published in scholarly journals, the number of VA "career investigator" award recipients on staff, or (most simply) the amount of FTEE currently allocated by that specialty to research in the VA's CDR. A variation on the latter, rejected by all panels, would allocate to each specialty at each VAMC a research FTEE total equal to the mean level for that specialty in "similar" facilities, e.g., those belonging to the same RAM group (for a definition of the latter, see chapter 4).

Adopting any such empirically driven approach to determining research FTEE in the Reconciliation Strategy implies that $c = 0$ in Equation 6.1.

In principle, the committee's preferred approach is to link research FTEE earned to dollars of research support raised. This could be accomplished through specialty-specific statistical analyses taking the following general form: R_1 = f(VA Research Dollars Raised, Non-VA Research Dollars Raised, Specialty-Specific Characteristics, Facility-Specific Characteristics). Once estimated, the model could be used to derive the expected amount of research FTEE, $\hat{R}_1$, for a given specialty at a given VAMC as a function of right-hand-side variable values specific to that specialty and VAMC.

A significant limitation, however, is that data presently available systemwide can link research dollars (by funding source) to facility, but not to specialty or program area within the facility. If funding data were collected annually for each VAMC by cost center, specialty-specific models could be estimated directly. (Multidisciplinary research would have to be analyzed in a somewhat more elaborate model that accommodates two or more specialties simultaneously.)

Until the appropriate data emerge, the committee recommends an interim approach in which the VA decision maker allocates research FTEE by specialty on the basis of the specialty's currently reported research FTEE level.

The validity of either this interim approach or the committee's preferred policy of linking research FTEE to research dollars is affected by the accuracy of the CDR. Steps for achieving better FTEE allocations across activities (direct care, education, and research) as well as PCAs are proposed in chapter 11.

Staff Physician FTEE for Continuing Education

Continuing education for staff physicians should be an important component of any VA quality assurance program. The committee therefore recommends that a certain minimum amount of FTEE for continuing education be expected for all specialties at all VAMCs.

As with research, establishing the appropriate commitment to continuing education constitutes a VA policy decision that must balance many factors. The committee proposes that the minimum commitment for any VA physician be no less than 60 hours per year—the time-equivalent of what the American Medical Association requires as qualification for its Physician Recognition Award for Continuing Medical Education (American Medical Association, 1986). This translates into about 0.03 FTEE per full-time physician.

The committee regards this as a bare minimum, however, and believes that a higher floor allocation—for example, 80 hours per year—is both defensible and feasible. This would translate into about 0.04 FTEE per full-time physician.

If one regards these minimums as "expert judgment" driven, then it is as if $d = 1$ in Equation 6.1.

EXTERNAL NORMS

Without exception, the specialty and clinical program panels concluded that the non-VA staffing criteria developed in this study were of limited usefulness in determining VA physician requirements. *After reviewing these external norm analyses, the committee concurs*.

Most analyses involved the application of simple staffing ratios—e.g., patient days/physician FTEE (for inpatient and long-term care) and patient visits/physician FTEE (for ambulatory care)—to determine the implied level of appropriate physician staffing at the illustrative VAMCs examined in this study. These ratios were either published or directly computable from published data (e.g., Department of Defense criteria) or else were inferred from observed staffing patterns at selected non-VA treatment sites.

In most instances, applying these simple ratios to derive VA FTEE levels was technically straightforward. But across specialties and program areas, there were recurring concerns:

- *Comparability of patients*. The ratios were computed for patient populations that frequently differed from VAMC patients in age, gender, and other more specific indicators of case acuity. Moreover, it is simply not possible at most facilities to determine from *existing data* how much physician time is devoted to treating the VA-comparable portion of total patient workload. Similarly, these ratios could not control for differences in the complexity of cases and intensity of care required between the non-VA and VA populations.
- *Definition of physician FTEE*. In contrast with the VA, most non-VA facilities do not measure physician time in terms of full-time equivalents. There is little need to, since physicians are typically not paid from a central budget but participate in patient care and educational activities as "attending" physicians with varying time commitments to one or more institutions. Hence, there is a risk that the denominators of the staffing ratios (for a given specialty and PCA) were not measured comparably.
- *Appropriate incentives*. In this era of tight budgets, observed staffing in private hospitals and clinics—particularly those that are for-profit—will reflect a special concern about controlling cost. This may be achieved through efforts to manage case mix or the resources allocated to treat patients, regardless of the level of severity. In the absence of countervailing pressures (either competitive,

regulatory, or peer-imposed), this can lead to inappropriately lean physician staffing. (This is not to imply, of course, that the private sector is under necessarily greater financial constraints than the VA.)

- *Policy relevance of observed staffing behavior*. With the exception of criteria derived from the Department of Defense, the Indian Health Service, and other centralized bureaucracies, these non-VA staffing ratios did not emerge through a formal decision process on appropriate staffing. Rather, they reflect the day-to-day decision making of organizations facing various patient demands, budget and supply constraints, and much uncertainty about how to match resources to needs.

These difficulties notwithstanding, the committee believes that useful external norms can be developed. A necessary (though not sufficient) condition is that physician staffing ratios be "conditional" constructs, computed as a function of case mix and acuity, the availability of nonphysician personnel, and other factors affecting total requirements. Such ratios could be used to generate implied physician staffing at VAMCs, conditional on these factors.

The intended result would be that external norm criteria could be applied at the level of detail and specificity already characterizing the expert judgment staffing exercises and the EBPSM.

To accomplish this, a detailed examination of physician staffing levels in relationship to workload and other factors affecting physician productivity would need to be undertaken at each non-VA facility selected for analysis. The committee recommends that the VA pursue these more detailed external norm analyses. Such norms would represent a valuable supplement to the staffing information derived from the EBPSM and the SADI.

OVERALL ADEQUACY OF PHYSICIAN STAFFING IN THE VA: COMMITTEE PERSPECTIVE

The primary purpose of the study has been to develop a physician staffing methodology, not implement it. Consequently, there are inherent limitations in the committee's ability to address the question, by specialty and program area, of whether current physician staffing in the VA is adequate overall.

Although the estimated empirically based models were used to derive physician requirements for all VAMCs (see chapter 4), such was not the case here for the expert judgment models. Both the SADI and the final versions of the DSE were applied only to the three (for psychiatry, four) VAMCs chosen as test sites for developing and refining these approaches (see chapter 5). Only for these facilities are there, via the panel analyses, estimates of physician requirements by all proposed empirically based and expert judgment approaches.

Hence, only for these test sites did the panels make quantitative assessments of whether VA physician staffing is adequate. (See the chapter appendix for a summary of each panel's estimates of the facilities' physician requirements, by approach, relative to the status quo reflected in the existing FY 1989 FTEE count.)

Without exception, the panels declined to render a *quantitative* assessment about whether the VA system was adequately staffed with physicians. Most panels did reach *qualitative* conclusions about staffing adequacy, however, based on the test site analyses and the general observations of individual panel members—both VA and non-VA—with years of experience working in VAMCs.

The committee's own conclusions are as follows:

- *Relying solely on analyses performed in this study, it is not possible to reach sound* quantitatively based *conclusions on whether current VA physician staffing levels are adequate* in the aggregate. (Though an important issue, it is not one the committee was asked to address.)

  The proposed physician requirements methodology can, and should, be used to estimate physician staffing deficits (or surpluses) by specialty and program area. These analyses should be performed at the facility level. By aggregating the results across VAMCs, the decision maker can estimate staffing deficits and surpluses for any desired grouping of facilities or for the system as a whole.
- *But the approach selected for determining physician FTEE for patient care, resident education, administration, and leaves does bear some logical connection to the qualitative judgment about whether staffing is adequate.*

To adopt an empirically based model—with its reliance on workload and FTEE data from the current system—for a given specialty or program area at a given point in time is consistent with the following qualitative judgment: Although individual VAMCs may have too many or too few of these physicians relative to VA systemwide productivity norms, the specialty or program is *in the aggregate* neither significantly understaffed nor overstaffed at that point in time.

This follows because the IPF model, by construction, serves to reallocate physician FTEE among VAMCs so as to leave unchanged the systemwide total. If the PF model is applied systemwide, this "zero-sum game" result is not guaranteed, but it is unlikely that the FTEE grand total will change significantly (see chapter 4).

The "point in time" phrase is inserted above because the conclusion might apply to some specialty or program now, but not five years from now, if workload expands faster than the physician resources to meet it or if other factors change.

Adopting either of the expert judgment approaches for a specialty or program area at a point in time is *logically* compatible with either of two conclusions:

(1) Although some VAMCs may have too many or too few physicians, the VA system as a whole is inappropriately staffed at that point in time. Hence, the SADI or the DSE becomes the means to help move the system away from the status quo; or

(2) The empirically based models are either conceptually inadequate or estimated with flawed data, so that expert judgment approaches are preferred on technical grounds.

- *A major difficulty in drawing valid inferences about VA staffing adequacy is the absence of data relating physician FTEE (in any specialty or program) to measures of patient access and quality of care*. Recent VA efforts to develop quality indices are noted in chapter 7. Also advocated there are statistical studies to investigate the linkages between physician staffing levels and indices of quality, as well as optimization models for deriving staffing levels that meet or exceed minimum quality standards.

  Until these linkages can be analyzed, inferences about the relationship between physician staffing intensity and patient outcomes will have to be derived by expert judgment, informed by the relevant available data.
- A close reading of the panels' final reports (see Volume II, *Supplementary Papers*) and of their meeting transcripts (unpublished) reveals a recurring theme, enunciated in qualitative terms: In most specialties and program areas, the VA currently has too few physicians in aggregate; in no case does it have too many.

The committee recognizes that each panel's conclusions reflect its own professional and specialty-oriented perspectives, its judgment about the staffing currently in the VA, and its beliefs about staffing requirements for the VA of the future. In keeping with this report's focus on methodology rather than the advocacy of specific staffing levels, the committee acknowledges the panels' views, but takes no formal position on their specific conclusions about the adequacy of current staffing. *But these panel conclusions, emerging after months of careful deliberation by the panels, bear sufficient policy significance to warrant immediate investigation by the VA*.

The proposed physician requirements methodology provides the means to do this. Specifically, the following should be undertaken:

After the SADI has been further tested and refined (see chapter 5), the Reconciliation Strategy should be applied across the system to determine which specialties or programs in which VAMCs are significantly understaffed. At a selected sample of these, the VA decision maker should provide the additional resources to bring physician staffing up to the recommended target levels (or intermediate target levels, as the local situation dictates).

The effect of improved physician staffing on indicators of access and quality over time should then be formally evaluated. In this way, the VA decision maker would be moving quickly, selectively, and strategically in response to apparent resource deficiencies—while setting in motion analyses to determine whether increased physician staffing leads, in fact, to better outcomes.

ILLUSTRATION OF RECONCILIATION STRATEGY CALCULATIONS

In this hypothetical analysis, physician FTEE requirements are calculated through the Reconciliation Strategy, as summarized in Equation 6.1.

The focus is on one specialty, labeled *s*, at VAMC *i*. Four different physician FTEE totals are calculated: current staffing in s, as derived largely (though not entirely) from the facility's CDR, and three variants of the Reconciliation Strategy. For simplicity only, the projected workload relevant to *s* is assumed to be the same in all years.

Current Staffing

In the specialty *s* at VAMC *i*, there are 20 staff physicians in all, 10 full time and 10 part time. They generate a total of 15.8 staff physician FTEE, distributed as follows in the CDR:

Inpatient PCAs	7.5
Ambulatory PCAs	4.0
Long-Term Care PCAs	0.8
Education and Training/Instructional Cost (virtually all for resident training)	1.0
Other Miscellaneous Activities (which include 0.4 FTEE for Education and Training/Administration)	0.8
Research	1.5
Continuing Education	0.2
TOTAL	15.8

Additional survey data at *i* indicate 0.5 Contract FTEE for *s* and an estimated 0.6 FTEE from non-VA consulting physicians. Thus, total current physician staffing for specialty *s* is 15.8 + 0.5 + 0.6 = 16.9 FTEE.

Note that the 15.8 (and thus the 16.9) total incorporates implicitly all physician FTEE in specialty *s* associated with the following: administrative duties (by service chief and others), allowance for leaves of absence of all types, and additional coverage for nights and weekends. For these latter categories, there is no separate FTEE breakout in the CDR.

The Reconciliation Strategy

Equation 6.1 establishes the framework for calculating physician requirements under the Reconciliation Strategy. Two principal elements of that equation are the Empirically Driven Baseline and the Modifier for the *X* component of physician FTEE—that is, X_1 and $b(X_2 - X_1)$, respectively.

In what follows, total physician requirements for specialty *s* at VAMC *i* will first be derived assuming the IPF is the centerpiece for determining X_1. Then total requirements for *s* will be derived with the SADI as the centerpiece for determining X_2. At that point, these calculations will be analyzed from the perspective of Equation 6.1, which allows the VA decision maker to derive (if desired) a weighted-average calculation of physician requirements that balances the strengths and weaknesses of the individual empirically based and expert judgment approaches.

Physician FTEE Calculations Oriented Around the Empirically Driven Baseline (X1)

Considered first will be the computation of X_1 and the additional FTEE required for research and for continuing education in specialty *s*. The sum of these three FTEE components constitutes an estimation of total physician requirements that is thus oriented around the Empirically Driven Baseline.

Physician FTEE For Patient Care, Resident Education, Administration, and Leaves of Absence

The FTEE subcomponents included in the dependent variable of the IPF encompass staff physician direct care and related administrative activities on the impatient, ambulatory, and long-term care PCAs; education and training/ instructional costs (primarily for residents) by staff physicians; other miscellaneous activities by staff physicians (but here excluding FTEE under education and training/administration); and contract physician services.

Suppose that when the IPF estimated for specialty *s* is applied to VAMC *i*, the resulting predicted FTEE is 15.5. To complete this empirically based determination of X_1, the estimated FTEE are added for its subcomponents not reflected in the IPF. Here, the remaining subcomponents are education and training/administration (recorded currently in the CDR as 0.4 FTEE for s), and non-VA consulting physicians (whose estimated FTEE is 0.6). When these are added to the IPF result, the total FTEE for the Baseline is $X_1 = (15.5 + 0.4 + 0.6) = 16.5$.

Recall that FTEE for administration (except as noted), leaves of absence, and night and weekend coverage are already reflected implicitly in the IPF's dependent variable; no further allowance is necessary.

Physician FTEE for Research

Presently, 1.5 FTEE are allocated to research. By virtue of the committee recommendation that, in the short term, research FTEE be regarded as a pass-through, 1.5 FTEE will be assigned here. If this is regarded as an empirically driven choice, then $R_1 = 1.5$ and c = 0 in Equation 6.1.

This implies that total FTEE to this point, namely $(X_1 + R_1)$, is 18.0.

Physician FTEE for Continuing Education

Suppose the VA decision maker concurs that FTEE for continuing education should be built into the physician requirement calculations at a rate of 80 hours/year per full-time physician. As noted earlier, this is equivalent to earmarking about 4 percent of total FTEE for this purpose.

If this is regarded as an expert judgment choice, then $d = 1$ in Equation 6.1. However, the implied value for C_2 is not immediately inferable but must be computed as a function of the FTEE estimated for X_1 and for research, as well as the 4 percent factor.

Given the choices made thus far, it can be shown that to expand the present FTEE total, namely $(X_1 + R_2)$, to a new total reflecting the desired percentage of continuing education time overall, the computation is as follows:

$$\text{Total FTEE} = (X_1 + R_1 + C_2) = (X_1 + R_1)/(1 - 0.04)$$

This serves to inflate $(X_1 + R_1)$ by just enough that 4 percent of the Total FTEE can indeed be assigned to continuing education while the original FTEE allocations to X_1 and R_1 remain unchanged.

Solving the Total FTEE equation for the *absolute level* of FTEE assigned to continuing education, one gets

$$C_2 = [0.04/(1 - 0.04)]\,(X_1 + R_1)$$

Inserting the value computed for ($X_1 + R_1$) into the Total FTEE equation yields a value for ($X_1 + R_1 + C_2$) of 18.8 (after rounding), so that $C_2 = 0.8$ FTEE.

In sum, these calculations oriented around the Empirically Driven Baseline lead to total requirements in specialty *s* at VAMC *i* is 18.8 FTEE.

Physician FTEE Calculations Oriented Around the Expert Judgment Element of the Modifier (X2)

The components of Equation 6.1 will again be considered in turn.

Physician FTEE For Patient Care, Resident Education, and Administration

Suppose that by applying the SADI constructed for specialty *s* to VAMC *i*, the FTEE required for direct care, resident education, and administration on the inpatient, ambulatory, and long-term care PCAs is calculated to be 18.5. From the SADI, 0.5 FTEE from specialty *s* is estimated for resident education in the classroom (not PCAs) and also 1.5 FTEE for administration by the service chief and others. Thus regarding the subcomponents of X_2, only leaves of absence remains to be analyzed. Under the SADI (or the DSE) expert judgment approach, there are conceptual advantages to deriving the FTEE equivalent for leaves at a subsequent stage in the calculation process, as seen shortly.

Hence, at this stage in the process, total FTEE for this element of the Modifier may be expressed as $X_2 = (18.5 + 0.5 + 1.5 + \text{Leaves}_2) = (20.5 + \text{Leaves}_2)$, where Leaves_2 is the FTEE requirement for leaves of absence.

Note that by virtue of the way physician task times are elicited within the SADI, there is no need to incorporate additional FTEE for contract or non-VA consulting physicians; that is, the SADI is designed to estimate total physician time requirements, irrespective of the mix of staff, contract, and non-VA consulting physicians.

If it is assumed that specialty *s* is not significantly involved in outpatient emergency and admitting & screening activities, one would (by virtue of a committee recommendation in chapter 6) add no additional FTEE for night and weekend coverage. Hence, X_2 remains at ($20.5 + \text{Leaves}_2$).

Physician FTEE for Research

Presently, 1.5 FTEE are allocated to research. By virtue of the committee recommendation that, in the short term, research FTEE be regarded as a pass through, 1.5 FTEE will be assigned here. Assuming again this is regarded as an empirically based determination, $R_1 = 1.5$.

This implies that total FTEE, to this point, is $(X_2 + R_1) = (20.5 + \text{Leaves}_2 + 1.5) = (22.0 + \text{Leaves}_2)$.

Physician FTEE for Continuing Education

As before, assume the VA decision maker agrees that FTEE for continuing education should be built into the calculations at a rate of 80 hours/year per full-time physician—the equivalent of earmarking about 4 percent of total FTEE for this purpose.

Again, the implied value of C_2 is not immediately inferable here, but must be derived as a joint function of several factors: X_2, R_1 , and the 4 percent factor. Note, however, that $X_2 = (20.5 + \text{Leaves}_2)$, and that the value of Leaves_2 is yet to be determined; hence, before one can derive the implied value of C_2, the calculation of Leaves_2 must be addressed.

Physician FTEE for Leaves of Absence

Suppose the VA decision maker adopts the committee's recommendation that (in computing X_2) the FTEE allowance for leaves of all types be derived from the permissible amounts of *annual* leave available to full-time and part-time staff physicians. Recall that the annual leave ceiling for a full-time VA physician is the time equivalent of 0.12 FTEE, whereas for a part-time physician, the ceiling amounts to 0.08 FTEE. As before, let f be the fraction of full-time physician FTEE in total physician FTEE.

Now, the value of Leaves_2 (like C_2) is not immediately inferable here, but must be derived as a joint function of several factors: R_1, C_2, the other subcomponents of X_2, as well as the 8 percent and 12 percent factors and the fraction f. Consequently, Leaves_2 and C_2 depend, in part, on each other and must be jointly calculated in the final step leading to total physician requirements under this X_2-oriented approach. The formula for carrying out this final step is as follows:

$$\begin{aligned} \text{Total FTEE} &= (X_2 + R_1 + C_2) \\ &= [(X_2 - \text{Leaves}_2) + R_1 + C_2 + \text{Leaves}_2] \\ &= f[(X_2 - \text{Leaves}_2) + R_1]/(1 - 0.04 - 0.12) \\ &+ (1 - f)[(X_2 - \text{Leaves}_2) + R_1]/(1 - 0.04 - 0.08) \end{aligned}$$

where 0.04 is the desired fraction of FTEE for continuing education in total FTEE, and 0.12 and 0.08 are the desired fractions of FTEE for leaves of absence in total FTEE for full-time and part-time VA physicians, respectively.[2]

To estimate *f*, recall that specialty *s* now has 10 full-time physicians and a total staff physician FTEE of 15.8. If one assumes that *f* remains relatively unchanged as staffing moves from the status quo level to that prescribed by this Reconciliation Strategy variant, then a reasonable estimate of this parameter is 10/15.8 = 0.63.

Thus, Total FTEE = 0.63(22.0)/(0.84) + 0.37(22.0)/(0.88) = 25.8, where 22.0 = (20.5 + 1.5) = [(X_2-Leaves$_2$) + R_1].

By construction, 4 percent of this total—that is, 25.8 × 0.04 = 1.0 FTEE—is to be allocated to continuing education. Similarly, [0.67(0.12) + 0.37(0.08)] × 100 percent = 11 percent of the total is to be allocated to leaves of absence; that is, 25.8 × 0.11 = 2.8 FTEE are for this purpose. [This implies that (25.8-1.0-2.8) = 22.0 FTEE remain for the subcomponents of X_2 excluding leaves of absence, plus research—and this is precisely the intended result.] It follows that X_2 = [(X_2-Leaves $_2$) + Leaves$_2$] = 20.5 + 2.8 = 23.3 FTEE.

Thus, total FTEE for X_2 has been calculated in a way that simultaneously satisfies the following stipulations: (1) total FTEE for all subcomponents of X_2 except leaves of absence is based on the SADI; (2) the leaves subcomponent is based on the current VA rules regarding annual leave; (3) research FTEE is set at the current CDR-recorded level; and (4) continuing education FTEE is pegged at a level consistent with 4 percent of the total being devoted to this purpose.

Physician FTEE Calculations from the Perspective of the Reconciliation Strategy

When all FTEE-component variables (and weighting parameters) determined to this point are substituted into Equation 6.1, one obtains

[2]As a small concession to simplicity, this equation ignores the fact that X_2 will typically include some *non-VA* physician FTEE, for example, for C&A and WOC support and contract services. Strictly speaking, the leave adjustment should be performed only for VA staff physicians. The precise statement of total FTEE under this variant requires a somewhat more complicated formula:

$$\begin{aligned}\text{Total FTEE} = {} & f[(X_2' - \text{Leaves}_2) + R_1]/(1 - 0.04 - 0.12) \\ & + (1 - f)[(X_2' - \text{Leaves}_2) + R_1]/(1 - 0.04 - 0.08) \\ & + (X_2 - X_2')\end{aligned}$$

where X_2' is the *VA staff physician* component of X_2; thus, (X_2-X_2'), the non-VA-physician component of X_2, is not adjusted upward to allow for leave-induced productivity losses.

$$
\begin{aligned}
\text{Total FTEE} &= (X + R + C) \\
&= [16.5 + b(23.3 - 16.5)] \text{ (with } b \text{ to be determined)} \\
&+ [1.5 + c(R_2 - 1.5)] \text{ (with } c = 0) \\
&+ [C_1 + d(C_2 - C_1)] \text{ (with } d = 1),
\end{aligned}
$$

where R_2, representing an expert judgment-based estimate of research FTEE requirements, was not formally considered (by assumption); C_1, representing an empirically driven estimate of FTEE required for continuing education, was not formally considered (by assumption); and C_2, representing an expert judgment-based assessment of FTEE for continuing education, was defined here to be 4 percent of Total FTEE. Thus, C_2 is jointly determined with Total FTEE. When that total is oriented around X_1, C_2 is found to be 0.8 FTEE; when the total is oriented around X_2, the calculated value of C_2 is 1.0 FTEE.

Hence, the linchpin decision in executing the Reconciliation Strategy (in this example and in most real applications) is determining the appropriate value for the parameter b. Basically, the VA decision maker has three alternatives:

1. Set $b = 0$ (and thus select Empirically Driven Baseline),
2. Set $b = 1$ (and thus select the expert judgment element of the Modifier), or
3. Set b between 0 and 1 (and thus select a weighted average of these two that presumably balances the strengths and weaknesses of each).

Suppose that after considering a number of factors (e.g., pertinent local data omitted from either the IPF or the SADI), the VA decision maker sets $b = 0.25$. Then $X = [16.5 + 0.25(23.3\text{-}16.5)] = 18.2$. Of course, $R = 1.5$. To determine Total FTEE in a way that properly incorporates the required FTEE for continuing education, one can adapt the formula used earlier:

$$(X + R + C) = (X + R)/(1 - 0.04) = 20.5, \text{ so that (after rounding) } C = 0.8.$$

To summarize, under this particular weighted-avarage variant of the Reconciliation Strategy, $X = 18.2$, $R = 1.5$, $C = 0.8$, and Total FTEE = 20.5. By comparison, when $b = 0$, Total FTEE = 18.8; and when $b = 1$, Total FTEE = 25.8.

If local circumstances at VAMC i argue that this specialty s staffing target of 20.5 FTEE should be phased in, the VA decision maker would initially increase staffing to an intermediate target level that lies between the status quo of 16.9 and 20.5.

REFERENCE

American Medical Association, Office of Physician Credentials andQualifications . 1986. Information Booklet on the Physician Recognition Award. Chicago, Illinois.

APPENDIX

SPECIALTY AND CLINICAL PROGRAM PANEL CONCLUSIONS

The following appendix comprises the concluding sections of the reports of the six specialty and two clinical program panels, whose full reports are contained in Volume II, *Supplementary Papers*. Each panel's conclusions are presented here as a distinct entity for ease of reproduction and use.

MEDICINE PANEL

For determining VA physician requirements in internal medicine, the panel endorses a variant of the study committee's Reconciliation Strategy that puts primary weight on "data-driven" approaches to calculating FTEE. Regarding the FTEE components of the Reconciliation Strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

Internist FTEE for patient care should be derived from the PF version of the EBPSM. The panel feels that the PF model is conceptually superior to the IPF because it is specific to the PCA, not just to the facility. Therefore, it allows total physician requirements for patient care to be derived as the sum of FTEE required on all PCAs. For VAMCs I, II, and III, the PF model yielded FTEE levels in better accord with the panel's own judgment about appropriate staffing than did the IPF model. Since the PF focuses entirely on patient care, additional facility-specific data would be required to capture (1) FTEE devoted to resident education and miscellaneous activities and (2) other FTEE not in the CDR and, hence, not in the PF. Included in the latter are FTEE representing contract physicians and C&A and WOC physicians.

The panel believes that expert judgment approaches for determining physician requirements are also valid, but, compared with statistically based approaches, they are relatively expensive and cumbersome to operate. Because the panel concludes that the PF model represents a satisfactory approach for determining internal medicine requirements—given current VA staffing arrangements—it sees no need to utilize either the SADI or the DSE as primary tools for calculating FTEE for medicine.

The panel recognizes that other specialties may find it useful to apply some form of modifier (perhaps multiplier) to the EBPSM in order to derive FTEE estimates that would properly account for historical patterns of understaffing or changes in the technology of treatment. In a given facility, this may also be required for internal medicine. The proposed Reconciliation Strategy provides a useful framework for deploying such multipliers.

Research

The panel had difficulty ascertaining the proper allocation for research. Many facilities are research hospitals whereas others perform no significant investigations. The issue becomes even more complicated since the goal of increased research may exist at a hospital before a full research staff can be recruited. The amount of FTEE assigned to research in the CDR over several years may serve as an initial approximation. However, the panel believes that independent support of these estimates is necessary. For example, each facility should provide a list of the staff physicians who have grant support from the National Institutes of Health or other major funding agencies (e.g., American Heart Association) or a merit award from the VA. In a given VA medicine service, if 10 FTEE are listed for research in the CDR, but only three investigators have independent grant support, then the amount of FTEE assumed for research in the execution of the Reconciliation Strategy should not be 10 but a much smaller number. (It is presumed that serious investigators will have grant support.) Other data such as dollar funding levels or published papers from the facility could be used but are probably more difficult to evaluate than the independent funding criterion.

It is important that a VAMC demonstrating strength in research be allowed to have sufficient physician FTEE to maintain (or improve) its program over time. Only in this way will the research base of the VA system be maintained.

Continuing Education

No fixed standard for continuing education exists in major medical centers in the VA system or outside. Much continuing education takes place in internal teaching functions such as grand rounds. A reasonable figure for meetings outside the medical center would be 10 working days per year. This would allow attendance at two major medical meetings every 12 months.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should follow established VA rules.

Purchased Coverage for Nights and Weekends

Assuming an adequate availability of residents, none is required.

Consulting & Attending and Without-Compensation Coverage

Assuming the VAMC is adequately staffed with VA physicians, there is no need for additional C&A and WOC FTEE.

External Norms

There are at least three significant problems in applying non-VA staffing standards to determine the appropriate number of VA physicians in internal medicine. First, it is exceedingly difficult to obtain comparable FTEE counts from most private-sector facilities. Much of the patient care in community and university hospitals is provided by attending physicians or faculty who admit patients and spend variable amounts of (generally unrecorded) time treating them. Second, there are differences in the economic incentives facing VA and most non-VA physicians. A growing percentage of non-VA physicians are under increasing pressure, from hospitals as well as third-party payers, to control costs; this may affect practice styles and the pattern of care. Third, it is difficult to identify facilities with patient populations comparable to the VA's.

Hence, the panel found the external norms analysis interesting but not very useful for determining VA requirements in internal medicine.

Overall Adequacy of Physician Staffing in the VA

With a sample of but three VAMCs examined in detail, the panel feels that it is not possible to produce a defensible *quantitative* assessment of whether the VA is understaffed or overstaffed in internal medicine. However, the panel's endorsement of an EBPSM, with its concomitant reliance on input-output data from the current system, followed from the observation that expert judgment estimates, although in general slightly higher than numbers derived from the empirical models, were in actuality quite close. Although individual VAMCs may have too many or too few internists relative to systemwide productivity norms, internal medicine in the aggregate does not appear to be significantly understaffed at present. However, the panel emphasizes that this should not be regarded as a "permanent" conclusion, but rather one to be reevaluated periodically.

A reasonable approach to investigating in more depth whether physician staffing in medicine is appropriate would be to apply either the SADI or the DSE to all (or a representative sample) of VAMCs and compare the resulting FTEE levels with those obtained from the PF model and with actual staffing at these facilities. That is, the analyses performed on VAMCs I, II, and III could be extended to a number of VAMCs. Then, one would have considerably more information for evaluating the appropriateness of both current staffing and the PF model as a tool for helping establish desirable FTEE levels.

Other Points

In implementing any staffing model, the VA should establish an appeals mechanism that allows a VAMC to question what it believes, on objective grounds, to be an unreasonable staffing recommendation. There may be evidence that the facility's reported data are in error or are no longer relevant. Factors relevant to physician requirements at the facility may have been omitted entirely from the model (since no true model will include all factors that bear on staffing at every VA).

One natural step in the appeals process would be to apply either the DSE or a rather detailed version of the SADI to the VAMC in question. This result could be compared with the facility's current staffing and the level derived from the PF. With this information available, VA decision makers at the facility and Central Office would have a firmer basis on which to reach a final judgment.

In this regard, the panel urges the VA to continue efforts to improve the accuracy of the FTEE data in the Cost Distribution Report.

Final Remarks

For determining VA physician requirements in internal medicine, the medicine panel endorses a variant of the Reconciliation Strategy that relies upon the PF for deriving FTEE for patient care, resident education, and administration. In general, the panel favors data-driven approaches to determining physician requirements in medicine.

The panel's estimate of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above are summarized in Table 6A. 1. These results are of interest in their own right and serve also to establish the FTEE boundaries within which the panel's Reconciliation Strategy-derived estimates would likely fall. In particular, the PF-based estimates in the table should closely approximate what would emerge from applying this panel's Reconciliation Strategy recommendations to VAMCs I, II, and III.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers*.]

Table 6A.1 Estimates of Physician Requirements in Medicine at Three VAMCs

A. Total FTEE[1]							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified[2]	Survey[3]
VAMC I	31.4	31.9	27.1	23.8	39.8	24.8	32.0
VAMC II	45.7	50.5	43.9	49.9	54.0	39.8	58.0
VAMC III	14.5	15.9	13.1	11.9	23.8	16.8	13.4[4]
B. Direct Care Plus Resident Education FTEE Only[1]							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified[2]	Survey[3]
VAMC I	15.4	15.8	11.1	13.0	14.6	14.6	N.A.
VAMC II	32.1	36.9	30.2	29.0	23.0	23.0	N.A.
VAMC III	12.0	13.3	10.6	9.9	13.9	13.9	N.A.

[1] All estimates are intended to exclude physician FTEE from the medicine service allocated to the emergency room and admitting & screening areas of ambulatory care; these FTEE fall under the purview of the ambulatory care panel. Also excluded from the estimates at VAMC III are internists assigned to the emergency room and admitting & screening at two satellite ambulatory care facilities.

[2] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.

[3] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level at the facility emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

[4] The panel's original median (26.0) was premised, in part, on CDR and PF estimates for VAMC III that *did* incorporate the ambulatory care functions referenced in footnote 1. When the FTEE for these functions is removed from consideration (in line with the remainder of the table), a "corrected" median estimate of 13.4 FTEE emerges.

SURGERY PANEL

For determining VA physician requirements in both surgery and anesthesiology, the panel recommends particular variants of the Reconciliation Strategy (the "disaggregated weighted-average" approach proposed by the study committee). Regarding the FTEE components of the Reconciliation Strategy, the panel proposes the following:

Patient Care, Resident Education, and Administration

For surgery, the panel concludes that both the DSE and the SADI are viable approaches for determining FTEE for these activities. Purely statistical approaches to staffing, although conceptually well founded, are problematic at present because of flaws in the VA data used in their estimation. On the basis of its experience with both expert judgment methodologies, the panel regards the DSE as closer to a "gold standard" approach to staffing, yet recognizes that it would be highly cumbersome to implement regularly across the VA system. Hence, the panel believes that adopting a suitably refined version of the SADI instrument would be the more appropriate option; these refinements should include, in particular, a more detailed specification of case acuity, on the wards as well as in the operating room.

The panel has several concerns about the empirically based models' reliance on data from the VA CDR. If the PF or the IPF were to be the *primary* tool for determining physician requirements, then greater attention must be paid to improving the overall accuracy of the CDR data. In surgery, it may be particularly important for the EBPSM to distinguish between full-time and part-time FTEE, since a substantial amount of the VA's surgery is performed by physicians whose major appointments are elsewhere. Eight of these surgeons each working one-eighth time in the VA are not likely to be the productivity equivalent of one full-time VA surgeon. A similar issue arises for anesthesiology. Another issue affecting both surgery and anesthesiology is that some VAMCs have no distinct cost center for anesthesiology (cost center 212); in those facilities, anesthesiologist FTEE are counted in the surgery cost center (202). In such cases, the number of surgeons would be overestimated and anesthesiologists underestimated.

In sum, for determining surgeon FTEE for patient care, resident education, and administration, the panel endorses a weighted-average strategy with all of the weight placed on a SADI-based approach. [In the terminology of the Reconciliation Strategy, this is equivalent to setting $b = 1$; see Equation 6.1.]

For anesthesiology, the panel recommends a variant of the Reconciliation Strategy that allows (but does not require) the VA decision maker to place due weight on both expert judgment and empirically based approaches in calculating physician requirements. As described in chapter 6, the analytical vehicle for accomplishing this is a particular specification of the Reconciliation Strategy in which the parameter b is allowed to vary between 0 and 1.

To arrive at compromise positions about the appropriate FTEE levels for the VA medical centers studied here in depth, the panel's two anesthesiologists engaged in an exercise to derive a "consensus" value of b for each facility. For VAMCs I, II, and III, the means (midpoints) of the anesthesiologists' b values were, respectively, 0.43, 0.49, and 0.38.

The panel emphasizes that these particular weightings are specific to these particular facilities; hence, they are a reflection of, and serve to articulate, the anesthesiologists' professional judgment about appropriate physician staffing *for these facilities*. If other VAMCs had been examined, different b values would likely have emerged. In general, the Reconciliation Strategy should be executed on a facility-specific basis, so that relevant local data and circumstances can be factored into the staffing decision process. In this way, the parameter b becomes an appropriate reflection (or articulator) of the decision process, not the mechanical driver of that process.

Research

The panel feels strongly that FTEE allocations for research should be related to measurable indicators of research productivity and excellence. The amount of VA and non-VA research support is considered the single most important indicator. Quite clearly, not all surgery and anesthesiology services in the VA merit the same level of research FTEE.

Continuing Education

There ought to be some minimal level of continuing education built into the FTEE requirements of *all* VAMCs. A figure of 10 days per year was discussed, but there was no consensus about the exact amount of time to be devoted to continuing education. There was, however, a clear consensus that continuing education is important for quality assurance and should be specifically recognized in calculating surgeon and anesthesiologist requirements.

Leaves of Absence

The percentage of time allocated to various types of leave should be calculated in a way consistent with the VA's own policies and practices. The panel believes that these analyses would suggest that about 12 percent of total FTEE is a reasonable allocation.

Purchased Coverage for Nights and Weekends

Assuming an adequate availability of residents, none is required.

Consulting & Attending and Without-Compensation Coverage

The use of C&A and WOC physicians enhances the quality of clinical and educational activities in the VAMC. The panel also notes that in affiliated VAMCs, C&A and WOC surgeons can make important contributions to handling some portions of patient workload and resident training. However, given the increasing cost pressures facing the academic affiliates, the panel urges that when the VA computes surgeon requirements, it does not make unwarranted assumptions about the availability of C&As and WOCs. Rather, the fraction of total surgeon FTEE requirements to be filled by VA staff physicians should be determined only after careful consideration of the local availability of C&A and WOC surgeons.

External Norms

Developing non-VA physician staffing standards to which the VA's own staffing could be validly compared proved difficult for several reasons.

First, most non-VA facilities do not measure physician time in terms of an FREE. There is no need for these hospitals to do this since surgeons, anesthesiologists, and other physicians are not paid from a central budget but participate in clinical and educational activities as "attending" physicians with widely varying time commitments.

Second, a portion of the surgery workload at many non-VA institutions is comparable to the workload found in VAMCs. But given current data systems in the private sector, it is exceedingly hard to determine how much physician time is devoted to caring for the *VA-comparable portion* of total workload.

Third, since few private institutions have established explicit staffing standards, and there are no nationally recognized standards, one can question how much policy significance should be given to observed staffing ratios.

Overall Adequacy of Physician Staffing in the VA

It is evident from Tables 6A.2a and 6A.2b that the panel does not regard surgery and anesthesiology staffing to be adequate (in FY 1989) at the three VAMCs studied in depth. However, the panel feels that it is premature to draw general conclusions about the adequacy of staffing in these specialties across the VA. If the SADI or the DSE could be applied to facilities across the board, the panel is confident that the question of staffing adequacy could be addressed quantitatively.

Other Points

First, all FTEE estimates derived from the SADI and the DSE assumed a 40-hour work week. In reality, surgeons and anesthesiologists work much more than this—perhaps closer to a 55-hour week. If some such higher (and more realistic) hours-per-week assumption were to be used, the derived FTEE levels presented in the panel's report would be reduced accordingly. The way in which hours are converted into FTEE is an important issue that the study committee may want to review.

Second, though the panel kept to its charge of examining the physician *FTEE* (rather than physician expenditures) required to meet workload, it emphasizes that one budgetary complication cannot be ignored. In most areas, the going market rate for one FTEE surgeon or anesthesiologist is considerably more than the VA's top salary level. Thus, a VA requiring X anesthesiologist FTEE would need to budget for some greater number ($X + Y$) to have sufficient funds to purchase X. Failing that, the VA must work out some form of reciprocal agreement with its affiliated medical center to augment its anesthesiology staffing. But these affiliates are under increasing pressure to cut costs, and they may become increasingly resistant to such sharing arrangements.

Final Remarks

For establishing VA staffing standards in surgery and anesthesiology, the panel endorses the study committee's Reconciliation Strategy, with the components of FTEE specified as indicated above.

The panel concludes with a summary (Tables 6A.2a and 6A.2b) of its estimates of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers*.]

Table 6A.2a Estimates of Physician Requirements in Surgery at Three VAMCs

A. Total FTEE						
VAMC	CDR	PF	IPF	DSE	SADI	Survey[1]
VAMC I	14.4	17.3	19.1	31.1	34.1	28.0
VAMC II	17.3	15.7	17.9	34.2	37.8	30.8
VAMC III	9.4	10.0	10.6	14.8	18.5	14.5
B. Direct Care Plus Resident Education FTEE Only						
VAMC	CDR	PF	IPF	DSE	SADI	Survey
VAMC I	7.0	9.9	11.7	9.7	9.7	N.A.
VAMC II	14.5	12.9	15.1	12.7	14.1	N.A.
VAMC III	7.4	8.0	8.6	7.5	9.1	N.A.

[1] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

Table 6A.2b Estimates of Physician Requirements in Anesthesiology at Three VAMCs

A. Total FTEE					
VAMC	CDR	IPF	DSE	SADI	Survey[1]
VAMC I	7.2	4.0	17.7	30.9	(8,25)
VAMC II	6.0	8.2	23.9	36.9	(14,25)
VAMC III	1.0	1.5	10.0	16.9	(4,6)
B. Direct Care Plus Resident Education FTEE Only					
VAMC	CDR	IPF	DSE	SADI	Survey
VAMC I	6.7	3.5	4.8	6.7	N.A.
VAMC II	5.7	7.9	8.7	14.1	N.A.
VAMC III	1.0	1.5	3.3	7.1	N.A.

[1] Responses from both anesthesiologists in parentheses.

PSYCHIATRY PANEL

For determining VA physician requirements in psychiatry, the panel endorses a variant of the Reconciliation Strategy that offers the flexibility to use expert judgment approaches as a corrective to statistical staffing models. Regarding the FTEE components of the Reconciliation Strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

For these activities, the VAMC's target level of FTEE should be determined through an expert judgment process, not by one of the proposed empirically based models. Although the panel admires the rigor of the statistical models, at best they can indicate only how the current aggregate level of psychiatry FTEE can be better distributed across VAMCs. It appears unlikely that these models, alone, can address an issue the panel feels is paramount: The VA, as a whole, is now understaffed in psychiatry. (The panel acknowledges that if these staffing deficiencies are reduced, then eliminated, it may well become appropriate to consider deriving psychiatry staffing requirements largely from empirically based models.)

Given projected workload and other factors, what is the appropriate target level of psychiatry FTEE required for patient care, resident education, and administration? To address this question, the panel recommends a form of the Reconciliation Strategy whose expert judgment component is built around the SADI. Although the DSE is an excellent vehicle for examining staffing at an individual VAMC in depth, to apply this instrument across the system would be very labor intensive—possibly requiring a "permanent" expert panel to interpret and update the data. The SADI methodology, on the other hand, could be applied comparatively rapidly to compute psychiatry staffing levels for all VAMCs.

The current SADI instrument, although promising, is an experimental construct. The VA should apply it across the system, revise it on the basis of what is learned, and then periodically reevaluate and update it. This would require some form of expert panel, but the overall manpower commitment would be less than for a DSE-Based approach.

When the panel applied the SADI (and also the DSE) at four selected VAMCs, all were found to be understaffed. One facility (VAMC III) was seriously short of psychiatrists by any standard.

Reflecting on these results, the panel feels that it is not feasible to immediately achieve the several-fold increase in psychiatry staffing that is derived from this initial version of the SADI for facilities such as VAMC III. Rather, the panel endorses a variant of the Reconciliation Strategy in which psychiatrist FTEE at a VAMC is incremented initially by some appropriately chosen fraction of the total difference between the SADI-derived level and the current level.

To arrive at these psychiatry staffing targets, the panel experimented successfully with, and recommends to the VA, a weighted-average version of the Reconciliation Strategy. The IPF and the SADI served as the core approaches for establishing the FTEE boundaries of staffing targets for patient care, resident education, and administration. In the current terminology of the Reconciliation Strategy, a value of 0.35 for the weighting parameter *b* (see Equation 6.1) seemed reasonable to the panel—given the four VAMCs evaluated.

The panel emphasizes that had a different group of facilities been analyzed, the ratio might have been different. Indeed, there is a strong case that the parameter *b* should be determined on a facility-specific basis, in response to relevant information about current staffing at the VAMC and other factors.

The panel urges the VA to refine the SADI further, then perform these calculations across the board to derive psychiatry staffing targets for all VAMCs in the system. The most seriously understaffed facilities should have top priority in acquiring the resources necessary to boost staffing up to computed target levels, and the implications for patient care should be evaluated over time. Average length of stay, treatment outcomes, rates of rehospitalization, and other indicators of the quality and effectiveness of care should be monitored at these selected facilities.

If these indicators improve significantly over time, subsequent iterations of the Reconciliation Strategy should indicate, in response, that additional psychiatrists are appropriate. Thus, what the panel anticipates, if the Reconciliation Strategy is implemented properly, is a type of "transition" or "phasing in" policy, in which psychiatrist FTEE are initially incremented at a number of VAMCs, then further increased over time as the supporting data emerge.

It is important that the initially derived staffing targets be sufficiently different from the status quo FTEE levels that the anticipated resulting changes in the quality and effectiveness of care are observable and measurable.

Research

The panel has serious concerns about adopting an empirically based approach for determining research FTEE in psychiatry in the absence of accompanying policies that recognize an important equity point. Psychiatrists at many VAMCs have been so pressed to handle patient care demands that little time has been left for research. Current FTEE allocations to research in the CDR are smaller than would be the case in a less strained system. To compensate for this inequity, the VA should consider providing "seed money" to stimulate research activities of VA physicians in specialties, such as psychiatry, where the opportunity to launch promising projects has been limited. The panel feels that research improves both physician recruitment and retention, and the quality of care. It recommends that the amount of FTEE allocated to research be a conscious VA policy decision not tied to the status quo. This allocation should be determined on the basis of scholarly promise, but should reflect a genuine commitment to equal opportunity.

Allocations for research derived from existing data will only perpetuate existing inequities in psychiatric research.

Continuing Education

Physician FTEE for continuing education should be based on what the individual VAMC has deemed to be an appropriate level. The most straightforward indicator of this is the amount of FTEE allocated to continuing education on the facility's CDR in the previous fiscal year.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should be based on existing VA policies.

Purchased Coverage for Nights and Weekends

There is a need for continuous backup coverage (on-call coverage for nights and weekends) by staff psychiatrists. The extent to which the backup coverage amounts to actual hours put in on the wards will be a function of several factors including the allocation of resident staffing, case mix, and case acuity. The panel therefore supports a policy calling for additional (purchased) psychiatrist FTEE for nights and weekends. This additional staffing cannot be calculated globally through a formula, but must be determined on a facility-by-facilitybasis.

Consulting & Attending and Without-Compensation Coverage

Assuming the VAMC is adequately staffed with VA physicians, there is no need for C&A and WOC FTEE to meet basic patient care demands. But these non-VA physicians can enhance the overall quality of care at the VAMC and play a valuable role in resident education and continuing education for the staff.

External Norms

Efforts to uncover non-VA staffing criteria, or norms, that could be used to evaluate psychiatry staffing in the VA proved to be problematic.

As indicated in the panel's full report (see Volume II, *Supplementary Papers*), workload-to-psychiatrist FTEE ratios were computed from data derived from a variety of non-VA sources, including private psychiatric facilities, university hospitals, and public treatment facilities. In the end, the panel concluded that it is simply inappropriate, and potentially misleading, to apply simple ratios of this type to infer appropriate staffing at VAMCs. There are both methodological and philosophical problems with such comparisons.

Methodologically, there were two major difficulties in comparing staffing ratios across facilities. First, there was no control, or adjustment, for possible differences in patient severity; thus, a patient day or a patient visit was assumed to be a relatively homogeneous workload index. In fact, this may not be the case. Second, it was not possible to apply a standard definition of a psychiatrist FTEE, nor could the panel accurately split out a non-VA facility's FTEE into inpatient and outpatient components. (One can attempt to do this for VA psychiatrists via the CDR.) The net result is that the denominator in the staffing ratios could not be defined and computed uniformly.

Philosophically, a major caveat is that most of these non-VA ratios emerged not through some formal decision on optimal staffing, but rather as behavioral responses to patient demands in light of various incentives and constraints. For private psychiatric hospitals, in particular, there is a question about what factors influence physician staffing levels. In some, a concern for profits and the accompanying desire to control costs likely influence the observed ratios at these facilities. In others, many participating psychiatrists are community based and their FTEE are not well recorded (or counted at all) in the facility's personnel system; consequently, workload-to-psychiatrist ratios computed at such sites would tend to be inflated.

Future efforts to develop external staffing norms should focus largely on university hospitals and other selected facilities with a demonstrated concern for the quality of care. The analyses should be performed in detail, so that adjustments can be made for important differences between the non-VA sites and the VAMCs to which the norms would be applied.

Overall Adequacy of Physician Staffing in the VA

For the four VAMCs studied in depth, psychiatry staffing was not adequate in FY 1989. In all four, the current FTEE level was significantly below the FTEE level derived using the SADI. At least two of the four (VAMCs III and IV) are severely understaffed.

The panel believes that the findings emerging from this small-sample study fairly reflect the state of psychiatry staffing in the VA, but it would be premature to draw conclusions about the overall extent of understaffing in each of the facilities across the system. If a version of the SADI (after further testing and development) were applied via the proposed Reconciliation Strategy to a broader sample of VAMCs, the overall situation could be assessed more precisely.

Final Remarks

In determining physician staffing in psychiatry, the panel recommends a variant of the Reconciliation Strategy in which FTEE targets are formally established and evaluated, as indicated above.

A summary of the panel's estimates of physician requirements for four actual VAMCs is provided in Table 6A.3.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers*.]

Table 6A.3 Estimates of Physician Requirements in Psychiatry at Four VAMCs

A. Total FTEE							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified	Survey[1]
VAMC I	17.2	17.2	19.7	31.5	35.0	37.7	30.0
VAMC II	24.6	23.8	28.1	52.7	55.6	62.2	40.0
VAMC III	8.9	12.4	13.3	39.8	80.3	72.0	55.0
VAMC IV	19.0[2] 26.0	23.4	28.7	33.9	70.0	69.9	50.0
B. Direct Care Plus Resident Education FTEE Only							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified	Survey[1]
VAMC I	10.5	10.6	13.0	12.3	12.2	12.4	N.A.
VAMC II	19.4	18.6	22.9	29.0	25.3	30.3	N.A.
VAMC III	8.5	11.9	12.8	24.1	50.1	47.9	N.A.
VAMC IV	16.4[2] 23.4	20.8	26.1	24.4	43.0	46.3	N.A.

[1] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

[2] The smaller of these two figures was used at the second panel meeting; however, staff subsequently learned that there were an additional 7.0 FTEE psychiatrists at this facility. In the CDR, they were allocated to the ambulatory care cost center rather than the psychiatry cost center, and for this reason did not show up in the initial data analysis. The corrected figure for total psychiatry FTEE for VAMC IV is 26.0 FTEE. A similar modification applies to the Direct Care Plus Resident Education FTEE estimates. The PF and IPF estimates for VAMC IV have also been adjusted upward accordingly.

NEUROLOGY PANEL

The panel endorses the study committee's Reconciliation Strategy (the "disaggregated weighted-average" approach) as a framework for computing physician requirements in neurology. Regarding the FTEE components of this strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

Neurology FTEE for these activities should be calculated from an expert judgment-based staffing model, not from an empirically based model that relies on current VA staffing data. Both the SADI and the DSE are acceptable expert judgment models. Because the DSE provides a richer array of details about workload and other facility-specific factors, it is arguably closer to a "gold standard" methodology than the SADI. Yet, for determining VA neurologist FTEE over the long term, the panel favors the SADI. Because it is a generic rather than a facility-specific construct, it will be more economical to apply on a systemwide basis than the DSE. The SADI's task-time estimates can be periodically reevaluated and updated as new data become available. The neurology version of the SADI is ready for its initial systemwide application; this should proceed without delay.

Neither the PF nor the IPF version of the EBPSM is acceptable at present because the VA data used in their estimation is flawed in at least two significant respects.

First, these data (of necessity) reflect current input-output relationships, which are skewed because (in the panel's view) neurology is seriously understaffed in many VAMCs. That is, the current data reflect the status quo, and that is an inadequate basis for drawing policy conclusions about appropriate staffing in neurology.

Second, in more than half of all VAMCs there is no neurology service (though one or more neurologists at such a facility may perform consultation on other services). In these cases, the existing neurology FTEE may be attributed, completely or in part, to the medicine service; when this occurs, both the NEU_MD *and* the MED_MD variables in the PF and the IPF models will reflect some measurement error, which will lead to biased coefficient estimates in the EBPSM. In addition, the panel has concerns that the outpatient workload variable used in the present PF and IPF models (NEUCAPWWU) may also suffer from measurement error problems.

Between the two empirically based models, the IPF function is preferred. Even though neurologists consult on many types of VA services, the neurologist FTEE variable is statistically significant in only three of the 14 PCA-specific PF equations. Thus, deriving neurologist FTEE from these equations will almost certainly underestimate total neurologist requirements for patient care at a given facility. Because the IPF properly acknowledges all recorded neurologist FTEE at a facility, regardless of the degree to which it appears to "produce" workload, this form of underestimation will not arise with the IPF. A second advantage of the IPF is that, because it is estimated at the facility level, it does not require neurologist FTEE allocated across PCAs or between patient care and resident education. Because FTEE allocations to PCAs and among activities are frequently made arbitrarily, it is preferable to avoid models, such as the PF, that require them.

Research

An empirically based, rather than expert judgment-based, approach should be adopted for determining FTEE allowances for research. The most straightforward, reasonable procedure is to assign each neurology service (or consultant service) the amount of research FTEE allocated on the facility's CDR in the previous fiscal year. An alternative approach deserving investigation is to make these FTEE allowances dependent on quantitative measures of research productivity, such as grant funding levels. The greater the demonstrated research productivity of a neurology service, the higher should be its FTEE allocation to research, both in absolute terms and (typically) as a percentage of total FTEE.

Continuing Education

Like the research allocation, physician FTEE for continuing education should be based on what the individual VAMC has deemed to be an appropriate level; the most straightforward indicator of this is the amount of FTEE allocated to continuing education on the facility's CDR in the previous fiscal year.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should be based on existing VA policies.

Purchased Coverage For Nights and Weekends

Assuming an adequate availability of residents, none is required.

Consulting & Attending and Without-Compensation Coverage

Assuming the VAMC is adequately staffed with VA physicians, there is no need for additional C&A and WOC FTEE.

External Norms

The panel concludes that it is difficult to apply non-VA staffing standards to determine the appropriate number of neurologists for the VA. Across facilities there are substantial differences in what is meant by "patient workload" and "physician FTEE." In many institutions, neurology is still part of internal medicine. Staffing in private hospitals is frequently driven by concerns about profit margins, which may influence physician staffing intensity; this calls into question whether a desirable norm is being observed. University medical centers generally deliver high-quality care, but serve a patient population quite different from the VA's.

Overall Adequacy of Physician Staffing in the VA

From Table 6A.4 it is evident that actual neurology staffing in FY 1989 at all three VAMCs examined in detail by the panel is below that recommended by any of the proposed approaches to staffing. These results are consistent with the conclusion that neurologist staffing in the VA may not be adequate at present. But because of the small sample size of facilities examined, it is not possible from these analyses to render a quantitative assessment of neurologist understaffing for the system.

Other Points

Regardless of whether the VA adopts an empirically based or expert judgment-based approach (or some combination) to physician staffing, the models should distinguish sharply between VAMCs that have a full neurology service and those that offer only neurology consultation.

If the VA does adopt an empirically based approach, it is crucial that neurologist FTEE allocations in the CDR be made more accurate. As noted, this is especially important for the PF, wherein physician FTEE are allocated by function to various PCAs. In addition, the ambulatory workload variable used in the present models (NEUCAPWWU) must be refined so that it becomes a better direct indicator of the work performed by the neurologist in the clinic setting.

Final Remarks

For neurologist staffing, the panel recommends a variant of the Reconciliation Strategy in which the FTEE required for patient care, resident education, and administration would be determined through the SADI.

The panel's estimate of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above, are summarized in Table 6A.4.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers.*]

Table 6A.4 Estimates of Physician Requirements in Neurology at Three VAMCs

A. Total FTEE

VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified[1]	Survey[2]
VAMC I	1.6	1.7	3.4	4.8	8.2	3.6	7.5
VAMC II	5.5	5.8	6.3	7.1	8.6	5.2	8.3
VAMC III	10[3]	0.0	0.9	1.5	2.0	1.3	2.0
B. Direct Care Plus Resident Education FTEE Only							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified	Survey
VAMC I	1.0	1.1	2.8	2.7	1.7	1.7	N.A.
VAMC II	4.3	4.6	5.1	4.2	3.4	3.4	N.A.
VAMC III	1.0[3]	0.0	0.9	1.2	1.0	1.0	N.A.

[1] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.

[2] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

[3] Because there is no separate CDR cost center for neurology at VAMC III, the CDR submitted by that facility indicates (of necessity) that total neurologist FTEE was 0 in FY 1989. However, personal communication with the facility revealed the presence of approximately 1 FTEE neurologist, dedicated entirely to direct care. In response, the CDR counts above have been adjusted in both cases to reflect this FY 1989 reality.

On the other hand, the decision was made to leave the PF-derived FTEE projections at 0, in both cases above, to reflect, candidly, what the panel feels is an undesirable feature of the way this particular model is used presently to derive physician staffing requirements. That is, if the CDR indicates that, at baseline, NEU_MD is 0 across all PCAs, the "multiplier adjustment" approach presently being used to calculate "projected FTEE" for a given year will always imply that 0 neurologists are required that year—regardless of workload and other factors (see "Using the PF to Compare Projected and Actual Physician FTEE Devoted to Direct Patient Care" in chapter 4).

These comments underscore the importance of ensuring that CDR data reflect the *actual* count of physicians, by specialty, at each VAMC. They also illustrate how direct communication with a VAMC can avert errors in interpretation.

REHABILITATION MEDICINE PANEL

As a framework for determining VA physician requirements in both rehabilitation medicine and spinal cord injury (SCI), the panel endorses a variant of the study committee's Reconciliation Strategy (the "disaggregated weighted-average" approach). With respect to the FTEE components of the strategy, the panel recommends:

Patient Care, Resident Education, and Administration

For these activities, FTEE should be derived from an expert judgment model rather than the EBPSM. Both the SADI and the DSE represent acceptable expert judgment models, but the SADI is preferred because it will be easier and more efficient to apply across the system. Although application of the rehabilitation medicine SADI to VAMCs I, II, and III resulted generally in reasonable physician FTEE estimates, its acceptability and reasonableness should be assessed on a systemwide basis soon, and reevaluated periodically.

Neither the PF nor the IPF variant of the EBPSM is fully acceptable because the VA data used in their estimation have potential errors in two major areas.

First, these data (of necessity) reflect current input-output relationships, which are skewed because rehabilitation medicine is seriously understaffed in many VAMCs; thus the data reflect the status quo, clearly an inappropriate basis for estimating appropriate physician staffing for high-quality rehabilitation medicine and SCI patient care.

Second, in over half of all VAMCs there is no inpatient rehabilitation medicine service (RMS), though one or more physiatrists at such a facility could consult on other services. In these cases, there is a likelihood that the existing RMS FTEE will be attributed, completely or in part, to the medicine service. If this occurs, both the RMS_MD *and* the MED_MD variables in the PF and the IPF models will reflect measurement error. The panel believes that this could result in a substantial underestimation of physician requirements in rehabilitation medicine.

RESEARCH

An empirically based, rather than expert judgment-based, approach should be adopted for determining FTEE allowances for research. One method is to assign each RMS and SCI service (or consultant service) the research FTEE allocated on the facility's CDR in the previous fiscal year. Another approach is to base research FTEE on indicators of research productivity, such as the amount of grant funding. The panel prefers the latter approach.

Continuing Education

Physician FTEE for continuing education should be based on the individual VAMC's recommended level; this can be easily determined as the amount of FTEE allocated to continuing education on the previous fiscal year's CDR.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should be consistent with the VA's policies.

Purchased Coverage For Nights and Weekends

Assuming an adequate availability of residents, none is required.

Consulting & Attending and Without-Compensation Coverage

In rehabilitation medicine, this category is primarily for education purposes.

External Norms

The panel pursued this topic with both enthusiasm and some ambivalence; it now concludes that there is much difficulty in applying non-VA staffing standards to determine the appropriate number of rehabilitation medicine and SCI physicians for the VA. Staffing levels in private, freestanding hospitals are frequently influenced by the profit motive. In affiliated university hospitals, there are technically more complex procedures performed with a different group of patients; physiatrist FTEE in these settings is not measured comparably to the comprehensive approach taken by the VA. Furthermore, the education of residents and allied health workers is more intensive at university hospitals, necessitating a more intensive involvement of attending physicians in the training process. Some other organizations examined (e.g., Department of Defense) treat a substantially different patient mix than do VAMCs; hence, their patient populations present different management problems than those in most VA facilities.

Overall Adequacy of Physician Staffing in the VA

From Table 6A.5 it is evident that actual rehabilitation medicine staffing in FY 1989 at two of the three VAMCs examined in detail is below that recommended by any of the models, except the PF; however, for VAMC III, only the DSE result is significantly greater than current RMS staffing, as reflected in the CDR. Because this is indeed a small sample, it would be premature to present a quantitative assessment of understaffing for the system.

Other Points

Regardless of whether the VA adopts an empirically based or expert judgment-based approach (or some combination) to physician staffing, there would be much merit in developing models that distinguish sharply between VAMCs with a full RMS program, including a bed service, and those that offer only RMS consultation.

If the VA does adopt an empirically based approach, it is crucial that rehabilitation medicine physician FTEE allocations in the CDR represent more accurately how the physiatrists at a given VAMC spend their time.

Final Remarks

For rehabilitation medicine and SCI physician staffing, the panel endorses the modified version of the Reconciliation Strategy described above. For patient care, resident education, and administration, the centerpiece of the staffing model would be the SADI.

The panel's estimates of physician requirements for three actual VAMCs are shown in Table 6A.5. The expert judgment estimates reflect the collective experience of the panel's VA and non-VA members.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers.*]

Table 6A.5 Estimates of Physician Requirements in Rehabilitation Medicine at Three VAMCs

VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified[1]	Survey[2]
A. Total FTEE							
VAMC I	3.9	3.9	5.5	9.5	8.7	5.5	8.0
VAMC II	3.0	2.0	4.6	9.9	6.4	5.3	8.0
VAMC III	1.8	2.2	2.0	3.2	1.7	1.6	3.0
B. Direct Care Plus Resident Education FTEE Only							
VAMC	CDR	PF	IPF	DSE	SADI	SADI-Modified[1]	Survey[2]
VAMC I	1.9	1.9	3.5	6.2	3.2	3.2	N.A.
VAMC II	2.7	1.5	4.1	6.8	3.0	3.0	N.A.
VAMC III	1.7	2.1	1.9	2.5	1.1	1.1	N.A.

[1] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.

[2] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

OTHER PHYSICIAN SPECIALTIES PANEL

As a framework for determining physician requirements in the specialties of laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology, the panel endorses the "disaggregated weighted-average" approach to the Reconciliation Strategy (see Equation 6.1 and the accompanying text). Regarding the components of the strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

For these activities, FTEE should be derived from expert judgment methodologies. Although both the Staffing Algorithm Development Instrument (SADI) and the Detailed Staffing Exercise (DSE) are acceptable expert judgment approaches, the SADI is preferred. The focus of the SADI is on the time required by physicians to perform specific tasks and functions, making it suitable both for technologically based specialties, like laboratory medicine, and specialties that also have a strong component of physician-patient interaction, such as nuclear medicine. The panel has made a first-cut effort to estimate these SADI task times.

On the basis of these results, the panel concludes that the SADI should be applied experimentally at a representative sample of VA medical centers to derive first-cut estimates of physician requirements in the four specialties. It would be possible to apply the DSE within the same representative sample, but the administrative burden would be considerably greater; in the judgment of the panel, that entire process would be inefficient since distinct DSE instruments would have to be developed for each VAMC.

Neither of the two empirically based approaches is acceptable at present. The production function (PF) variant could not be estimated for any of the four specialties; the PF is specific to PCAs, and there is no single "dominant" PCA defined in the overall methodology for any of the four specialties. The inverse production function (IPF) can be satisfactorily estimated for each of the specialties. But the IPF (like the PF) relies heavily on staffing data from the VA's Cost Distribution Report (CDR), whose reliability the panel regards as variable at best, and specifically unreliable in these hospital-based specialties.[1]

[1] From a larger methodological perspective, the panel does find merit in the PF approach because, in principle, it permits physician requirements to be calculated as a function of both other labor inputs (e.g., support personnel) and nonlabor inputs (e.g., the quantity and vintage of equipment). The IPF models presented to the panel do not permit this.

Though the panel did not feel the need to adopt such an approach, it does see the merits of a version of the Reconciliation Strategy in which FTEE requirements are computed as a weighted average of expert judgment and statistical modeling results—especially for establishing reasonable initial increments, or decrements, in physician staffing relative to the status quo.

Research

An empirically based, rather than expert judgment-based, approach should be adopted for determining FTEE allowances for research. The most straightforward, reasonable procedure is to assign each specialty that amount of research FTEE allocated on the facility's CDR in the previous fiscal year. An alternative, and preferable, approach is to make these FTEE allocations dependent on quantitative measures of research productivity, such as grant funding levels and research publications.

Continuing Education

All VA physicians should be expected to receive some minimum amount of continuing education annually as an important part of an overall quality assurance program. This minimum FTEE commitment to continuing education should not vary by specialty or facility. The VA could base these FTEE allocations on standards established by the specialty boards for recertification, by the states for maintaining licensure, or by the American Medical Association for its Physician Recognition Award for Continuing Medical Education.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should be set globally, perhaps equated to an overall average computed across the VA system.

Purchased Coverage for Nights and Weekends

Assuming an adequate availability of residents, none is required. The panel notes, however, that this is a significant assumption and may not hold for all VAMCs, especially the smaller facilities.

Consulting & Attending and Without-Compensation Coverage

Assuming the VA is adequately staffed with VA physicians, there is no need for additional C&A and WOC FTEE to handle the quantity of workload presenting. However, these non-VA physicians can serve to enhance both the quality of patient care and educational opportunities for VA staff physicians and residents.

External Norms

In a strictly mechanical sense, non-VA staffing standards were successfully applied to determine the implied appropriate staffing at VAMCs I, II, and III for each of the four specialties. The overall result is that, although a given VAMC was sometimes understaffed according to a particular criterion, there was no significant pattern of understaffing or overstaffing.

But the validity of these comparisons is threatened by some fundamental problems. For each of the four specialties, there are national guidelines relating workload to physician staffing, but it is not clear whether these make proper allowance for all of the patient care and non-patient-care duties expected of the VA staff physician. With external norms derived from staffing behavior observed at non-VA facilities, there are several difficulties. The definition of *workload* for the four specialties varies across non-VA facilities. There is no universal definition of an FTEE, and virtually no other institution attempts to define it with the precision of the VA. Similarly, few private-sector facilities have data systems that keep track of the allocation of physician FTEE to specific types of activities. Since few hospitals routinely study the relationship between workload and physician FTEE, the non-VA staffing ratios that do emerge are often roughly estimated on an ad hoc basis.

Overall Adequacy of Physician Staffing in the VA

There was a general consensus among panel members that, for the three VAMCs studied in depth, there was a degree of understaffing (in FY 1989) in diagnostic radiology, nuclear medicine, and radiation oncology; laboratory medicine appeared neither significantly overstaffed nor understaffed in these facilities. However, the panel is unwilling at present to extend these conclusions to the VA system as a whole. A sample of three is too small for valid inferences.

If the SADI were applied across the system, the question of overall staffing adequacy could be directly confronted. But a large caveat would remain, at least in the short term, because still lacking is quantitative information linking physician staffing intensity in these specialties to indicators of the quality of care. Evidence of such a linkage can be investigated only gradually over time, as quality of care indices are developed and their relationship to physician staffing levels investigated.

Other Points

Panel members differed on whether it is better to report physician staffing recommendations in the form of a range of alternative values or as a single point estimate. Some argued in favor of point estimates because budget pressures will inevitably lead the VA decision maker to the low end of whatever range is presented. Others pointed out that, first, a range allows one to reflect the genuine uncertainty that exists about "the" appropriate staffing level and, second, the VA decision maker may not invariably choose the lowest point on the range.

The panel was impressed by the ongoing work in the VA's pathology service to develop a methodology to account for how laboratory medicine physicians allocate their time that is more detailed than what is currently available from the CDR, the DSE, or the SADI. (See the panel's report in Volume II, *Supplementary Papers.*) As the VA proceeds to refine the laboratory medicine SADI, it should investigate the development of time estimates at the level of task specificity found in the pathology service survey instruments.

Final Remarks

For determining physician requirements in laboratory medicine, diagnostic radiology, nuclear medicine, and radiation oncology, the panel endorses the variant of the Reconciliation Strategy described above.

The panel's estimates of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above, are summarized in Table 6A.6.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers.*]

Table 6A.6 Estimates of Physician Requirements in Other Physician Specialties at Three VAMCs

Source of FTEE Estimate	VAMC I	VAMC II	VAMC III
LABORATORY MEDICINE			
CDR	3.4	9.2	2.0
IPF	5.9	9.8	3.5
DSE	3.7	5.8	1.8
SADI	2.9	5.2	1.8
SADI-Modified[1]	1.6	3.1	1.5
Survey[2]	3.9	8.0	2.0
NUCLEAR MEDICINE			
CDR	2.0	2.0	0.0
IPF	2.2	2.0	0.6
DSE	4.4	3.6	0.9
SADI	6.7	3.1	1.8
SADI-Modified[1]	5.1	2.9	1.3
Survey[2]	5.0	3.5	1.5

[1] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.
[2] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

Source of FTEE Estimate	VAMC I	VAMC II	VAMC III
DIAGNOSTIC RADIOLOGY			
CDR	7.0	13.9	4.6
IPF	8.5	10.4	3.9
DSE	9.6	21.0	6.2
SADI	12.3	25.0	7.7
SADI-Modified[1]	7.8	18.6	5.2
Survey[2]	7.8	18.6	5.2
RADIATION ONCOLOGY			
CDR	0.0	1.9	0.0
IPF	1.5	3.5	1.4
DSE	2.1	4.3	0.1
SADI	2.2	3.1	0.4
SADI-Modified[1]	1.9	3.0	0.1
Survey[2]	2.0	4.0	0.2

[1] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.
[2] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

AMBULATORY CARE PANEL

To determine the number of physicians required for the ambulatory care program at VAMCs, the panel endorses the study committee's proposed Reconciliation Strategy. Regarding the components of the strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

To derive the level of physician FTEE required to care for a given patient workload, while residents are being trained and administrative duties are being handled, the panel recommends an expert judgment-based methodology built around the SADI. The DSE is an acceptable alternative methodology, but the SADI is the better approach for ambulatory care for several reasons.

The time (and hence, FTEE) required to deliver ambulatory care can be usefully conceptualized as the time to manage a sequence of patient visits, of varying complexity. Some will be initial visits, others followup. Some will be handled with residents and various nonphysician practitioners; others may involve primarily the physician. Some will be emergency, others routine. Depending on the patient's problem, different specialties (or mixes of them) will be involved. The degree of physician involvement in a given visit will be influenced by all of these factors. Because it focuses on the physician time required per visit or per procedure, the SADI methodology is thus well suited for computing physician requirements in ambulatory care. Unlike the DSE instrument, which is facility specific, the SADI is a generic construct that can be applied directly to any VAMC (assuming adequate information about outpatient workload, residents, and support personnel).

The application of the SADI to the ambulatory care program at VAMCs I, II, and III leads generally to plausible estimates of physician FTEE for patient care, resident education, and administration. The panel regards this as a fairly successful small-scale experiment; however, the validity and acceptability of the SADI methodology should be evaluated further through a much broader application involving a strategically chosen sample of VA ambulatory care programs.

Either form of the empirically based physician staffing model presents problems at present. Conceptually, the PF does offer an attractive approach for analyzing physician requirements in ambulatory care. All of the VA's clinic stops are mapped into six mutually exclusive and exhaustive PCAs, and one can calculate alternative combinations of provider types that are consistent with meeting patient workload in each PCA. Given certain assumptions, physician FTEE required by specialty can be deduced from these statistical analyses. But a major concern is that the FTEE data used in estimating these models may be significantly flawed at present. The panel believes that physician FTEE devoted to ambulatory care is consistently undercounted in the current data system. Despite efforts to improve data collection at many VAMCs, there is insufficient uniformity in the way facilities allocate physician FTEE between inpatient and ambulatory care and among activity categories within ambulatory care. Because the PF model requires FTEE broken out to this level of detail, the issue is important. Correspondingly, if CDR record keeping continues to improve over time, this objection to the PF model should dissipate.

The IPF model is plagued by these same data difficulties, but it presents a more fundamental problem. Because the IPF equations presented to the panel do not allow physician FTEE to be analyzed by PCA, there is no appropriate IPF for ambulatory care. (However, the effect of outpatient workload on physician requirements is recognized in each IPF.)

Research

Physician FTEE allocated to research should reflect a deliberate VA policy decision—not something determined mechanically from CDR data. The panel recommends that this determination be made by each facility with guidance from VA Central Office. Although a good research program will enhance the overall quality of ambulatory care at any VAMC, the panel acknowledges that the amount of FTEE allocated to research will—and should—vary significantly across facilities. In determining these FTEE, VA policy makers should be guided by measurable indicators of research productivity such as the level of VA and non-VA research funding. The strength of the VAMC's affiliation with a scientifically productive medical school is another potential indicator.

Continuing Education

As with research, the commitment to continuing education should not be dictated by the status quo, but rather be the result of a conscious VA policy decision on what continuing education is required to promote high-quality care. At a minimum, the FTEE allocated to continuing education should be commensurate with the commitment required to maintain board certification in the specialties concentrated in ambulatory care. The panel strongly recommends that the continuing education allowance be greater than this minimum and be applied to all VAMCs, affiliated or not. Further, each VAMC should develop a vigorous continuing education program of its own and ensure that all staff physicians participate to a specified extent.

Leaves of Absence

The percentage of total FTEE earmarked for vacation, sick leave, administrative leave, and other authorized absences should be established on the basis of existing VA regulations.

Purchased Coverage For Nights and Weekends

When emergency, admitting, or other ambulatory care areas are open, one or more staff physicians should be available either to provide patient care or to supervise the provision of patient care by residents or others. When availability cannot be provided by existing staff physicians—for example, when extensive coverage is needed in smaller institutions with few staff physicians—then additional physician availability should be arranged for nights and weekends by purchasing coverage from other physicians. The amount of purchased coverage will depend on the total number of hours of coverage needed, the number of staff physicians available to provide coverage, and the distribution of staff physician effort between night or weekend coverage and other duties. (At some VAMCs, this "off hour" coverage is provided by residents hired specifically for the task. In the future, quality management concerns and other factors may serve to reduce the role of residents in this area.)

In general, decisions about the purchase of additional coverage should be made by each VAMC following guidelines provided by VA Central Office.

Consulting & Attending and Without-Compensation Coverage

These non-VA physicians enhance the quality of both patient care and resident education. Therefore, the need for these services may be greater in hospitals with more extensive teaching programs and in hospitals with limited types of specialists on their staffs. Decisions about the acquisition of C&A and WOC services should be made at each facility following guidelines provided by the VA. The panel notes also that compensation for C&A services has not been raised in many years; the fee remains $40/visit for attendings and $75 for consultants. The VA should strongly consider increasing these payment rates.

External Norms

The panel reviewed non-VA staffing ratios (visits/MD) from five sources and also VA guidelines for ambulatory care issued about 25 years ago. Each of these "norms" was applied, in turn, to VAMCs I, II, and III to calculate the physician staffing level in ambulatory care consistent with the norm. The implied physician staffing level of each VAMC could then be compared with its actual staffing.

In sum, the panel found these analyses interesting, but counsels caution in drawing policy inferences from them. The overall trend from applying these norms was as follows: Two VAMCs (I and II) appeared neither significantly overstaffed nor understaffed, whereas VAMC III's CDR total for ambulatory care was significantly lower than any of the norms suggested that it should be.

The validity of these comparisons hinges on the validity of applying these externally derived visits/MD ratios to VA facilities, and the panel has several concerns in this regard. First, an outpatient "visit" is not a homogeneous concept but rather is defined specifically by the number, type, and severity of problems presented by the patient. In applying these norms (within the scope of this study), there was no way to control for this natural variability. Second, although the definition of a physician "FTEE" in the VA is relatively clear, this is not the case elsewhere. Hence, there will be some (unobserved, hard-to-correct) heterogeneity in the denominators of these staffing ratios, threatening the validity of the comparisons.

Overall Adequacy of Physician Staffing in the VA

For the three VAMCs studied at length, two (VAMCs I and II) were found (in FY 1989) to be understaffed according to all modeling approaches except the PF; VAMC III was significantly understaffed by all approaches. In the panel's judgment, this general pattern of results would likely be replicated if these modeling approaches were applied across the VA system. Speaking qualitatively, the panel feels that for the patient care that needs to be delivered, ambulatory care in the VA is presently understaffed. However, a sample of three is too small for drawing quantitative conclusions about the degree of understaffing systemwide. If a physician requirements methodology built around the SADI were to be applied to ambulatory care programs across the system, a quantitative assessment would be possible—and the panel's present judgment on staffing adequacy could be checked directly.

Other Points

Whatever physician staffing methodology the VA adopts should be reevaluated and updated on an ongoing basis. Given the anticipated changes in patient demographics, the technology of care, and physician practice patterns in the private sector, determining physician requirements in the VA cannot be a one-shot affair. A thorough reassessment of the methodology and required data should be undertaken *at least* every 5 years.

Final Remarks

For calculating physician requirements for the ambulatory care program at VAMCs, the panel supports the use of a Reconciliation Strategy whose FTEE components are analyzed as recommended above.

The panel's estimates of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above, are summarized in Table 6A.7.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers.*]

Table 6A.7 Estimates of Physician Requirements in Ambulatory Care at Three VAMCs

A. Total FTEE					
VAMC	CDR	PF	DSE	SADI	Survey[1]
VAMC I	28.4	26.4	54.2	43.0	47.5
VAMC II	51.3	41.0	95.7	52.8	67.0
VAMC III	19.3	30.7	79.2	50.1	52.5
B. Direct Care Plus Resident Education FTEE Only					
VAMC	CDR	PF	DSE	SADI	Survey[1]
VAMC I	21.3[2]	19.0[2]	27.9	21.8	N.A.
VAMC II	47.8[3]	37.5[3]	52.9	29.9	N.A.
VAMC III	9.1[4]	30.5[4]	52.4	35.1	N.A.

[1] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirically based approaches (as applicable), and from both expert judgment approaches.

[2] Based on a systemwide average for medicine services in RAM Group 3, these figures assume that 74 percent of total education FTEE in ambulatory care is for resident education.

[3] Based on a systemwide average for medicine services in RAM Group 5, these figures assume that 67 percent of total education FTEE in ambulatory care is for resident education.

[4] Based on a systemwide average for medicine services in RAM Group 4, these figures assume that 61 percent of total education FTEE in ambulatory care is for resident education.

LONG-TERM CARE PANEL

As a framework for determining VA physician requirements in long-term care, the panel endorses a specification of the Reconciliation Strategy that can assess the FTEE needed for all extended care and geriatric services, not simply for nursing home and intermediate care beds. Regarding the components of the strategy, the panel recommends the following:

Patient Care, Resident Education, and Administration

For these activities, FTEE should be derived from expert judgment approaches rather than the EBPSM, for several reasons.

First, the PF variant of the EBPSM allows one to infer physician requirements for the nursing home and intermediate PCAs, but those geriatric and extended care activities occurring on other PCAs are excluded from what the model calls "long-term care." For example, geriatric evaluation units (GEUs) are analyzed as part of the inpatient medicine PCA.

Second, because the IPF is specialty specific and the long-term care (LTC) program is multidisciplinary, there is no IPF that applies to LTC. [However, the effect of nursing home and intermediate care workload on physician requirements is recognized in each IPF through the independent variable RUGWWU (Resource Utilization Group Weighted Work Units).]

Third, an expert judgment model built around the SADI offers a flexible approach for evaluating physician FTEE requirements for all extended care and geriatric services. The current LTC SADI is designed to capture the FTEE of physicians whose dominant commitment is to the VAMC's LTC "service." But it would be straightforward to extend the SADI to include the FTEE of all physicians, regardless of specialty or dominant commitment, who devote time to extended care or geriatrics. Thus, the important role of psychiatrists and rehabilitation medicine physicians would be acknowledged.

Research

The amount of FTEE earmarked for research should be empirically driven, that is, based on a facility-or specialty-specific analysis of the existing relationship of research funding and other indicators of research activity to research FTEE. Hence, these research FTEE allocations would vary by facility and likely be a function of the facility's affiliation status.

Continuing Education

The panel recommends that there be a minimum amount of FTEE set aside for continuing education, perhaps pegged to state medical licensure requirements. In addition to this baseline allocation, the panel recommends that additional FTEE for continuing education be allowed for physicians in highly affiliated VA facilities or where significant research is ongoing. These physicians should be expected to present research findings and report on program developments at national meetings of the specialties in which they hold academic appointments. The effects of this allowance on total FTEE requirements should be estimated according to the level of affiliation and the amount of research funding at each facility.

Leaves of Absence

As a baseline across the system, the percentage of total FTEE allocated to leaves of all types should be set at a uniform level; the panel concurs with the committee that a reasonable benchmark is the amount of annual leave. However, there should be a mechanism to allow for leave days beyond this baseline for facilities that participate heavily in external research and education activities. An index for the latter would be the facility's affiliation status.

Purchased Coverage for Nights and Weekends

Assuming adequate support from medicine and the other services, no additional FTEE are required.

Consulting & Attending and Without-Compensation Coverage

Assuming the VAMC is appropriately staffed with VA physicians, there is, almost by definition, no need for additional C&A and WOC FTEE to meet basic needs. The panel notes, however, that these non-VA physicians can serve to improve the quality of patient care.

External Norms

For three VAMCs the panel computed what physician FTEE would have been had each been staffed with the same intensity, in turn, as three private-sector nursing homes, another VA nursing service, and to the level suggested by the VA's own rough guidelines published in 1965. The overall finding was that none of the three VAMCs was significantly overstaffed or understaffed (in FY 1989).

The panel believes that these analyses suggest that staffing norms can be usefully applied in LTC. But two caveats should be noted. First, except for the old VA guidelines noted, these "norms" are simply a reflection of the staffing behavior of LTC units as they have evolved over time. Second, there is no universally accepted operational definition of an FTEE, so that these workload/FTEE ratios computed for non-VA facilities must be carefully interpreted. It is not clear, for example, to what extent a "full-time" physician in a given private facility has other outside responsibilities occupying significant portions of the work week. In general, it appears that private LTC facilities collect good workload statistics (e.g., admissions, patient days), but physician staffing data are less likely to be recorded in a standardized fashion.

Overall Adequacy of Physician Staffing in the VA

Given the small number of VAMCs examined in detail, the panel could make no determination about the overall appropriateness of staffing for LTC in the VA. To make a global determination, it would be necessary to apply the SADI across the VA system. The panel urges that this be done, and in a way sensitive to particular concerns that arise in LTC. For example, the SADI must indicate the extent to which physicians assigned to LTC (rather than medicine) have primary responsibility on intermediate medicine units, since this would have a major effect on the amount of time that LTC physicians must spend on these units. Similarly, the SADI must specify clearly whether physicians have a primary care role, or consultative/advisory role, in the operation of VA hospital-based home care (HBHC) units.

Other Points

The panel feels that there are at least seven issues requiring careful consideration as the VA continues to refine the proposed physician staffing methodology.

1. Physician staffing requirements were not reviewed for HBHC because, under the current VA system, the program is implemented by nursing with little direct physician involvement for patient care. In the non-VA home care field, the push toward decreasing utilization of higher cost inpatient services has shifted the care of many patients to the community. This trend will be seen in the VA as well for the elderly and, perhaps, for AIDS patients. These veterans will

have a higher acuity of illness than those currently being serviced by HBHC, and the rate of patient turnover will increase. Because of this, physicians will be more directly involved in the following activities: (a) screening for enrollment into HBHC, (b) patient care planning, (c) multidisciplinary care management, (d) periodic in-home assessment, and (e) evaluation of patient progress and potential for discharge from HBHC to other levels of care.

Rather than contenting itself with current levels of physician activity in HBHC, the VA should review external VA norms to determine requirements for physician involvement in the future. The American Academy of Home Care Physicians will be a significant resource for this endeavor.

2. Geriatric psychiatry is an area requiting particular attention. Although a high percentage of nursing home patients have secondary diagnoses involving mental disorders, psychiatrist time allocated to nursing home units appears to be disproportionately low. Additional analyses are required to determine whether this is merely a feature of the VA FTEE reporting system, or reflects a surprising lack of involvement of psychiatry in the treatment of these patients. (A similar question arises in other areas where geriatric psychiatry would be expected to play a significant role, e.g., HBHC, Adult Day Health Care, and Geriatric Evaluation and Management Units.)
3. Of the LTC workload measures available to the panel, the one most closely correlated with patient acuity appears to be the RUGWWU scores, which are derived from the well-known Resource Utilization Group (RUG) methodology. Nonetheless, the panel strongly recommends that the VA determine the degree to which RUGWWU scores are predictive of *physician*, rather than nursing, activity. If the correlation is deemed inadequate, the search for better workload variables should continue.
4. With regard to intermediate medicine units, the panel suggests that there are at least three different types of arrangements, and that the particular arrangement has an impact on the use of the physician and the amount of time that he or she may need to spend on the unit. These types of arrangements are:

a. Distinct, identified units where the LTC physician is responsible for providing primary care;
b. Distinct, identified units where the LTC physician has a consultative role only; and
c. Not an identified or distinct unit but an arrangement in which intermediate care beds are dispersed throughout other services and in which the LTC physician has a consultative role only.

5. With regard to training issues, the panel suggests that the involvement of medical students on long-term care units be explored in detail. For example: What is the usual number of students doing clerkships on a long-term care unit at one time? How long do such clerkships usually last? In how many VA

facilities, and how often, are such clerkships operational? What demands does this place on long-term care physicians with respect to teaching and supervision? Are house staff allocations based adequately on the LTC needs of the VAMC? These same questions may need to be explored in relation to residents in different postgraduate years. Further, it is important to clarify the actual average time involvement of fellows assigned to long-term care units; for example, if a fellow is assigned "full-time" to a unit, how much time does this mean he or she generally spends per day on the unit?

6. Another concern of the long-term care panel is the importance of nonphysician practitioners (NPPs) in the provision of LTC services. There is a need to distinguish between different responsibilities and functions of nurse practitioners relative to physicians assistants, and the differential impact of each of these types of NPPs on physician time requirements. (The surveys conducted by the nonphysician practitioners panel, discussed in Volume II, *Supplementary Papers*, shed some light on these questions.) The panel also stresses that all NPPs should have maximum flexibility in all long-term care activities, in order to ensure optimal use of physician time.
7. One final and major point: Further iterations of the LTC SADI should have the capability of assessing physician time requirements for *all* of the following activities, defined by the VA's Office of Geriatrics and Extended Care as falling within its purview:

Nursing home care (VA, community, state home)
Domiciliary care (VA, state home)
State home hospital care
Hospital-based home care
Community residential care
Adult day health care
Hospice/palliative care
Respite care
Geriatric Research, Education, and Clinical Centers
Geriatric Evaluation and Management Units
Dementia and Alzheimer's disease initiatives
Information and referral services or activities

Hence, the scope of "long-term care" activities in the overall physician requirements methodology would be operationally defined in an appropriate fashion and could encompass the growing role of physicians in such programs as HBHC.

It is important to distinguish between geriatrics and long-term care, and to articulate the relationship between the two—demand for long-term care is not generated exclusively by geriatric patients, and geriatricians have responsibility for patients outside the long-term care setting.

Final Remarks

The panel urges the VA to adopt a form of the Reconciliation Strategy that uses expert judgment rather than statistical models to determine the amount of physician FTEE required for patient care, resident education, and administration within the LTC program of a VAMC. The remaining components of FTEE discussed above should be determined through a combination of empirically based and expert judgment-based approaches, as indicated.

The panel's estimates of physician requirements for three actual VAMCs, based on applications of the empirically based and expert judgment approaches discussed above, are summarized in Table 6A.8.

[Note: A more complete discussion of these results is found in the panel's report to the study committee; see Volume II, *Supplementary Papers*.]

Table 6A. 8 Estimates of Physician Requirements in Long-Term Care at Three VAMCs

A. Total FTEE						
VAMC	CDR3	PF[3]	DSE[4]	SADI[4]	SADI-Modified[1, 4]	Survey[2, 4]
VAMC I	0.7	0.3	2.3	3.2	1.3	2.5
VAMC II	1.6	1.3	2,7	3.1	2.4	2.5
VAMC III	3.3	3.1	3.0	3.3	2.5	3.0
B. Direct Care Plus Resident Education FTEE Only						
VAMC	CDR[3]	PF[3]	DSE[4]	SAD[4]	SADI Modified[1, 4]	Survey[2, 4]
VAMC I	0.6	0.2	1.5	0.5	0.5	N.A.
VAMC II	1.6	1.3	1.7	1.6	1.6	N.A.
VAMC m	3.3	3.1	1.2	2.1	2.1	N.A.

[1] Derived by replacing the SADI-based estimates for non-patient-care activities with estimates based on the DSE; all FTEE for patient care and resident training in the PCAs continue to be derived from the SADI.
[2] Panel median response to the question, posed by mail survey in September 1990, of what is the overall preferred physician FTEE level at each VAMC. To provide a context for the response, each panel member was presented with a summary of the physician FTEE level emerging, alternatively, from the CDR, from both empirlcally based approaches (as applicable), and from both expert judgment approaches.
[3] Does not include FTEE for consults by geriatricians to the non-LTC patient care areas, i.e., all PCAs except nursing home and intermediate care.
[4] Does not include FTEE for consults by nongeriatricians to nursing home and intermediate care PCAs.

7

Management Uses of the Physician Staffing Methodology

The previous three chapters have demonstrated how VA physician requirements can be computed from several different perspectives, then reconciled to produce staffing recommendations. The discussion of how the VA decision maker might put these results to use proceeds at two levels. In the first—management philosophy and strategy—there are two main issues to consider. In implementing any selected variant of the Reconciliation Strategy (see chapter 6), what is the most appropriate role of decision makers at VA Central Office *vis à vis* those at the VAMCs? And, how does the nature of the methodology itself influence this? The second issue is the degree to which analytical models for physician staffing, such as those developed here, should become one part of a larger decision support system for resource management in the VA.

Finally, specific examples are presented showing how the VA decision maker can apply components of the physician staffing methodology to ask certain "what if" questions important to resource management. In the process, the committee introduces the analytical machinery to address an issue raised frequently in the course of the study. Can physician requirements be determined through application of the empirically based models in ways that actively promote, or at least protect, the quality of care? The answer, in principle, is yes. An example at the end of this chapter shows how this might work.

VA DECISION MAKERS IN CENTRAL OFFICE AND THE VAMCS: PROMOTING AN DIALOGUE

Each VAMC's overall budget and personnel ceiling are approved by VA Central Office. But within these two management parameters, the number of physician Full-Time-Equivalent Employees (FTEE), by specialty, is determined largely at the VAMC level, with many local factors—including short-term personnel constraints—influencing the specification of physician staffing, by specialty.

By its very structure and logic, the Reconciliation Strategy implies that the allocation of physician FTEE across the system would be more centrally directed than is currently the case. Within a given specialty or program area, all facilities would be judged by the same criteria. There is the presumption that facilities with similar mission-related demands would be prescribed similar physician FTEE levels.

The committee was not asked to consider the budgetary costs of meeting VA physician requirements or how, if at all, the methodology could or should be linked to the budget process. However, the committee can envision a resource management policy in which the portion of the VAMC budget allocated to staff physicians is established in accordance with the FTEE targets (and intermediate targets) derived through applications of the Reconciliation Strategy.

The committee does believe that the likelihood of the physician staffing methodology influencing VA physician staffing is substantially greater if the methodology is made an integral part of the budget process at the facility level. Therefore, the committee recommends that the VA take steps to achieve this integration concurrently with the implementation of the methodology.

For the Reconciliation Strategy to be implemented successfully and to be improved over time, however, there must be strong channels of communication between Central Office and each VAMC. And the dialogue must be an active, two-way interchange. There are two reasons why this is crucial.

First, the acceptability of specific physician staffing levels—and of the methodology that produced them—is likely to be greater if they emerge from a process that genuinely engages the local facility. This does not mean that every facility director or chief of staff would be in agreement with every staffing target (or intermediate target) finally set. But local decision makers would have had the opportunity to present information judged relevant to the decision. Moreover, the criteria and reasoning behind that decision would be clear, precisely because it arises from a clearly defined decision process—the Reconciliation Strategy.

Second, any broadly applicable methodology for determining VA physician requirements—no matter how sound the statistics or thoughtful the expert judgment—will necessarily use models that are simplifications of reality. A model, by definition, cannot incorporate every factor that could influence the number of physicians required at every VAMC. In addition, certain variables that the VA decision maker might wish to include may have to be omitted simply because the data are missing or inadequate. Errors may occur in the measurement of some variables in the model in ways known to the local VAMC, but not apparent to the decision maker in VA Central Office.

Hence, a second fundamental purpose of the dialogue between Central Office and the VAMC is to ferret out and evaluate context-specific, "local" information that reduces the likelihood of model error. Put differently, the dialogue should improve the likelihood that each VAMC is treated fairly in the execution of the Reconciliation Strategy.

How might this dialogue work in practice? Applying the Reconciliation Strategy, decision makers in Central Office would derive, for all physician specialties and program areas at a given VAMC, FTEE targets and intermediate targets (see chapter 6). Whatever differences exist between actual and targeted staffing would be communicated to the facility, along with information describing how the targets were computed.

The facility would be expected to respond. If it agreed with the recommendations, there is little more to debate (except perhaps where the funds will be obtained to meet proposed staffing levels). But, on occasion, the facility may take exception to the targets; if so, it might wish to introduce supporting evidence not generally available at Central Office.

For example, non-VA consulting physicians might contribute significantly to productivity on the inpatient medicine patient care area (PCA); their exclusion from that PCA's production function (PF) means that the model might understate the *staff* physician FTEE required to meet workload if these consultants were to be curtailed. Similar "omitted variable" biases could arise if a nonphysician practitioner, such as the physician assistant, is a significant contributor to workload. It could also arise if capital equipment or physical space factors not included in the model are relevant to productivity in the medicine PCA.

This VAMC might be aware of certain data measurement problems that skew the medicine PCA staffing figures in its Cost Distribution Report (CDR). Or it might wish to contend that patients in this PCA are more severely ill than its overall weighted work unit (WWU) score indicates because the diagnosis-related-group (DRG) scheme (the clinical basis for the WWUs) does not discriminate adequately among these patients.

In each case, the VAMC could provide the supplementary information required for improving Central Office's understanding of the facts.

There also may be occasions when the facility would request new (typically additional) physician staffing levels in a specialty or program area as part of a proposed expansion of services or in response to other local conditions. The Reconciliation Strategy could be applied to generate evidence either supporting, or failing to support, the facility's request.

There are already precedents in the VA for policy decisions being influenced by a dialogue between Central Office and decision makers in the field; one of the more prominent examples arose in the context of Medical District Initiated Program Planning (MEDIPP) (Veterans Health Services and Research Administration, 1989). Preliminary hospital bed projections for each of (what used to be) 27 districts were transmitted from planners in Central Office to district planners and directors, who could either accept the allocations or appeal them by bringing to bear relevant VAMC-specific data and other pertinent information.

Because the proposed dialogue between Central Office and the VAMCs is oriented around the interpretation and evaluation of formal models for staffing, it is appropriate to reflect briefly on the general role of models in health care resource management.

USE OF MODELS IN MANAGEMENT DECISION MAKING

All management activities use models of some type in defining the scope of the problem under discussion and refining the elements of the decision making process. From the *balance sheet* of the accountant showing the sources and uses of funds to the *map* of the field commander showing the disposition of friendly and enemy forces, models of countless varieties and applications are used everywhere in administrative and management activities. So ubiquitous are implicit models or rules of thumb that many managers use them extensively without ever consciously realizing it. It brings to mind the story of Monsieur Jourdain in Moliere's *Bourgeois Gentilhomme* (Miller and Starr, 1960) who discovers, to his complete amazement, that he has been speaking *prose* for 40 years without realizing it!

Model building is not a totally new way of looking at a familiar problem, in this case, physician staffing. Rather, model building seeks to make explicit and to quantify the relationships between elements in the real world and to improve one's understanding of real-world phenomena. When the abstraction of reality that is used in management decision making consists only of words and some loosely related numbers, the resultant management decisions may carry with them some of the same quality of fuzziness. As the process of model building becomes more explicit, the assumptions used in the abstractions of reality become better defined. Also, since no model can capture all the richness of the reality upon which it is based, the process of modeling forces the manager to define the boundaries of the abstraction.

Models compress data and relationships that exist in life into manageable representations of reality that can be explored and manipulated more easily. The model, then, is always less complex and less complete than reality; but, to be useful, it must be sufficiently complete to represent those elements of the real world under investigation. Unfortunately, as the basis of a model becomes less familiar and, in particular, derives from statistical analyses, the model sometimes takes on a mystique that inhibits its appropriate utilization by management or, in the extreme, precludes even a rational evaluation of its merits.

In the remainder of this chapter, an attempt is made to remove some of this mystique. In particular, ways are suggested in which components of the physician staffing methodology might profitably be used in management decision making. Some suggestions are also made on how management might ensure that the models presented are valid representations of reality.

To be used effectively in management decision making, the physician staffing methodology must be adaptable to changing circumstances and to the availability of new data. Further, the usefulness of any management model will depend on whether it can be readily understood and presented to decision makers in a "user-friendly" fashion.

No model, regardless of how carefully it is crafted, can ever provide the final and definitive answer to a management problem. Models must be seen as advisory to the decision process. Indeed, this is an undergirding precept of the committee's proposed Reconciliation Strategy.

THE PHYSICIAN STAFFING METHODOLOGY AS AN COMPONENT OF AN VA DECISION SUPPORT SYSTEM

In the early days of management science modeling, the analysis of data and the solution of complex mathematical models were so time-consuming that results could be developed only offline and presented to management as "the solution." The process left management with little opportunity to interact with the models, to ask "what if" questions, or to posit entirely different formulations. Recent advances in the speed and availability of computing new solution methods and software for the creative presentation of data have all revolutionized the way management science models are developed and used. The integration of these models into management decision making has been facilitated by the development of decision support systems.

As generally used, the term "decision support system" means a computer-based system that assists the decision process by providing the manager with timely and relevant information so that the effects of alternative resource allocations can be understood and easily communicated. A decision support system typically has three components: a comprehensive data base, a high-level data-base manager or information processing software, and a set of appropriate decision models. It is the availability of decision models that differentiates the decision support system from a conventional management information system. A fourth element sometimes implied is the availability of user-friendly inputs and outputs. These typically take the form of menu-driven software perhaps with lightpen or touch-screen menu selection for input and the easy availability of presentation-quality graphic displays for outputs. These displays (charts, tables, three-dimensional plots) show the relationships between variables in the "what if" questions in a way that can be rapidly seen, understood, and communicated. Figure 7.1 depicts the relationship of these elements.

A management information system alone can be used to produce standard reports of operations or special reports on request. The decision support system goes beyond that to allow managers to pose complex "what if" questions, to explore the interrelationships of changes in one part of the system to others, and to forecast system performance under a variety of future alternative scenarios. Models for exploring these "what if" questions can take a variety of forms, but they have one common characteristic. Each is a compact representation of the relationships thought to exist in the real world. In the present study, each of the modeling components of the physician staffing methodology is such a compact representation.

To function properly within a VA decision support system, the physician staffing methodology would need to be backed up with accurate data bases on actual staffing for physicians and direct and indirect support personnel, availability of residents and fellows by specialty and postgraduate year of training, current workload levels, current and planned programs affecting physician requirements, facility characteristics, and so forth, as detailed in chapters 4 through 6.

In a comprehensively defined decision support system, the decision maker would also want the capability to explore the fiscal implications of physician staffing decisions *vis à vis* decisions about other types of personnel, capital equipment, and facilities. Although these nonphysician factors are important elements in a decision support system, they lie outside the scope of this study and are not analyzed in the examples that follow.

APPLYING THE METHODOLOGY TO RESOURCE MANAGEMENT QUESTIONS

This section illustrates how components of the physician staffing methodology can be further analyzed to help the VA decision maker better understand the implications of alternative management decisions.

Sensitivity Analysis

Sensitivity analysis permits management, through manipulation of the methodology's component models, to explore the following generic question: How does a key system output (e.g., patient workload) change in response to systematic variation in one or more inputs (e.g., physicians) or productivity-influencing factors (e.g., affiliation status)? Because the analysis is conducted within a model of the process, rather than the process itself, a broad range of alternatives may be explored quickly and cheaply with no disruption of the patient care process, or of administrative and clinical relationships. The ability to perform sensitivity analyses quickly and easily is an essential attribute of a decision support system.

Sensitivity analysis can also help the decision maker validate a model and better understand its implications. As management poses questions of the staffing methodology (e.g., the physician FTEE required to staff the psychiatry service at VAMC I in FY 1991), sensitivity analysis can indicate whether the answers are implausible or counterintuitive. If the methodology's recommendations are consistently at variance with management's prior expectations, it is possible that some important relationship was misspecified in the component models, that inappropriate input data were used in exercising the models, or that some important real-world constraints have been ignored. In any event, sensitivity analysis likewise can be used to identify changes that must be made in the models or their application to improve validity.

A pair of examples drawn from the current study illustrates the process of sensitivity analysis and also provides a vehicle for noting both its benefits and its limitations. Both the production function (PF) and the inverse production function (IPF) variants of the Empirically Based Physician Staffing Models (EBPSM) provide a means of studying the relationship between physician staffing and patient workload (typically measured in WWUs).

Exploring the PF Variant

Consider again the estimated PF equation for the inpatient medicine PCA, as presented in chapter 4 (but with *t*-statistics now omitted):

$$\begin{aligned} W = {} & 6.144 + 0.213\ \text{MED\_MD} - 0.007\ (\text{MED\_MD})^2 \\ & + 0.138\ \text{SUR\_MD} + 0.163\ \text{PSY\_MD} + 0.106\ \text{NEU\_MD} \\ & + 0.015\ \text{RESIDENTS} + 0.015\ \text{FELLOWS} \\ & + 0.048\ \text{SUPPORT/MD} + 0.048\ \text{SOCW} \\ & - 0.237\ \text{HGROUP6} \\ & - 0.003\ (\text{MED\_MD} \times \text{FELLOWS}) \end{aligned} \qquad (4.11)$$

To proceed with the sensitivity analysis, some VAMC is selected and plausible values are assigned to the right-hand-side variables; in Equation 4.11, all except HGROUP6 involve inputs into a production process that yields workload (*W*), expressed here in terms of WWUs. Then, one or more inputs are varied from their initial values and the workload response can be observed. That is, the sensitivity of output to specific changes in input usage can be examined. (A preview of such analyses was presented in chapter 4 when the coefficient estimates in Equation 4.11 were being interpreted.)

Suppose the initial variable values are as follows: MED_MD = 9.00, SUR_MD = 0.25, PSY_MD = 0.20, NEU_MD = 0.50, RESIDENTS =

20.00, FELLOWS = 15.00, SUPPORT/MD = 12.00, SOCW = 4.50, and HGROUP6 = 0 (i.e., this inpatient medicine PCA is assumed not to be located in a large psychiatric hospital). Given these hypothetical values, the derived predicted value of workload is 5,045 WWUs/yr.

Assume, for illustration, that two additional full-time internists are added (i.e., MED_MD is increased from 9.00 to 11.00), while support staff are incremented so as to preserve the current level of support-staff intensity—that is, maintain SUPPORT/MD at 12.00.[1] Then, all else equal, predicted workload increases to approximately 5,335 WWUs/yr. The comparatively small increment in predicted workload is attributable to the combined effect of diminishing marginal productivity (as captured in the squared term in Equation 4.11) and the negative interaction effect with FELLOWS, which worsens as MED_MD increases (for any given value of FELLOWS).

This type of analysis can easily be extended to consider changes in several other inputs at once (in addition to SUPPORT) or to trade off increases in one input for decreases in another. If there were dollar costs available to associate with each input change, the net change in workload for each proposed change in budgetary allocation could be estimated.

If such sensitivity analyses were to be performed in a functioning decision support system, the response of output to specified input changes could be displayed graphically in real time to permit rapid visualization and interpretation. To illustrate, the graph of workload as a function of internist FTEE in the inpatient medicine PCA of a hypothetical facility is shown in Figure 7.2; as above, it is assumed that all other variables in Equation 4.11, including SUPPORT/MD, are held fixed. The figure clearly indicates that successive increases in internist FTEE cause workload to increase, but at a decreasing rate, all else equal.

The graph also illustrates the danger of projecting too far beyond the range of the data on which the model is based. Figure 7.2 implies that if internist FTEE is increased beyond about 12, the marginal output per additional internist becomes negative. The real world probably does not behave this way. This is a result of the model providing the best statistical fit within the range of the original data. It also illustrates the value of having readily available graphic displays to supplement tabular summaries of the data.

This statistically derived PF indicates most precisely the relationships between inputs and outputs when the prediction is made at the sample mean

[1] This would be accomplished as follows. The assumption that SUPPORT/MD = 12.00 at baseline implies that SUPPORT = 119.40 FREE, since MD (the sum of all direct-care FREE for hands-on physicians in the PCA) is 9.00 + 0.25 + 0.20 + 0.50 = 9.95. That is, 119.40/9.95 = 12.00. When MED_MD becomes 11.00, MD increases to 11.95, and SUPPORT must rise to 143.40 FTEE for SUPPORT/MD to remain 12.00.

values of the inputs. When an attempt is made (as it surely will be) to ask the model to predict output for input values departing significantly from those observed in the sample, the statistical confidence in the prediction diminishes (see Kmenta, 1986).

In general, if radical changes in scale are contemplated, such models are ill-equipped to provide management with accurate insights on the anticipated outcome. Also, the model assumes that the technology of care underlying the input-output relationships found in the original sample will not change significantly over time.

Similar cautions apply to the expert judgment models. The decision maker's confidence in prescriptions derived through the SADI or the DSE diminishes as the forecasts extend beyond the scale of operations, organizational structures, and technologies familiar to the expert judges.

The examples above represent but one type of application of sensitivity analysis. Within the EBPSM framework, many other interesting questions can be asked, some more statistically complex than above.

Note, for example, that the parameters of the PF and the IPF are estimated with uncertainty; each reported coefficient estimate is, in fact, the mean of an estimated distribution of possible values. Computer simulations can be conducted to investigate the sensitivity of workload production (in the PF) or physician requirements (in the IPF) to random variations in these coefficient values around the estimated means.

Sensitivity analysis could be applied equally well within the expert judgment approaches to staffing. In applications of the SADI, the sensitivity of physician requirements for PCA-related activities to variations in task performance times could be examined. In another type of query involving the SADI (or the DSE), one could study the effect on physician FTEE requirements of alternative rules for combining the task-time estimates of individual experts to derive group consensus estimates.

Yet another application, quite simple but powerful, would be to chart how the FTEE recommendations emerging from the Reconciliation Strategy vary with the weighting parameters *b*, *c*, and *d*, as defined in Equation 6.1.

Exploring the IPF Variant

Consider next the estimated IPF equation for surgeons, as presented in chapter 4 (again, *t*-statistics are omitted):

$$\begin{aligned} \text{SUR\_MD}' &= 0.959 + 2.172\ \text{SURWWU} \\ &+ 0.0007\ \text{SURCAPWWU} - 1.773\ \text{HGROUP6} \\ &- 0.009\ (\text{SURWWU} \times \text{SURCAPWWU}) \\ &+ 20.731\ (\text{SURWWU} \times \text{HGROUP6}) \qquad (4.26) \end{aligned}$$

The salient sensitivity analysis question now is: How does the surgeon FTEE required for patient care and resident education at the VAMC vary as the amount of surgical workload is systematically altered? Let the hypothetical baseline values of the right-hand-side variables be: SURWWU = 0.65; SURCAPWWU = 150; and HGROUP6 = 0. (For computational reasons, workload in the IPFs is deflated by the constant multiplier 10,000.)

The effect of changes in surgery inpatient workload on surgeon requirements is summarized in Figure 7.3. In this case, there is evidence of diminishing marginal productivity for surgeons, but it is not so visually obvious as in the medicine example; a close examination of Figure 7.3 reveals that the relationship between SURWWU and SUR-MD' is not linear, but slightly concave. Thus, as inpatient workload increases, surgeon FTEE for patient care and resident education must increase, at a slightly increasing rate.

As with the PF equation, caution must be exercised about predicting physician FTEE for workload values that differ significantly from those in the sample that is used to estimate the equation. In particular, as each right-hand-side variable in Equation 4.26 departs from its sample mean value, the prediction error on SUR-MD' increases. Correspondingly, the 95 percent prediction interval widens (see chapter 4), and statistical confidence in the prediction is reduced (Kmenta, 1986).

Such sensitivity analyses provide useful insights about input-output relationships at a given VAMC. However, they are not geared to deal with a second type of management issue (outlier analysis) of considerable importance to the VA decision maker if the Reconciliation Strategy is to be implemented as advocated earlier.

Outlier Analysis: Comparing Actual Versus Model-Predicted Values for Physician Ftee and Patient Workload

One potentially important aspect of the dialogue envisioned between Central Office and the individual VAMC is a careful scrutiny by all parties of the facility's actual performance, along several possible dimensions, in comparison with the performance predicted from components of the physician staffing methodology. Two important, and related, dimensions are physician FTEE levels and workload productivity.

If there is little difference between actual and predicted performance in a particular area, the facility is operating according to expectations, and further inquiry typically would not be indicated. If there is a significant difference between actual and predicted—that is, if the facility is an "outlier"—the reasons should be explored.

Such gaps do not necessarily indicate that the VAMC is managing its resources poorly. There may be good justification for why physician FTEE or workload production is higher or lower than expected, based on one or more of the staffing models. Or there may not be. Through the two-way dialogue, these points can be put forward, discussed, and resolved.

To illustrate how the physician staffing methodology can inform this discussion, an actual-versus-predicted analysis using both variants of the EBPSM is conducted. Specifically, IPFs are used for medicine, surgery, and psychiatry specialties to predict the total amount of physician FTEE for patient care and resident education expected at two actual facilities, VAMC II and VAMC III, in FY 1989. These predictions are then compared with the corresponding actual FTEE reported by the facility, and the percentage difference is computed.

In parallel, PFs are used for the medicine, surgery, and psychiatry inpatient PCAs to predict the workload volume expected in these PCAs at VAMCs II and III in FY 1989. (Recall from the PFs reported in chapter 4 that workload is measured in WWUs in the inpatient medicine and surgery equations and in bed-days of care in the inpatient psychiatry equation.) The workload predictions are compared with the corresponding actual WWUs generated in FY 1989, and the percentage difference is computed.

These calculations are summarized in Table 7.1. The data are displayed so that the percentage difference in FTEE for each specialty at a facility is paired with the percentage difference in workload production for the PCA in which it is arguably the "dominant" physician specialty. Thus, the internist is assumed to be the dominant physician in the inpatient medicine PCA, and so on.

The focus is first on psychiatry staffing at VAMC III, a medium-sized unaffiliated facility. When VAMC III's actual FY 1989 values for workload and other variables are inserted in the psychiatry IPF, it can be shown that the expected FTEE level for patient care and resident education is 12.84. The facility's CDR indicates that 8.47 psychiatrist FTEE were allocated to these purposes in FY 1989. The percentage difference is thus [(8.47-12.84)/12.84] × 100 = -34.0.

In both surgery and psychiatry, a common pattern arises at both facilities. For a given total workload (not necessarily just inpatient), each IPF indicates that actual staffing is below what is expected for a VA facility with its attributes (e.g., affiliation status). Likewise, for a given FTEE distribution of physician and nonphysician personnel (not just in the dominant specialty), each PF indicates that actual workload productivity in the PCA is greater than expected for a VA facility with its attributes. Although such a parallel pattern is not logically required, it does appear plausible. On the other hand, the pattern does not arise in medicine. This could be explained by historical staffing patterns that have not been adjusted to reflect actual workload.

The main point is that such analyses focus and facilitate the inquiry about the appropriateness of current staffing levels. Questions naturally are raised, information is introduced in response, and the Reconciliation Strategy can function as intended.

The actual-versus-predicted analysis of Table 7.1 can be extended clearly to encompass all physician specialties, PCAs, and also the expert judgment approaches to deriving predicted FTEE.

Choosing an Optimal Specialty Mix of VA Physicians Through Linear Programming

The examples considered thus far have been developed in an unconstrained environment. That is, only the relationships between specified inputs and outputs have been considered without taking into account factors that impinge on the availability and productivity of inputs. Each input costs money, takes up space, requires supervision or support services, and so on. If these realities are not considered, the solution developed from the model might make perfect statistical sense, but violate real-world fiscal or operational constraints.

In the day-to-day delivery of VA medical care, there are implicit bounds (upper and lower) on the relative proportions in which various providers are combined to meet mission-related activities in the PCAs. For example, residents require supervision, which is typically less than 1 to 1 but more than 1 to 30. In the inpatient medicine PCA, consultations are made by physicians from most other services, but rarely is the implied FTEE close to that contributed by the medicine service itself.

In the delivery of VA medical care as envisioned in the SADI and the DSE, there are *prescriptively* determined (though implicit) bounds on the ratios between physician specialties and between physicians and other types of personnel. Moreover, in some instances, the judgment may be that some minimum level of physician FTEE, in one or more specialties, is required to promote the quality of care.

One methodology that can be used to represent these constraints explicitly—and ensure that all are considered simultaneously while deriving an optimum allocation of resources—is linear programming (Dorfman et al., 1958). Three simple applications are presented below to illustrate further how components of the physician staffing methodology might fit into the decision support framework. With respect to Figure 7.1, such mathematical programming models represent one member in the set of possible models that fit into the third box. The VA decision maker could call upon the models as needed.

The following three linear programming problems focus on the ambulatory medicine PCA. The VAMC modeled here represents no particular facility, but would be representative of many large affiliated VAMCs (assume RAM Group 5) with a busy ambulatory medicine PCA.

Problem 1

Suppose a decision maker at the VAMC wishes to determine what combination of staff physician FTEE, by specialty, will minimize the total annual physician-related salary cost of providing care in the ambulatory medicine PCA as the number of assigned residents is varied from zero to some previously agreed upon maximum, while satisfying the following constraints: (a) provider FTEE will be adequate, in sum, to meet the workload projected for the PCA, and (b) the FTEE ratios between types of attending physicians will not vary beyond the upper and lower bounds of similar ratios observed across the VA system.

To operationalize the output constraint specified in (a), the PF for the ambulatory medicine PCA (Equation 4.17) is used. Specifically, FTEE levels entered into this PF must be large enough, and in the proper mix, so that the ambulatory workload levels that these inputs are expected to produce equal or exceed the projected ambulatory workload. For this example and the variants that follow, the projected workload is assumed to be 3,859,312 capitation weighted work units (CAPWWUs).

To effectively use the linear programming method of solving constrained optimization problems, both the objective function (in this case, the sum of the weighted salaries) and the constraints (in this case, the PF and the staffing ratios) must be linear functions of the decision variables (i.e., contain no quadratic or higher-order terms, no interaction terms, and so on). When these conditions are not met, one generally must resort to a nonlinear programming solution technique. In the case at hand, Equation 4.17 does contain a quadratic (squared) term, but it enters in such an uncomplicated manner that the equation can be readily approximated by a piecewise linear function with little loss in solution speed and accuracy.

Using systemwide representative salaries for MED_MD, OTHER_MD, and RESIDENTS, and assuming (for simplicity only) that there are no rehabilitation medicine physicians available for this PCA at the facility, the linear programming problem can be stated formally as follows:

$$\text{Minimize} \quad \$88{,}555\ \text{MED\_MD} + \$90{,}113\ \text{OTHER\_MD} + \$30{,}068\ \text{RESIDENTS, subject to:}$$

$$\text{(a)} \quad 0.063\ \text{MED\_MD} + 0.060\ \text{OTHER\_MD} + 0.150\ \text{RESIDENTS} - 0.010\ (\text{RESIDENTS})^2 \geq 0.800,$$

$$\text{(b)} \quad 10.8 \leq \text{MED\_MD/OTHER\_MD} \leq 15.6$$

$$1.0 \leq \text{MED\_MD/RESIDENTS} \leq 2.0$$

The objective function to be minimized is simply a general statement of the salary costs of these physicians defined as relevant to the problem. The left-hand-side of the production constraint, (a), is that part of the ambulatory medicine PCA PF pertaining to the decision variables in the linear programming; the remaining terms of this PF (in general, those not pertaining to a decision variable) are collected on the right-hand side of the constraint.

Referring to Equation 4.17, RMS_MD has been assumed to be zero; the facility is in RAM Group 5, so that HGROUP(3+5) = 1; and thus HGROUP6 = 0, as will the interaction term involving it. Hence, the right-hand side of (a) is computed in this instance as

$$[\text{Projected } W - \text{Constant Term} - \text{Term involving HGROUP}(3+5)]$$
$$= \ln(3{,}859{,}312 + 1) - 14.017 - 0.349 = 0.800.$$

Regarding the inequalities in (b), the first constrains the ratio of MED_MD to OTHER_MD to be ± 20 percent of the typical such ratio in similar VAMCs. The other constraint is designed to ensure adequate staff physician supervision of residents. Both constraints are, of course, illustrative.

To demonstrate the effect on staffing and cost of systematically varying the number of residents, these relationships are used but the number of residents is constrained to be less than a given upper bound, which starts at zero and stops when RESIDENTS passes the point of positive marginal productivity.

The result of this analysis is shown in Table 7.2 and displayed graphically in Figure 7.4. In each case, the staffing shown for the MED_MD and OTHER_MD is that which results in the minimum salary cost, given that the number of residents is constrained to be no less than 0, 1, 2, etc. In this ambulatory medicine PCA, residents closely substitute for staff physicians, resulting in diminishing salary costs until the point is reached where the addition of more residents no longer justifies their salary expense. Clearly, in an actual application with these characteristics, one would not add more than six residents unless it was felt that the teaching mission or some other benefit not captured in the salary minimization objective justified this additional expense.

Problem 2

As noted in chapter 2, the VA Office of Quality Management is developing statistical models relating measurable outcome indicators of the quality of care to various structure and process characteristics of the VA system. In due course, the relationship between physician FTEE and quality indicators will likely be examined.

Suppose, for example, that such analyses were to indicate that for high-quality care, the number of residents should never exceed the number of staff physicians assigned to the ambulatory medicine PCA. In this case, the constraint on resident supervision in (b) must be adjusted so that

$$\text{MED\_MD} \geq \text{RESIDENTS}$$

Under these more constrained conditions the result of the linear programming analysis is:

$$\begin{aligned}\text{MED\_MD} &= 4.730\\ \text{RESIDENTS} &= 4.730\\ \text{OTHER\_MD} &= 0.303\end{aligned}$$

The salary cost is $588,427 which is, of course, lower than the four-resident solution but higher than the five-resident solution. Although these tradeoffs are easy to see in this rather simple example (which is one reason why it was chosen), they are less obvious in cases where many more variables are involved and literally an infinite number of solutions are feasible, but only one (or a very small number) of "best" solutions exist.

Problem 3

As a final example, suppose that staffing policy at the VAMC requires that this PCA must have at least 0.500 OTHER_MD assigned. Let the number of residents achieve its optimum (i.e., cost minimizing) level. Under these conditions the optimum solution is:

$$\begin{aligned}\text{MED\_MD} &= 3.651\\ \text{OTHER\_MD} &= 0.500\\ \text{RESIDENTS} &= 6.000\end{aligned}$$

The cost of this solution is $548,761, higher than the optimum solution in which OTHER_MDs is smaller. In fact, any deviation from the optimum six-resident solution presented earlier will lead to higher costs. The only way to lower costs is to staff at a level less than required to produce the projected CAPWWU output. This would clearly violate the original workload target requirement.

An interesting alternative linear programming formulation of this problem (not presented here) is to recast the question as: What is the maximum output obtainable within a given budget constraint? In that case, the roles of the objective function and the output constraint above are reversed, but the analysis proceeds similarly.

These few examples illustrate the variety of ways that the empirically based models can be utilized within a decision support framework to assist management in the rapid evaluation of alternative staffing configurations. Combined with the expert judgment approaches, these systems (once fully developed) should lead to a better understanding of the budgetary and organizational consequences of staffing decisions.

Although not illustrated here, sensitivity analysis and other decision management techniques can be applied likewise to the expert judgment staffing models. If both the empirically based and expert judgment models are fully integrated into a comprehensive VA decision support system, it would be possible to derive a better understanding of the budgetary and organizational consequences of alternative staffing proposals.

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Table 7.1 Comparisons of Actual Versus Model-Predicted Values of Physician Staffing and Workload for Three Specialties at Two Actual VAMCs

% Departure from Predicted Value = [(Actual Value-Predicted Value)/Predicted Value] × 100

Physician Specialties	VAMC	Physician FTEE for Patient Care and Resident Education[1] (%)	Weighted Work Units (WWUs) for the Specialty's Dominant Inpatient PCA[2] (%)
Medicine	II	1.2	8.2
	III	44.9	-0.3
Surgery	II	-3.8	9.0
	III	-13.9	12.4
Psychiatry	II	-15.4	26.5
	III	-34.0	103.3

[1] From the Inverse Production Function.

[2] From the Production Function.

Table 7.2 Optimal Staff Physician FTEE and Corresponding Total Salary Cost for a Hypothetical Ambulatory Medicine PCA as the Number of Assigned Residents is Varied

RESIDENTS	MED_MD	OTHER_MED	Salary Cost
0	11.968	0.767	$1,128,939.00
1	9.873	0.633	961,442.00
2	8.078	0.518	822,169.00
3	6.582	0.422	711,120.00
4	5.386	0.345	628,298.00
5	4.488	0.288	573,692.00
6	3.890	0.249	547,313.00
7	3.890	0.249	577,381.00

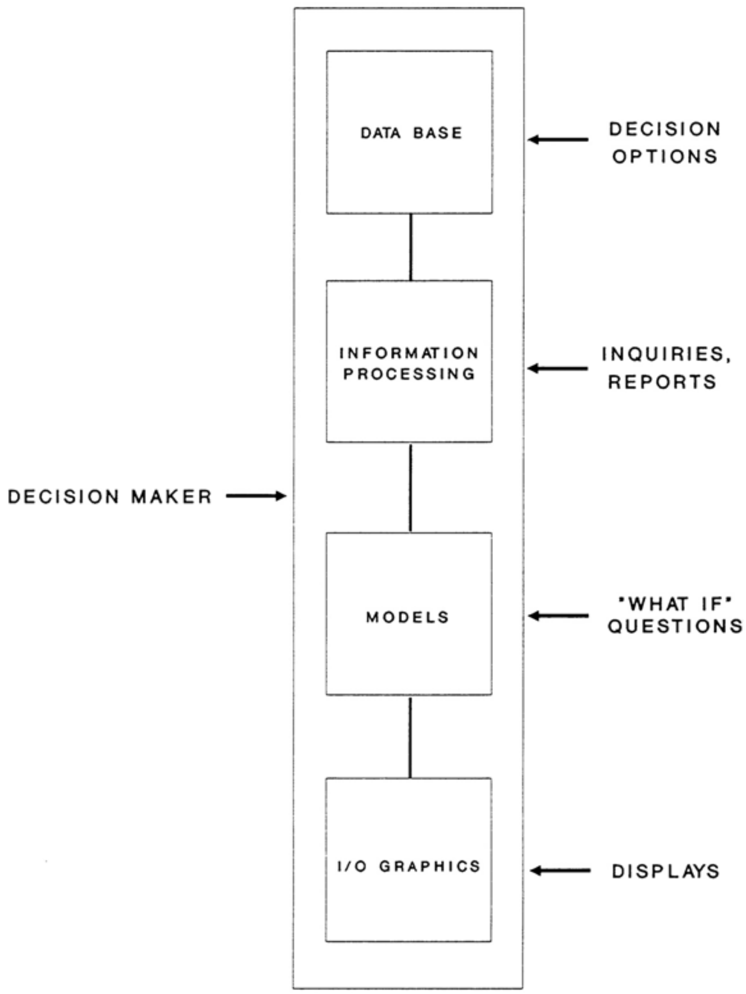

FIGURE 7.1 Elements of a Decision Support System

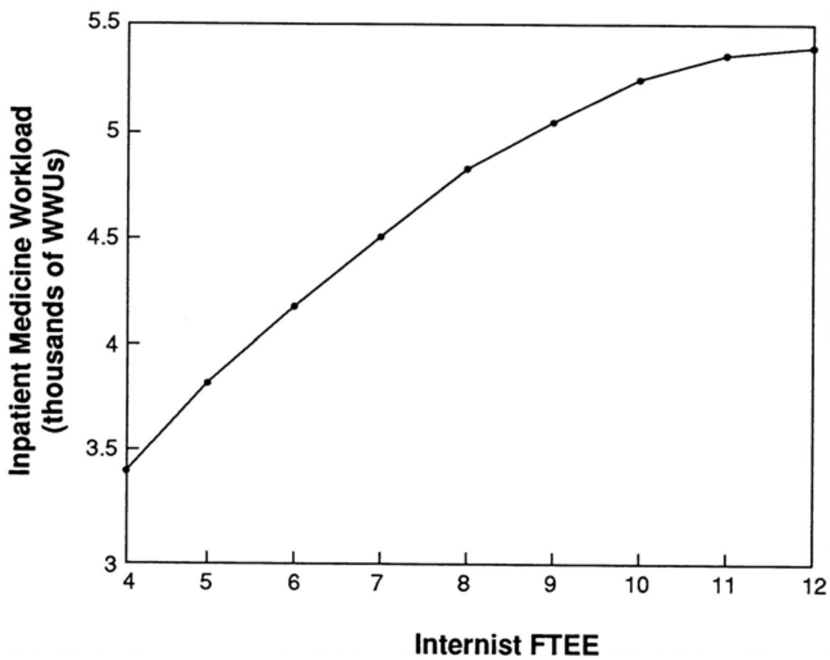

Figure 7.2
Nonlinear Relationship between Internist FTEE for Patient Care and Medicine Service Workload, as Derived from the Inpatient Medicine Production Function

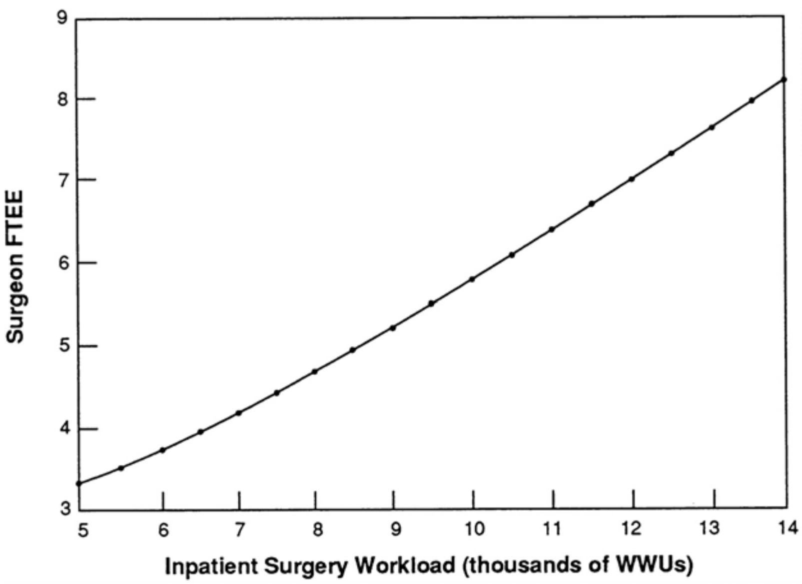

Figure 7.3
Impact of Surgery Inpatient Workload on Surgeon Requirements for Patient Care and Resident Education, as Derived from the Surgery Inverse Production Function

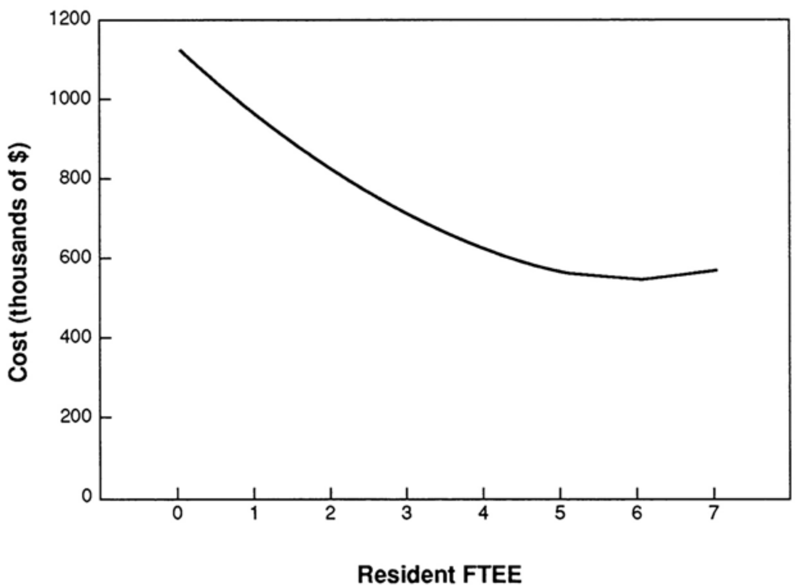

Figure 7.4
Impact of Variations in Resident FTEE on Physician Salary Cost in the Ambulatory Medicine PCA of a Hypothetical Large Affiliated VAMC

8

Projecting Future Patient Workload

A critical element in any application of the methodology presented in chapters 4 through 6 to determine future VA physician requirements is an estimate of future VA patient utilization (workload). This chapter focuses on the derivation of these estimates.

Consistent with the VA's original request to the Institute of Medicine, the committee determined that its methodology should be capable of taking into account projected changes over time in the volume and case mix of workload resulting from the aging of the veteran population (Institute of Medicine, 1987). The methodology also should be flexible enough, in the committee's view, to incorporate the influence of other factors possibly affecting workload, such as the proportion of females in the veteran population or the distribution of veterans across eligibility-for-care categories.[1]

A detailed account of how the methodology can be used to determine future VA physician requirements, by specialty or program area, is presented in chapter 4, where illustrative applications are shown for four actual VA medical centers (VAMCs) for FY 2000 and 2005. The important role that these workload projections play in management applications of the methodology, such as

[1] In 1986, Congress established three categories of eligibility for VA health care. The VA is required to provide hospital care and may provide outpatient and nursing home care, free of direct charge, to veterans within category A, defined to include those with service-connected disabilities, low-income veterans without such disabilities, and certain "exempt" veterans, including (for example) former prisoners of war, those exposed to Agent Orange, recipients of VA pensions, and those eligible for Medicaid. Veterans not in category A are assigned to either category B or category C on the basis of current income and net worth; the VA may provide care to these veterans on a "resources available" basis. At any point in time, there are well-defined income limits establishing eligibility for category B. Veterans not eligible for category B on the basis of either income or net worth are placed in category C.

In fiscal year 1989, more than 95 percent of the applications for health care at all VA facilities in the country were from veterans in category A (U.S. Department of Veterans Affairs, 1989).

sensitivity analysis, is demonstrated in chapter 7. However, those chapters and their applications deal only with the empirically based approaches built around the production-function (PF) and inverse-production-function (IPF) equations. From chapter 5 (and especially Figures 5.1 and 5.3), it should be clear how the expert judgment-based approaches, after further refinement, could be applied in an analogous fashion to determine future physician requirements.

Each empirically based or expert judgment approach requires estimates of future workload, developed at the level of specificity and detail appropriate for the case at hand. In the PF equations, the required projections take the form of W_{iji}, the workload for patient care area (PCA) *j* at VAMC *i* for fiscal year *t*. In the IPF equations, projections are required for W_{ijki}, the workload associated with physician specialty *k* in PCA *j* at VAMC *i* for FY *t*. (See Equations 4.9 and 4.10, and the subsequent discussion "Using VA Data to Assign Values to Variables" in chapter 4.)

In the expert judgment approaches, future workload must be projected at a somewhat greater level of detail than for the Empirically Based Physician Staffing Models (EBPSM) applications. In applications of either the Staffing Algorithm Development Instrument (SADI) or the Detailed Staffing Exercise (DSE), inpatient and long-term care workload must be projected by ward within PCAs, while taking into account consultations across PCAs as well as the volume of specialized diagnostic and intervention procedures performed by physicians. Under either expert judgment approach, ambulatory workload must be projected by specialty clinic within ambulatory PCAs.

The main purpose of this chapter is to describe and briefly illustrate how these workload projections can be derived. For the analyses, the committee adopted several working assumptions:

• Following the recommendation of its data and methodology panel, the committee agreed that the workload projection methodology developed for this study would reflect an adaptation of existing VA approaches. This is in line with the statement of work, which notes that, "The development of a formal mathematical/statistical patient care effective demand model is beyond the scope of this study."

The committee also was influenced by two other considerations. First, the workload projection approaches described in this chapter are being used to guide VA resource allocation decisions, especially those related to facility planning. All else equal, it is preferable that the workload projections driving decisions about the requirements for beds, physicians, and all other resources be mutually compatible and logically consistent. This consideration becomes all the more important if the allocation of these resources is analyzed interactively within a decision support system, as discussed in chapter 7.

Second, the major alternative approach to deriving future workload—namely, a statistically estimated demand-for-care model based on economic theory considerations—is a complex undertaking, sufficient in scope and scale to merit a separate study.

The committee believes that it is a study worth undertaking, as indicated in its concluding recommendations in chapter 11. The precision and specificity—and thus the policy usefulness—of the workload projection methodology would be enhanced if predictions about veteran utilization of the VA system could be derived as a function of such demand-influencing factors as income, health insurance coverage, availability of alternative sources of care, perceived quality of VA care (as indexed by such variables as scope of services), and distance from the VAMC, as well as age, gender, and eligibility-for-care status. A veteran's employment status will be an underlying determinant of several of these factors.

• The formulas presented in the next three sections of this chapter—and the resulting workload projections that were used in the chapter 4 illustrations—do adjust for age, but not for gender or eligibility-for-care status.

Because only 4.6 percent of the present veteran population is female (U.S. Department of Veterans Affairs, 1991), the sample sizes would be exceedingly small for most of the female-specific population cells required for a gender-specific breakout of W_{iji}, and W_{ijki}. Unstable estimates for the female cells would likely result.

Not presently available are projections of the veteran population by eligibility-for-care status at the level of specificity required for splicing W_{iji}, and W_{ijki} on this basis.

However, it is straightforward to extend the present workload projection models to accommodate both gender and eligibility (and other factors), once the required data become available.

• Over the next three sections it will become clear that existing VA workload models are readily adapted for the projections required by the EBPSM. This is less the case for the expert judgment approaches. In each section, procedures are proposed and illustrated for using projections of W_{iji}, and certain proportionality assumptions, to derive corresponding projections for the workload variables used in the SADI and the DSE. It is not difficult, in concept, to derive independent projections for the SADI or the DSE workload variables, but additional data collection and analyses would be required.

• The sequence of steps to derive workload projections from any of the models below is similar. For example, age is assumed to be the only variable in the projection model. For each VAMC *i* and PCA *j*, the mean value of current workload is computed per veteran for each age cell, the size of the veteran population in each cell is estimated for the fiscal year of interest, the (current) mean workload per veteran of each cell is multiplied by its projected cell size, and cells are summed to derive total workload for that fiscal year.

Throughout, this estimate is termed the *projected* workload to denote its derivation via this particular, nonprobabilistic process. Workload estimates that might be derived from statistically based demand-for-care models are termed *predictions*. Statements about statistical confidence can be made about the latter but not about the projections derived by use of existing VA techniques. (A similar distinction in terminology was made in chapter 4 regarding the physician FTEE estimates emerging from the IPF versus the PF.)

In the remaining sections, the models are presented in some detail because the committee believes that it is important for the reader to appreciate the way in which particular assumptions translate into particular workload projections. Only then can the strengths and weaknesses of this projection approach be assessed objectively.

One should not infer from the formula-oriented presentation below that these models are to be applied mechanistically in the Reconciliation Strategy. In the dialogue envisioned between VA Central Office and the VAMCs, the validity of particular workload projections would be a prime topic for discussion.

As noted in chapter 7, a precedent for such dialogue has been established in at least one aspect of the VA's strategic planning operations. In the Medical District Initiated Program Planning (MEDIPP) process that was active until 1990 (Veterans Health Services and Research Administration, 1989), planners in Central Office provided district planners with preliminary estimates of future VA hospital bed requirements. District planners would typically transmit these projections to decision makers at the individual VAMCs; discussions would ensue; and periodically the district would ask Central Office to modify the projections, marshaling data and qualitative arguments to make the case.

With the abolition of districts as part of a VA reorganization in 1990, this process has been suspended temporarily (and replaced by the Resource Planning and Management [RPM] methodology). But the *concept* of the process is important, for it provides a practical means to carry out the committee's intent that the formulas guide, not govern.

INPATIENT WORKLOAD

This discussion focuses on the derivation of inpatient workload projections required for the EBPSM. A procedure for obtaining workload projections for the expert judgment models is presented subsequently.

PROJECTIONS FOR THE EBPSM

As noted in chapter 4, the inpatient care workload measure that, with one exception, performed best overall on statistical and clinical criteria was the

Weighted-Work-Unit WWU) score; the exception came in the inpatient psychiatry PF equation, where bed-days of care (BDOC) was preferable.

Hence, the presentation here centers around the WWU. In applications involving the inpatient psychiatry PF equation in chapter 4, BDOC in the psychiatry inpatient PCA is assumed to grow over time in proportion to total WWUs there.

Projection Model

The basic equation underlying the inpatient workload projection model is

$$\text{WWUs} = (\text{WWUs/Discharges}) \times \text{Discharge Rate} \times \text{Vet Pop} \qquad (8.1)$$

The equation says that future WWUs will be calculated as the product of the projected number of WWUs per inpatient discharge, the number of discharges per veteran (Discharge Rate), and the size of the veteran population. Since the product of the latter two is simply the projected number of discharges, the equation calculates projected WWUs as the product of projected WWUs per discharge and projected discharges.

The operational form of this equation (the version used to project workload in practice) is somewhat more complicated because it must accommodate several considerations: aging of the veteran population, differentiation of WWUs by physician specialty category (see "Using VA Data to Assign Values to the Variables" in chapter 4), and the breakout of the VAMC into PCAs.

When these are acknowledged, Equation 8.1 becomes

$$\text{WWU}_{ijkt} = \sum_{a=1}^{A} (\text{WWU}_{ijk,\,1989,\,a} / \text{Discharges}_{ij,\,1989,\,a}) \times \text{Discharge Rate}_{ijta} \times \text{Vet Pop}_{ita}, \qquad (8.1')$$

where

WWU*ijk*, 1989, *a*	=	total WWUs associated with specialty *k* generated by age group *a* in PCA *j* of VAMC *i* in FY 1989;

Discharges*ij*, 1989, *a*	=	the number of age group a discharges from PCA *j* of VAMC *i* in FY 1989;
Discharge Rate_{ijia}	=	the projected number of age group a discharges from PCA *j* of VAMC *i* in FY *t*, divided by the projected age group a veteran population size in the Primary Service Area (PSA) associated with VAMC *i* in FY *t*;
Vet Pop_{ita}	=	the projected age group a veteran population for the PSA of VAMC *i* in FY *t*.

The inpatient PCAs are medicine, surgery, psychiatry, neurology, rehabilitation medicine, and spinal cord injury (SCI). The age groups are 0-24, 25-34, 35-44, 45-54, 55-64, 65-74, and 75 +, so that $A = 7$.

The PSA of VAMC *i* is defined as the set of contiguous counties such that each has a plurality of its medical and surgical VA inpatient discharges from VAMC *i*. Loosely, the PSA of VAMC *i* is the group of counties generally served by that facility. It is a concept long used in VA facility planning and serves to define the catchment area (and thus, roughly, the VA target population) for each VAMC. Workload projections for all PCAs in this study use this same definition of a PSA, except for SCI. PSAs are defined on a regional basis, but the principle of trying to capture the appropriate target population is the same.

For the PF variant of the EBPSM, the required form of projected workload is

$$\text{WWU}_{ijt} = \sum_{k=1}^{5} \text{WWU}_{ijkt} \qquad (8.2)$$

where the five specialty-associated types of WWUs generated on any inpatient PCA *j* are (using the notation of chapter 4) MEDWWU, SURWWU, PSYWWU, NEUWWU, and RMSWWU.

For the IPF variant, the required form of projected workload is

$$\text{WWU}_{ikt} = \sum_{j=1}^{6} \text{WWU}_{ijkt} \qquad (8.3)$$

where the sum is across the six inpatient PCAs, and *k* is now properly interpreted as one of the six physician specialties linked expressly to an inpatient PCA (medicine, surgery, psychiatry, neurology, rehabilitation medicine, and

SCI). For a specialty such as nuclear medicine, with no single PCA link, the inpatient workload variable is defined as the sum of some specified subset of the WWU_{iki}, in Equation 8.3 (see "Estimated PF and IPF Equations" in chapter 4).

Although these projection techniques are similar to those used in the VA hospital planning model, there are some notable differences. In particular, the hospital model does not have a specialty-specific capability at present. It uses BDOC/Discharges rather than the WWUs/Discharges found in Equation 8.1 and thus expresses workload in terms of patient days rather than WWUs. Both the VA model and the one proposed here produce workload projections based on the projected age-adjusted veteran population.

Using VA Data to Assign Values to Variables

The projected value of each component of Equation 8.1' is derived from data collected and analyzed by the VA:

- WWUs/Discharges—Values for both the numerator and the denominator are contained in the VA Patient Treatment File (PTF) (with WWUs appended), as discussed in chapter 4, and the Annual Patient Census. Since WWUs first became accessible nationally at the required (PCA-specific) level of detail in FY 1989, historical observations on this ratio were available for FY 1989 only (given the time frame of the analysis).
- Discharge Rate—For the numerator (Discharges), the required data are from the PTF and the Census, as just noted. For modeling purposes, a VA patient is said to be discharged if he/she is either (1) discharged from the facility or (2) transferred to another PCA in the facility. In addition, for the most recent fiscal year only, a "pseudo discharge" is generated for each patient occupying a bed in the facility at the end of a fiscal year. The veteran population data for the denominator are available, by age and PSA, from the VA official internal projections.

The projected discharge rate used in Equation 8.1' is computed as a function of the three most recently available historical discharge rates, as follows:

If the historical rate has risen continuously over three years, the projected discharge rate for FY *t* is derived by taking the most recent rate as the base and imparting to it a one-time percentage increase equal (in percentage terms) to the observed percentage increase over the three years, up to a maximum increase of 10 percent.

If the historical rate has declined continuously over the three years, the projected rate is set at the most recent historical rate.

If the historical rate fluctuates over the three years (i.e., was not monotonically increasing or decreasing), the projected rate is the overall average historical rate for the three-year period.

If there are no discharges in a given PCA-age cell in any of the three years, the projected discharge rate equals the rate observed in the most recent year.

• Vet Pop—Historical as well as projected veteran population estimates, by age and PSA, are based on VA internal projections.

Numerical Illustration

Focusing on Equation 8.1', calculations are begun at the most micro level, then are aggregated as required to obtain illustrative estimates for Equations 8.2 and 8.3. The calculations pertain throughout to VAMC II, an actual VA facility used in analyses in chapters 4 through 6, and to FY 2000.

The first problem is the projection of the MEDWWUs that will be generated in the inpatient medicine PCA for the oldest age group, 75 +.

For FY 1989, MEDWWUs for the 75 + age group in the medicine inpatient PCA was 628.95, and there were 1,075 discharges. Thus, WWUs/ Discharges = 628.95/1,075 = 0.59.

For this age group, the discharge rates from the inpatient medicine PCA for the three most recent fiscal years of 1987, 1988, and 1989 are, respectively, 0.066793, 0.067805, and 0.063077. Since these rates do not continuously increase or decrease, the projected discharge rate is computed as the overall average of the three, which turns out to be 0.066109.

The projected veteran population for the 75+ age group in the PSA associated with VAMC II for FY 2000 is 54,813.

The projected workload that results when these components are combined —namely, $W_{\text{VAMC II, Inpatient Medicine, MEDWWUs, FY 2000}}$—equals 0.59 × 0.066109 × 54,813 = 2,120 MEDWWUs.

After similar calculations are completed for each of the other six age groups, total projected MEDWWUs on the medicine inpatient PCA are found to be (7 + 78 + 290 + 817 + 1,639 + 1,789 + 2,120) = 6,740, where the age-specific projections have been arrayed in ascending chronological order.

Total projected WWUs for the inpatient medicine PCA—the key workload value required in applications of the inpatient medicine PF—appears in the notation of Equation 8.2 as $W_{\text{VAMC II, Inpatient Medicine, FY 2000}}$ and is computed as the sum of the MEDWWUs, SURWWUs, PSYWWUs, NEUWWUs, and RMSWWUs generated on this PCA. The first of these has been computed as 6,740; the remaining four are 1,703, 168, 210, and 22, respectively, yielding total of 8,843 WWUs.

Total projected MEDWWUs—the key inpatient workload variable in the medicine IPF—appears in the notation of Equation 8.3 as $WV_{\text{VAMC II, Medicine, FY 2000}}$.

It is the sum of the projected MEDWWUs across the six inpatient PCAs of medicine, surgery, psychiatry, neurology, rehabilitation medicine, and SCI. For

VAMC II and FY 2000, this is the sum of 6,740, 1,195, 317, 454, 98, and 56, respectively, yielding total projected MEDWWUs of 8,860.

Similar computations can be performed for each inpatient PCA, for each type of WWU, for any VAMC, and for any future fiscal year.

Projections for the Expert Judgment Approaches

As noted in chapter 5, data for computing most of the workload variables used in the SADI and the DSE either now exist, or could readily be collected, at the individual VAMCs. But an automated, national data base containing this information does not now exist. Thus, the VA decision maker is in no position currently to apply analogues of the workload projection formulas shown above in "Projections for the EBPSM" to obtain *direct* estimates of such SADI or DSE inpatient workload variables as average daily census (ADC) by ward, admission rates by PCA, various physician-performed procedures, and consultations to other inpatient PCAs.

However, what may be termed *indirect* estimates can be derived from the workload projections discussed under "Projections for the EBPSM" above, as follows:

Average Daily Census

For the inpatient medicine PCA at VAMC II, total projected WWUs for FY 2000 are 8,843. The corresponding total WWUs for FY 1989 were 7,484, implying a projected 18 percent increase in workload by FY 2000. Indirect estimates of the corresponding ADC workload variables, as required for both the SADI and the DSE, are obtained by assuming that ADC changes in proportion to total WWU between the two years.

To be specific, Figure 5.1 indicates an ADC of 28 on Ward 1 (a general medicine unit) of the inpatient medicine PCA at VAMC II in FY 1989. If it is assumed that the ADC will increase in proportion to total WWUs for the PCA, an ADC on Ward 1 for FY 2000 of 28(1.18) = 33.04 can be projected.

Note that this particular proportionality assumption, like others used below, is simple to implement as a first cut, but should not be adopted without close scrutiny. For example, if the projected aging of the veteran population leads to an increase in WWUs/Admissions, then ADC will not be proportional to WWUs.

This suggests a larger point. There are case mix and case severity assumptions embedded in any SADI at a point in time. When projecting future workload for the instrument, one must be alert to possible changes in case mix or severity that would affect physician time requirements.

Admission Rates

Two approaches to an indirect estimate of admissions to the PCA are available. First, one can assume the admission rate will change over time in proportion to total WWUs for the PCA. An alternative (given the population aging effect noted just above) is to assume that the admission rate moves in proportion to total PCA discharges (as defined earlier), the projection of which is an intermediate product in the workload formula Equation 8.1'.

The daily admission rate for the inpatient medicine PCA at VAMC II in FY 1989 was 15.2. Under the first approach, the admission rate for FY 2000 is projected to be 15.2(1.18) = 17.94. Under the second approach, there were 9,868 discharges in FY 1989 from the inpatient medicine PCA of VAMC II. It can be shown that 11,848 discharges from this PCA are projected for FY 2000, a rate of increase from FY 1989 of 20 percent. When this value is applied to the FY 1989 daily admission rate in medicine at VAMC II, the resulting projected rate for FY 2000 is 15.2(1.20) = 18.24.

Physician-Performed Procedures

To obtain indirect estimates here, the rate at which a given diagnostic or interventional procedure is performed is assumed to change over time in proportion to total WWUs for the PCA most closely associated with the procedure. An example is the problem of projecting the number of endoscopies at VAMC II for FY 2000. This procedure is associated with the inpatient medicine PCA. In FY 1989, about 13 endoscopies were performed daily. Thus, the projected daily performance rate for FY 2000 is 13(1.18) = 15.34.

Consultations in Other Inpatient PCAs

To derive projections for these workload measures, which are explicitly required for the SADI, the following is assumed: The consultation rate by physicians in a given specialty to a given inpatient PCA will change over time in proportion to the projected change in that specialty's associated WWU total generated in this PCA.

In the context of the present example, the problem of projecting consultations from the medicine service to the inpatient surgery PCA is considered. Records at VAMC II indicate that, in FY 1989, there were approximately 2,778 consultations from medicine to inpatient surgery, implying a daily rate of 10.7 (based on 260 consultation days/yr). In FY 1989, total MEDWWUs attributed to the inpatient surgery PCA were 1,102. For FY 2000, the corresponding projected MEDWWUs are 1,195, an increase of about 8.4

percent. Applying the proportionality assumption again, projected consultations per day from medicine to inpatient surgery for FY 2000 are computed as 10.7 (1.084) = 11.6.

If the VA pursues the concentrated testing and development of the SADI recommended in chapter 6, a national data base of observations on the workload variables required for the instrument would emerge naturally. The stage would be set for projecting their future values via techniques analogous to those summarized in Equation 8.1', and there would be no need to use indirect estimate methods.

AMBULATORY CARE WORKLOAD

The initial focus again is on workload projections for the EBPSM. Subsequently, a procedure for using these to derive projections for the expert judgment approaches is discussed.

Projections for the Ebpsm

The ambulatory care workload variable that, with one exception, performed best overall on statistical and clinical criteria in the estimated equations of chapter 4 was the Capitation Weighted Work Unit (CAPWWU); the exception came in the PF equation for the ambulatory other physician services (OPS) PCA, where the use of clinic-stop visits was preferable.

Hence, this presentation concentrates on the CAPWWU workload variable. Since the projection of future CAPWWUs requires a projection of future clinic stop visits, no additional steps are required to obtain this workload variable for the OPS equation.

Projection Model

The basic equation underlying the ambulatory care workload projection model is

$$\text{CAPWWUs} = (\text{CAPWWUs/Clinic Stops}) \times \text{Clinic-Stop Use Rate} \times \text{Vet Pop} \qquad (8.4)$$

The equation says that future CAPWWUs will be calculated as the product of the projected CAPWWUs per clinic-stop visit, the projected number of clinic-stop visits per veteran, and the projected size of the veteran population. Since the product of the second two elements is projected clinic stops, the equation implies that projected CAPWWUs is simply the product of projected CAPWWUs per clinic stop and projected clinic stops.

The version of this equation used to project workload here must also accommodate two additional factors: the aging of the veteran population and the partitioning of the ambulatory care arena into six mutually exclusive and exhaustive PCAs. Hence, Equation 8.4 assumes the expanded form

$$\mathbf{CAPWWU}_{ijt} = \sum_{a=1}^{A} (\mathbf{CAPWWU}_{ij,\,1989,\,a} / \mathbf{Clinic\ Stops}_{ij,\,1989,\,a}) \times \mathbf{Clinic\text{-}Stop\ Rate}_{ijta} \times \mathbf{Vet\ Pop}_{ita} \qquad (8.4')$$

where

$CAPWWU_{ij,\,1989,\,a}$	=	total PCA *j* CAPWWUs generated by age group *a* at VAMC *i* in FY 1989;
$Clinic\ Stops_{ij,\,1989,\,a}$	=	the number of age group *a* visits to clinic stops associated with PCA *j* at VAMC *i* in FY 1989;
$Clinic\text{-}Stop\ Rate_{ijta}$	=	the projected number of PCA *j* clinic-stop visits generated by age group a at VAMC *i* in FY *t*, divided by the projected age group *a* veteran population size in the PSA associated with VAMC *i* in FY *t*;
$Vet\ Pop_{ita}$	=	the projected age group a veteran population for the PSA of VAMC *i* in FY *t*.

The ambulatory PCAs are medicine, surgery, psychiatry, neurology, rehabilitation medicine, and other physician services. The age groups are the same seven defined previously for the inpatient workload model.

Because there is only one (specialty-linked) category of CAPWWU associated with each ambulatory PCA (i.e., MEDCAPWWUs are generated only in the ambulatory medicine PCA), the left-hand side of Equation 8.4' *is* the workload variable used in the PF equation for that ambulatory PCA.

For the IPF equations, the assignment of ambulatory workload variables is as follows: for medicine, the sum of MEDCAPWWUs and OPSWWUs (from the OPS PCA); for surgery, SURCAPWWUs; for psychiatry, PSYCAPWWUs; for neurology, NEUCAPWWUs; for rehabilitation medicine, RMSCAPWWUs; and for the other six physician specialties studied here, the sum of some subset of the six PCA-specific projections. See "Estimated PF and IPF Equations' in chapter 4 for a discussion of these PCA-to-specialty linkages required for the definition of ambulatory workload variables in the IPF equations.

The model summarized in Equation 8.4' differs from the existing VA outpatient workload model in several respects. The latter generates workload projections in terms of "patient visits" for the entire VAMC, disaggregated into several broad categories: compensation and pension examinations, applications for care, five distinct categories of mental health visits, and a residual category for "other" types of visits. On a single visit to the facility, however, a patient may generate several clinic-stop visits (see chapter 4).

In contrast, the model above uses patient-specific information about the pattern of clinic-stop visits, and their corresponding direct costs, in order to generate workload measures (CAPWWUs) that are specific to the PCA (not just the facility) and that reflect some information about relative case severity.

Using VA Data to Assign Values to the Variables

The projected value of each component of Equation 8.4' is derived from data collected and analyzed by the VA:

- CAPWWUs/Clinic Stops—Values for both the numerator and the denominator are contained in the VA Staff Outpatient File (with CAPWWUs appended). Since observations on CAPWWUs assigned to the ambulatory PCAs defined for this study were first available for FY 1989, historical observations on this ratio are consequently limited to that year (given the time frame of the analysis).
- Clinic-Stop Rate—For the numerator (Clinic-Stop Visits), the required data are from the Staff Outpatient File, as noted. The veteran population data for the denominator are available, by age and PSA, from official VA projections.

The projected clinic-stop rate in Equation 8.4' is computed from the three most recently available clinic-stop rates, as follows: If each rate is higher than the previous one, the projected clinic-stop rate for FY *t* is derived by taking the most recent rate as the base and imparting to it a "one-shot" percentage increase equal (in percentage terms) to the observed increase over the three years, up to a maximum increase of 20 percent.

If the historical rate has declined continuously over the three years, the projected clinic-stop rate is set equal to the most recent rate.

If the historical rate fluctuates over the three years, the projected clinic-stop rate is calculated as the overall average rate for the three years.

If there are no clinic-stop visits in a given PCA-age cell in any of the three years, the projected rate equals the most recent rate.

• Vet Pop—Historical as well as projected veteran population estimates, by age and PSA, are based on VA internal projections.

Numerical Illustration

First, the calculation of one of the components of Equation 8.4' is considered in a particular case; then this result is combined with other similar ones (not derived here) to obtain a projected value for $CAPWWU_{ijt}$, the key ambulatory care workload variable. The calculations all pertain to the ambulatory medicine PCA at VAMC II and to FY 2000. Hence, the workload projection is for $CAPWWU_{\text{VAMC II, Ambulatory Medicine, FY 2000}}$.

Consider first the projection of MEDCAPWWUs for the oldest age group, 75+.

In FY 1989, the workload total for this group was 758,453 MEDCAPWWUs, and total clinic-stop visits in the ambulatory medicine PCA were 8,266. Thus, MEDCAPWWUs/Clinic Stops were 91.76. For this age group, the clinic-stop rates in the ambulatory medicine PCA for the three (most recent) fiscal years of 1987, 1988, and 1989 are, respectively, 0.3029, 0.5002, and 0.4919. Since these rates exhibit neither an increasing nor a declining pattern, the projected clinic-stop rate is the overall average of the three, namely 0.4368. The projected veteran population for this group is 54,813.

When these three components are combined, the projected workload for the 75+ age group at VAMC II for FY 2000 is $91.76 \times 0.4368 \times 54{,}813 = 2{,}196{,}947$ MEDCAPWWUs.

For the remaining six age groups, projected MEDCAPWWUs have been computed to be, in ascending chronological order, 46,931, 249,726, 610,430, 1,427,560, 2,354,481, and 3,330,144. Summing over all age groups, as required by Equation 8.4', yields an overall projection of 10,216,219 for $CAPWWU_{\text{VAMC II, Ambulatory Medicine, FY 2000}}$.

Similar computations can be performed for each ambulatory PCA in any VAMC for any fiscal year.

Projections for the Expert Judgment Approaches

In both the SADI (see Figure 5.2) and the DSE (see Figure 5.1), calculating the physician FTEE for ambulatory care in some future year requires projecting the visit rates to specified types of clinics. Moreover, these projected rates typically must distinguish between initial and followup visits and be conditional on whether either residents or nonphysician practitioners (or both) are available to work with staff physicians in the clinic.

As was the case with inpatient workload, there is no national data base containing observations on ambulatory care visit rates, so defined. (Again, this would change if the SADI or the DSE were implemented, even experimentally, across the VA system.) Hence, a projection model such as that shown in Equation 8.4' cannot be used at present to derive direct estimates of future ambulatory workload.

However, indirect estimates of workload can be obtained by invoking proportionality assumptions similar to those used in the inpatient calculations.

Suppose it is assumed that, within each ambulatory care PCA, the visit rate for a given clinic changes over time in proportion to that PCA's CAPWWU score. For a medicine clinic (e.g., pulmonary), the visit rate is made proportional to MEDCAPWWUs. For a surgery clinic (e.g., urology), the visit rate is proportional to SURCAPWWUs. For the emergency and admitting & screening areas, the rate is proportional to OTHCAPWWUs, the workload index associated with the ambulatory OPS PCA.

To illustrate, total MEDCAPWWUs for VAMC II in FY 1989 was 9,705,108, and the projection for FY 2000 is 10,216,219. This represents a 5.3 percent increase between the two years. From Figure 5.1, the visit rate for the pulmonary clinic in FY 1989 was 53/week. Invoking the proportionality assumption, the projected pulmonary clinic visit rate for FY 2000 is 53(1.053) = 55.8. This is the workload projection for determining physician requirements at this clinic in FY 2000. (A caveat again is that the aging of the veteran population may lead the visit rate for the PCA *not* to be proportional to its total CAPWWU score; for instance, the latter may grow faster than the former.)

LONG-TERM CARE WORKLOAD

As before, the workload projection method for the EBPSM is examined first, then extensions of the analysis that yield (indirect) workload estimates for the expert judgment approaches are considered.

Projections for the Ebpsm

The long-term care (LTC) workload variable that performed best overall on statistical and clinical criteria in the estimated equations of chapter 4 was the Resource Utilization Group Weighted Work Unit (RUGWWU). Hence, the presentation will concentrate entirely on the RUGWWU workload measure.

Projection Model

The basic equation underlying the LTC workload projection model is

$$\textbf{RUGWWUs} = (\textbf{RUGWWUs/Discharges}) \times \textbf{Discharge Rate} \times \textbf{Vet Pop} \qquad (8.5)$$

The equation says that future RUGWWUs will be calculated as the product of projected RUGWWUs per discharge from an LTC unit, the projected number of discharges per veteran, and the projected size of the veteran population.

For use in this study, the equation must be expanded to acknowledge three specific factors: the aging of the veteran population, the breakout of the long-term care arena into PCAs, and the differentiation of RUGWWUs by physician specialty category (see "Using VA Data to Assign Values for the Variables" in chapter 4). Hence, the LTC workload model becomes

$$\textbf{RUGWWU}_{ijkt} = \sum_{a=1}^{A} (\textbf{RUGWWU}_{ijk,\,1989,\,a} / \textbf{Discharges}_{ijk,\,1989,\,a}) \times \textbf{Discharge Rate}_{ijta} \times \textbf{Vet Pop}_{ita} \qquad (8.5')$$

where

RUGWWU$_{ijk, 1989, a}$	=	total RUGWWUs associated with specialty *k* generated by age group *a* in long-term care PCA *j* of VAMC *i* in FY 1989;
Discharges$_{ij, 1989, a}$	=	the number of age group a discharges in FY 1989 from PCA *j* of VAMC i;
Discharge Rate$_{ijta}$	=	the projected number of age group a discharges from PCA *j* of VAMC *i* in FY *t*, divided by the projected age group a veteran population size in the PSA associated with VAMC *i* in FY *t*;
Vet Pop$_{ita}$	=	the projected age group *a* veteran population for the PSA of VAMC *i* in FY *t*.

The LTC PCAs are the nursing home and intermediate care. The age groups are the same seven defined for the inpatient and the ambulatory care workload models.

For the PF variant of the EBPSM, the required form of projected workload is

$$\text{RUGWWU}_{ijt} = \sum_{k=1}^{3} \text{RUGWWU}_{ijkt} \quad (8.6)$$

where the three specialty-associated types of weighted work units in LTC are (using the notation of chapter 4) MEDRUGWWUs, PSYRUGWWUs, and RMSRUGWWUs. Thus, each VA patient discharged from a nursing home unit or intermediate care ward will generate a certain number of RUGWWUs, which are labeled either as medicine, psychiatry, or rehabilitation medicine, depending on the primary diagnosis at discharge. In contrast to the inpatient projection model, there are no RUGWWUs specific to surgery or neurology.

For the IPF, the required form of projected workload is

$$\text{RUGWWU}_{ijt} = \sum_{k=1}^{3} \text{RUGWWU}_{ijkt} \quad (8.6)$$

where the sum is across the two PCAs of nursing home and intermediate care, and k is now properly interpreted as one of the three physician specialties (either medicine, psychiatry, or rehabilitation medicine) with a specific RUGWWU linkage to the LTC PCAs.

Thus, in the IPF for medicine, the LTC workload variable is simply

$$\begin{aligned}\text{RUGWWU}_{i,\,\text{Medicine},\,t} &= \text{RUGWWU}_{i,\,\text{Nursing Home},\text{Medicine},\,t} \\ &+ \text{RUGWWU}_{i,\,\text{Intermediate Care},\,\text{Medicine},\,t}\end{aligned}$$

which can also be expressed (in the notation of chapter 4) as MEDRUGWWU $_{it}$. The LTC workload variables for psychiatry and rehabilitation medicine are constructed similarly.

For each of the remaining physician specialties (e.g., surgery, neurology, or diagnostic radiology), the LTC workload variable in its IPF is defined as the sum of some specified subset of the RUGWWU_{ikt}, in Equation 8.7 (see "Estimated PF and IPF Equations" in chapter 4). For example, in the diagnostic radiology IPF, RUGWWU*i*, Medicine, *t* is used as the surrogate measure of LTC workload.

The approach to workload projection summarized in Equation 8.5' differs from current VA models in several respects. For intermediate care, the VA uses bed-days of care per discharge rather than RUGWWUs/Discharges, and expresses workload in patient days rather than WWUs. To project nursing home workload, in patient days, the VA multiplies the age-specific veteran population in a PSA by a corresponding civilian male nursing home utilization rate, derived from the 1985 National Nursing Home Survey (National Center for Health Statistics, 1985). In the present study, nursing home workload projections are derived entirely from VA data.

Using VA Data to Assign Values to the Variables

The projected value of each component of Equation 8.5' is derived from data collected and analyzed by the VA:

- RUGWWUs/Discharges—Values for both the numerator and the denominator are taken from the VA Patient Treatment File, with RUGWWUs appended. For intermediate care, the source is the same PTF from which the inpatient PCA workload data were derived. For the nursing home, the source is the Extended Patient Treatment File. In keeping with the inpatient and ambulatory care models, this component of the LTC workload projection equation is calculated for FY 1989 only.
- Discharge Rate—For the numerator (Discharges), the required data are taken from the PTF (for intermediate care) or the Extended PTF (for the nursing home), as noted above. Similar to the algorithm established for inpatient care, a VA patient is classified as discharged if he/she is either (1) discharged from the facility, (2) transferred to another PCA within the facility, or (3) occupies a bed in the facility at the end of the fiscal year. The veteran population data for the denominator are available, by age and PSA, from VA internal projections. The projected discharge rate in Equation 8.5' is computed from the three most recently available historical rates via "trending rules" identical to those used for deriving the projected discharge rate for inpatient PCAs (see "Using VA Data to Assign Value to the Variables" under "Inpatient Workload," above). Recall that these rules serve to establish certain upper and lower bounds on the projected discharge rate, regardless of the observed rate of change over the three-year period.
- Vet Pop—Historical as well as projected veteran population estimates, by age and PSA, are based on VA internal projections.

Numerical Illustration

The objective now is to demonstrate how the LTC workload is derived, via Equations 8.6 and 8.7, for use in the PF and IPF equations. To do so, first a workload projection is performed at the most detailed level possible. Then, it is shown how such results can be aggregated to produce LTC workload estimates in the desired form. The calculations again pertain to VAMC II and to FY 2000.

First, the focus is on the task of projecting the number of medicine RUGWWUs (MEDRUGWWUs) generated by the 75 + age group in the nursing home PCA at VAMC II in FY 2000.

For FY 1989, MEDRUGWWUs for the 75 + age group in the nursing home PCA were 12,690.7, and there were 62 discharges. Thus, MEDRUGWWUs/ Discharges = 12,690.7/62 = 204.69.

For this age group, the discharge rates in the fiscal years of 1987, 1988, and 1989 are, respectively, 0.0028857, 0.0033123, and 0.0036898. Since these discharge rates are increasing, the projected discharge rate for FY 2000 is calculated by taking the FY 1989 rate as the base and applying to it a one-time percentage increase equal to the lesser of the actual rate of increase observed over these three years, or 10 percent. Since the FY 1989 discharge rate is about 28 percent greater than the FY 1987 rate, the projected discharge rate for FY 2000 is calculated here as 0.0036898(1.10) = 0.0040588.

The projected veteran population for this group in the PSA associated with VAMC II for FY 2000 is 54,813. The projected nursing home workload for the age group 75+—namely $\text{RUGWWU}_{\text{VAMC II, Nursing Home, MEDRUGWWU, FY 2000}}$—equals 204.69 × 0.0040588 × 54,813 = 45,538 RUGWWUs.

To obtain projected medicine RUGWWUs for the nursing home PCA, all seven age-specific projections are added: (513 + 710 + 5,498 + 9,760 + 17,944 + 45,538) = 79,962.

Total RUGWWUs projected for the nursing home PCA—the workload value required in applications of the nursing home PF—is the sum of all RUGWWUs associated with medicine, psychiatry, and rehabilitation medicine: (79,962 + 2,514 + 22,116) = 104,593 = $\text{RUGWWU}_{\text{VAMC II, Nursing Home, FY 2000}}$.

Total projected RUGWWUs in medicine (MEDRUGWWUs)—the LTC workload variable required for the medicine IPF—is the sum of the MEDRUGWWUs projected for the nursing home and intermediate care PCAs: (79,962 + 47,298) = 127,260 = $\text{RUGWWU}_{\text{VAMC II, Medicine, FY 2000}}$.

Projections for the Expert Judgment Approaches

In applications of both the SADI and the DSE, patient workload projections are required for both the nursing home and intermediate care PCAs. Under either expert judgment approach, the same types of workload variables relevant to assessing physician requirements for the inpatient PCAs apply, as well, in the LTC PCAs: ADC, admission rates, physician-performed procedures (e.g., swan ganz catheter, spinal tap, nasogastric tubes), and consultations to other PCAs.

Procedures for using model-derived (WWU) workload projections to derive indirect estimates for these SADI/DSE workload variables have been described and illustrated under "Inpatient Workload" above. To reinforce that these procedures apply directly to LTC as well, one particular example is provided: the projection of ADC for the nursing home PCA at VAMC II for FY 2000.

In FY 1989, the ADC in the nursing home PCA was 96, and 63,584 RUGWWUs were generated. For FY 2000, the LTC workload model projects 104,593 RUGWWUs, a 64 percent increase from FY 1989. Invoking the assumption that changes in ADC are proportional to changes in RUGWWUs, the indirect estimate for nursing home ADC for FY 2000 is 96(1.64) = 157.44.

A Caveat

With the average occupancy rate at 95 percent and a growing waiting list of veterans to be admitted, there is presently an "excess demand" for nursing home beds in the VA (Audrey Urquhart, Program Analyst, Office of the Assistant Chief Medical Director for Geriatrics and Extended Care, Department of Veterans Affairs, personal communication, 1991). Given the expected growth of the age 65 + veteran population, this excess demand is likely to persist for years unless the VA rapidly increases the number of nursing home beds.

This issue is important to the interpretation of the LTC workload projection model. The discharge rate in Equation 8.5' is based on current VA nursing home utilization and thus reflects current supply constraints; if there were more nursing home beds available, this projected rate would undoubtedly be higher for most VAMCs. This raises the question of whether it is the appropriate rate to use for projecting LTC workload. The answer would appear to hinge on whether the VA will maintain, or change, its present policy assumptions about the provision of nursing home care to veterans.

Specifically, VA strategic planners in recent years have projected nursing home bed requirements under the assumption that the VA will provide nursing home care to about 16 percent of the eligible veteran population. Within this total market share, planners have assumed further that 30 percent of admitted veterans would be in state nursing home beds, 40 percent in community beds, and 30 percent in VA beds. The VA would pay (as it does now) for all of this care, but thus provide directly only about 30 percent of this 16 percent market share.

The observed nursing home discharge rate, critical to Equation 8.5', is a reflection of this market-share policy. If the policy does not change over time—so that the VA's share of total veteran nursing home care is stable—there will likely be a roughly stable relationship between current and future age-specific discharge rates, since discharges will *tend* to rise with the eligible veteran population, all else equal. In that event, the case for using the model summarized in Equation 8.5' to project LTC workload is supported.

On the other hand, if the VA significantly increases its supply of nursing home beds, the workload projection model would have to be modified accordingly. This could involve reassessing both the projected discharge rate and the projected RUGWWUs per discharge, since the (age-specific) severity mix of patients may change as the fraction of total market share treated increases.

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9

Affiliations With Medical Schools

SIGNIFICANCE OF AFFILIATIONS FOR THIS STUDY

The Establishment of Affiliations Between Vamcs and Medical Schools Has Been Pursued As an Policy Objective of the VA Since 1946. the Original Purpose of These Affiliations Was To Ensure That the VA Health Care System Was Staffed with Competent Physicians Who Maintained Currency with Advances in Medicine Through Their Medical School Relationships. These Affiliations, Which Became Formal Agreements in 1973, Grew To Involve, in Varying Ways, 134 of the Current 172 Vamcs. the Affiliations Have Enhanced the Physician Presence in the Vamcs in Various Ways: VAEmployment (Part-Time Or Full-Time) of Medical School Faculty Appointees, Placement of Residents in Vamcs, and Access To Consulting Physicians On an Paid Or Unpaid Basis. Thus, Affiliation Arrangements Are Important in the Physician Staffing For Most Vamcs. Quite Logically, the Scope of This Study Provided For Specific Attention To Be Given To Affiliations As They Affect Physician Staffing Requirements and the Patient Care Provided To the Veterans.

From Their Beginning in 1946, the Affiliations Involved the VAin the Teaching of an New Generation of Physicians (As Well As the Training of Other Health Professionals). Because Medical School Faculties Are Principal Performers of Medical Research, Faculty Status For VAStaff Also Increases the VAInvolvement in Biomedical Research. Thus, the Affiliation Agreements Have Facilitated the Incorporation of Teaching and Research Functions As Formal Components of the Mission of the VAHealth Care System.

To Reflect the Integral Part That Affiliations Play in the Physician Staffing For Most Vamcs, the Original Planning Study, Which Generated the Scope of Work For This Study, Gave Important Attention To Medical School Affiliations. the Work Plan Developed By the Planning Study, in Noting the Importance of the VAEducation and Training Mission Within the VAHealth Care System, Stated:

> There are two sorts of analyses essential to the development of a methodology for determining physician staffing requirements associated with the VA education/training mission. The first would be concerned with adjusting FTPE [full-time-physician equivalents] staffing requirements for patient care to take account of the loss of staff time for teaching students and the gain in patient care services provided by residents. The second would examine the broader implications for the VA health care system of its medical school affiliation agreements. (Institute of Medicine, 1985)

The first of these analyses—examining the staffing implications of the teaching function inherent in the affiliation arrangements—has been an integral part of the overall methodology described in chapters 4 through 6. This chapter looks more broadly at the implications of the affiliation agreements for physician staffing requirements and also at issues of cost and quality of care received by veterans.

Issues Concerning Affiliations

Affiliations are pervasive in the current VA health care system, and 45 years of VA policy have supported their development as an important way to obtain the physician staffing necessary for high-quality patient care. In addition, the current VA mission closely intertwines teaching and research activities with the affiliations. Thus, careful attention should be paid to the bases for retaining, strengthening, modifying, or reducing affiliations.

It is clear to the committee that a VA health care system without affiliations would be a very different system, and that the teaching and research aspects of the VA mission as legislatively authorized would be very difficult, if not impossible, to carry out without affiliations. Yet, the continued existence of unaffiliated VAMCs and the wide range of affiliations provides opportunities for comparison of effects. At the same time, these differences create a potentially unstable situation. The committee has heard that both within and outside the VA, questions have been raised about the value of affiliations and their effects on costs of VA medical care. Medical schools are not clamoring for new affiliations, and some schools have questioned the viability of current arrangements. The following discussion lays out the issues as the committee sees them and examines available evidence to provide support for the committee's conclusions and recommendations.

In summary, the questions examined in this chapter include the following:

- What are the direct effects of affiliation agreements on physician requirements? Are more or fewer VA staff physicians required to meet patient care needs because of the affiliations?
- What is the net effect of affiliations on the costs of meeting physician requirements? Is there an effect of affiliations on overall patient care costs?
- What are the benefits to patient care of affiliations?-Is there better access to state-of-the-art tertiary care?

  -Is there better access to highly qualified physicians across the whole spectrum of health services, including recruitment and retention of VA physicians?

  -What is the general effect of links to teaching and research on quality of care?
- Do the affiliations create any problems for meeting the full range of patient care needs of the veterans?-Because the affiliated institutions are mostly tertiary care facilities, do affiliations serve the primary care, rehabilitation, and chronic care (including psychiatric) needs of the population served by the VA?

  -By depending on residents for substantial amounts of care, are such desirable characteristics as continuity of care compromised?
- The current VA mission (in addition to the care of veterans) includes research, education, and backup to the Department of Defense in time of war. If the affiliations are critical to these aspects of the VA mission, could these missions be sustained without affiliations? Would a modification of the mission be required if affiliations are weakened?
- If affiliations provide net benefit for the VA patient care mission, what should be the policy toward lack of affiliation in some institutions? Can affiliations be designed to benefit all aspects of VA care responsibilities —primary care, rehabilitation, and care of the chronically ill including psychiatric and long-term care needs?

Committee Approach to These Issues

The study's work plan called for the appointment of a panel on affiliations to assist the committee in its consideration of these issues. That panel, consisting of a majority of non-VA members and a minority of VA physicians, met five times and participated in three sets of site visits to 15 VAMCs. A mail survey of 24 affiliated and unaffiliated VAMCs was also conducted.

The panel made very important contributions to the deliberations of this committee on the issues covered in this chapter. The full report of the panel is included in Volume II, *Supplementary Papers* . The committee has given careful consideration to the panel's work in reaching its conclusions and has also had the benefit of some additional analyses prepared by the study staff and the VA. However, the final conclusions are the responsibility of the committee.

Although the committee has attempted to marshall all available supportive evidence, these conclusions and recommendations rest substantially on the committee's judgment based on experience and logic, in addition to data. Much of the supportive data were suggestive rather than definitive, and data on crucial matters, such as the effects of specific aspects of the affiliations on patient care outcomes, are simply not available at this time. However, the committee clearly indicates when its conclusions are based substantially on its judgment rather than on data.

BACKGROUND AND HISTORY OF VA-MEDICAL SCHOOL AFFILIATIONS

The VA was established as an independent federal agency in 1930, combining the Bureau of Pensions (formed in 1833), the National Home for Disabled Volunteer Soldiers (1866), and the U.S. Veterans Bureau (1921). On January 3, 1946, President Truman signed Public Law 79-293, establishing the VA Department of Medicine and Surgery. Shortly thereafter, on January 30, 1946, the chief medical director of the VA published the second policy memorandum on the association of veterans hospitals and medical schools (Worthen, 1987).

Following World War II, members of the medical community became alarmed at the number of returning servicemen filling VA hospital beds, particularly since civil service red tape and the bad reputation of VA medicine had caused a critical shortage of doctors within the system. The creation at that time of a separate personnel system for physicians and nurses employed by the VA helped to circumvent some of the bureaucratic delays in hiring physicians. The idea of having the ranking medical schools as medical affiliates of VA hospitals was implemented largely through the efforts of Dr. Paul Magnuson, an orthopedic surgeon from Northwestern University. Well known to many deans and university professors in medical schools across the country, Dr. Magnuson drafted a plan to have medical school deans supply the staff for the VA's hospitals, and determined that he could have the first two such affiliation agreements operational within six weeks.

At that time, the VA had 83,339 beds in 98 hospitals, many in remote locations. None of the hospitals had accredited residency programs; the 1,000-bed VA hospital in Pale Alto had only five doctors. The day after the signing of Public Law 79-293, 56 medical residents were placed at Hines General (VA) Hospital in Chicago, by Northwestern University and the University of Illinois. During the next three weeks, the University of Minnesota placed 26 residents at Fort Snelling; over the following months, Dr. Magnuson went to Boston, New

York, San Francisco, and other major cities to enlist the aid of medical school deans in establishing affiliations. As outlined in Policy Memorandum No. 2:

> The schools of medicine and other teaching centers are cooperating with the threefold purpose of giving the veteran the highest quality of medical care, of affording the physician veteran the opportunity for post-graduate study which he was compelled to forgo in serving his country, and of raising generally the standard of medical practice in the United States by the expansion of facilities for graduate education. . . . The purpose of the Veterans' Administration is simple: affording the veteran a higher standard of medical care than could be given him with a wholly full-time medical service (Worthen, 1987).

This memorandum further states that "the Veterans' Administration retains full responsibility for the care of patients, including professional treatment, and the school of medicine accepts responsibility for all graduate education and training."

By 1950, the number of VA hospitals had increased to 151 with 117,000 beds. During the 1950s and 1960s, the total number of hospitals continued to increase; many outdated facilities were replaced, and new affiliations were established. A new policy in the late 1960s directed that new VA hospitals be built on or near campuses of affiliated medical schools. The VA Medical School Assistance and Health Manpower Training Act of 1972 provided for grants to assist in the establishment of new state medical schools that would be affiliated with VAMCs. The act further provided funds for medical schools already affiliated with VA hospitals, to enable them to significantly expand their collective class size and, in several cases, their curricula.

The cumulative effect of these actions is that 134 of the 172 VAMCs have some form of affiliation agreement with 102 of the 127 U.S. medical schools. These agreements represent a wide range with regard to scope and intensity of affiliation. Several of the facilities included among the "affiliated" group indicate only undergraduate medical student training rather than the presence of residents; a number of others list several staff physicians who have faculty appointments at the affiliated medical school, but apparently train neither students nor residents within the VA hospital itself. At the other end of the continuum are the large urban tertiary care VAMCs, which typically train 100 to 150 residents in many different specialties, as well as large numbers of medical students in clerkships, and trainees in many other health professions. Currently, there are approximately 80 VAMCs (mostly in RAM Groups 3 and 5, as defined in chapter 4) with substantial affiliations training residents in a number of different specialties.

MAJOR ISSUES ON AFFILIATIONS

Direct Effects of Affiliations on Physician Requirements

Affiliations encourage the more extensive involvement of VA physicians in research and teaching activities. As shown in Table 9.1, the percentage of physician time devoted to direct patient care activities is typically higher in nonaffiliated VAMCs (RAM Groups 2, 4, and 6). Tables 9.2 and 9.3 indicate that much of the rest of the physicians' time is devoted to education and research.

The time that VA physicians spend in teaching rather than direct patient care is offset by the presence of residents and other physicians in training. In the PF models described in chapter 4, when both the staff physicians and the residents are represented in the model, the estimated coefficients indicate that (all else equal) residents can substitute for staff physicians in achieving any given output level—that is, fewer staff physicians are required to deliver the same volume of care when residents are present.

In addition, the affiliation agreements enable the VAMC to supplement its physician staffing with faculty from the medical school who provide services under the classifications of "consulting & attendings" (C&As) and "without-compensation" (WOC). C&A physicians earn a fiat fee of $40 or $75 per consultation, depending on seniority and academic rank, regardless of the duration of their visit to the VAMC. WOC physicians also provide patient care and teaching/supervision services to VAMCs for which they are not compensated at all. Data on the time spent and services contributed to VAMCs in this manner are not kept systematically, either at the facilities or in any centralized data base. In order to estimate the magnitude of physician effort that these arrangements represent to the VA system, the affiliations panel conducted a series of four site visits in November 1989 and a mail survey of 24 VAMCs in February 1990 to help clarify the contribution of C&A and WOC physicians.

Four large, highly affiliated facilities were visited. Discussions with chiefs of staff, directors, and service chiefs at these four hospitals suggested that a careful accounting of time actually contributed by C&A and WOC physicians yields a small number of physician FTEE per month (approximately 2.0 to 3.0 FTEE in the VAMCs visited). Although many physicians whose names appear on the lists for C&As and WOCs (and there are frequently a relatively large number of individuals) may be involved in such activities at a particular VAMC, many may come to the VA only once or twice a month, for an hour or two at a time, and much of their time may be spent in teaching or supervising residents. Therefore, the translation of C&A and WOC time into FTEE results in relatively small numbers. The largest and most highly affiliated facility of those visited showed a total of 3.0 C&A and WOC FTEE per month for the entire VAMC.

(More details of the site visit findings are included in the affiliations panel's report in Volume II, *Supplementary Papers*.)

In the committee's view, the contribution of these C&A and WOC physicians is much greater than the 2.0 or 3.0 FTEE per month that their collective hours suggest. These physicians often represent highly skilled subspecialists to which the VAMC has access largely through this arrangement. (In the absence of affiliations, this subspecialty care would typically be obtained through contracts with physicians in the community, often at rates much higher than the VA salary scale.) Other aspects of this significance are discussed elsewhere in this chapter.

As shown in Table 9.3, VA physicians in affiliated VAMCs spend some time in research activities, especially in the larger, more highly affiliated institutions. Most of the research is separately budgeted, either through VA research funds or from external sources. Although physician time spent in research is often not accounted for in the VAMC's personnel budget, it is explicitly estimated in the facility's Cost Distribution Report. The committee believes that other benefits to VA patient care accrue from this opportunity for VA physicians to engage in research, as discussed in subsequent sections of this chapter.

In considering the net effect of affiliations on meeting physician requirements, the extensive use of part-time physicians by affiliated VAMCs raises several questions. Do time allocations in the VA data systems accurately reflect the time actually spent on VA functions? Are the contributions of several part-time physicians who comprise one FTEE truly equal to one full-time physician?

There are no systematic data available to address these questions. Therefore, the panel made site visits to eight VAMCs during which service and section chiefs were asked to describe the distribution of part-time and full-time physician FTEE on their services and the reliability of the data systems as indicators of levels of time and effort. These discussions revealed that, with some exceptions reported anecdotally, physician time contributions are described with reasonable accuracy in existing VA data systems. Although there may be distortions (i. e., physicians contributing more or less than their assigned hours), interviews during the site visits indicated that these probably cancel each other out. Further, the diversity contributed by the range of expertise and experience that part-time physicians bring to the VAMC compensates, on balance, for whatever loss of efficiency may result from having several part-time positions instead of one full-time position.

Cost Effects of Affiliations

The essential issue in addressing these questions is whether providing the same patient care services would cost more or less in the absence of affiliation arrangements. Although it is difficult to reach definitive conclusions about this issue, on the basis of available data, the implications have been explored.

Use of Part-Time, C&A, and WOC Physicians

Through affiliations the VAMCs have access to an array of physicians, many of whom are highly specialized, whose services would have to be obtained by other means if the affiliation arrangements did not exist. For most specialties, VA salaries are not competitive with earnings available in private practice or medical school faculty staffs. At many tertiary care VAMCs, if consulting services were not provided by non-VA physicians through affiliations, the facilities would have to obtain these physician services at market rates—and the impact on their budgets would be substantial.

Many examples of the benefits of availability of C&As and WOCs were identified in the site visits made by the affiliations panel. The chief of surgery at one VAMC estimated that between 40 and 50 percent of the surgical procedures at his facility are supervised or performed by WOCs. It was estimated at another VAMC that 40 percent of patient care time in medicine and its subspecialties is being contributed by WOCs. For example, at that VAMC, only one dermatologist is on staff, but there are five WOC dermatologists who help cover the four clinics each week. It was also noted that consultants often provide backup coverage, but they are not paid unless an emergency brings them to the VAMC. The relatively low FTEE for C&As and WOCs, as reported earlier in this chapter, probably does not reflect the important role non-VA physicians play in providing coverage at the affiliated VAMCs.

The use of residents also provides substantial patient care services at lower rates than equivalent full-time physician services purchased on the open market or provided through VA physician staff. These savings, however, are offset in part by the costs of teaching and supervision. Since the total number of residency slots is substantial (8,400), it seems unlikely that there could be a cost-effective substitution of other physician services for all of the services now provided by residents.

A third question about costs is whether teaching hospitals are more expensive for equivalent services. It has been generally acknowledged in the private sector that teaching hospitals as a group incur substantially higher costs than do nonteaching hospitals, although the exact reasons for these differences are difficult to document. One point is clear: In the VA, as in the private sector, highly sophisticated and expensive tertiary care programs serving the entire community and the regional area are nearly always located in affiliated teaching hospitals. Consequently, patients with the most difficult diagnoses and needing the most complicated treatments—the most expensive patients—are typically referred to and cared for in teaching hospitals. Further, the geographic environment in which most major teaching hospitals are located—large urban centers—adds to their operating costs because of increased costs for labor and supplies.

Benefits to Patient Care of Affiliations

In considering the value of affiliations for the VA medical care system, the committee believes that substantial benefits accrue to patient care, including access to high-technology care, access to highly qualified physicians, and a higher quality of care, in general.

Access to State-of-the-Art Tertiary Care

In the U.S. health care system, the provision of cutting-edge tertiary medical care is most frequently provided by teaching institutions with strong ties to medical schools—a patient care environment where the medical care is closely affiliated with education and research activities.

An inventory of clinical activities in VAMCs was conducted in 1990 by the Commission on the Future Structure of Veterans Health Care, an independent advisory group set up by the VA to recommend future strategies for its health care system. The inventory showed that affiliated VAMCs tend to have a substantially larger array of services available for their patients. Specifically, this inventory indicated that the concentration of high-tech services (the type typically associated with tertiary care) in affiliated hospitals was very high (Table 9.4). Although such services could be provided by other means, a very fundamental change in current arrangements would be required because of the pervasive nature of the affiliation arrangements. And, any proposed change would have to bear the burden of proof that the alternative approach would do the job as well.

Access to Highly Qualified Physicians Across the Whole Spectrum of Health Services, Including Recruitment and Retention of VA Physicians

The complex arrangements for providing physician services under the affiliation agreements involve faculty appointments, teaching and research opportunities, the sharing of clinical staff with medical schools through part-time appointments, and the provision of services by C&A and WOC physicians and by residents under the supervision of teaching staff. All of these arrangements provide access to highly qualified physicians, some of whom probably would not be available to provide services in VA institutions without the affiliations.

It was not part of this committee's charge to look in detail into the recruitment and retention of VA physicians. However, the committee firmly believes that if the VA attempted to staff the currently affiliated VAMCs by some way other than through the affiliations, the recruitment and retention of equally qualified physician staff would be much more difficult. Again, the burden of proof would be on the proposer of the alternative method.

General Effects of Teaching/Research Linkages on Quality of Care

The belief that affiliations result in a higher standard of care is widely held, and this belief is shared by the committee. However, this is extremely difficult to prove on the basis of empirical data. Outcome measures, such as mortality statistics, are still in the early stages of development, not just for the VA system, but for the medical care system as a whole. In 1989, the VA did conduct a review of mortality in VAMCs using a modification of the Health Care Financing Administration (HCFA) methodology. Of the VAMCs with mortality rates significantly higher than the predicted rate (i.e., the lower limit of the 95 percent confidence limits around the observed/predicted ratio was greater than 1.0), 6 of the 11 institutions so identified were in RAM Group 6—unaffiliated psychiatric institutions. These data certainly are not definitive, but they do suggest that there may be a concentration of quality-of-care problems in the unaffiliated institutions (U.S. Department of Veterans Affairs, 1989).

Structural and process measures of quality, such as the percentage of physicians who are board certified, or the accreditation results from the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), may provide some additional inferences concerning effects on quality. (As discussed in chapter 2, the VA is currently developing improved indicators that, in the future, could be used to monitor more definitively the quality of care provided in VAMCs. When developed, they could be used to analyze the quality effects of affiliations.)

The committee also notes that the previously cited data on the inventory of clinical services defines another very basic dimension of quality. If access to a particular type of service needed for the care of an individual patient is not available at all, that constitutes prima facie evidence of a deficit in quality, in the committee's view.

Problems in Meeting the Full Range of Patient Care Needs

Results of the Tertiary Care Focus of Affiliations

The committee presumes the value of affiliations for providing access to highly specialized tertiary care. However, the health care needs of veterans include primary care, rehabilitation, and care of the chronically ill, among whom a substantial number have chronic psychiatric impairments. It can be argued that the improved linkage to tertiary care may be of little benefit to these other patient care needs.

The aging of the population will lead to a higher incidence of chronic conditions within the veteran population being served by the VA. The findings of the specialty and clinical program panels, described in the appendix to chapter 6, suggest that psychiatry, rehabilitation, and ambulatory care services may be less well served by current VA staffing patterns than are the traditional tertiary-care subspecialties. The committee notes that the VA has given special emphasis to some of these needs through establishment of special geriatric centers and the development of new approaches to long-term care. Certain rehabilitation needs have also received special emphasis within the VA, specifically spinal cord injury and the development of prostheses.

The committee believes that the VA can ensure that the pattern of services offered in affiliated institutions matches the pattern of patient care needs among the VA population by developing additional programs in ambulatory and long-term care, giving special emphasis to psychiatry and rehabilitation initiatives. Through such programs, the VA also has an opportunity to provide leadership to the medical education community that will benefit all patients.

Continuity of Care Effects of Dependence on Residents and Part-Time Physicians

For primary care and the care of the chronically ill, certain attributes of care, such as continuity—a component of the normative definition of primary care developed by the IOM (Institute of Medicine, 1978)—may be important for encouraging patient compliance and behavior change. A pattern of care that depends heavily on residents and part-time physicians may not be conducive to these desirable patterns of care.

Again, the committee notes that, because many VAMCs are tied so closely to tertiary care medical environments, special attention may need to continue to be given to overcoming particular problems with the pattern of care typical of the teaching affiliation environment.

Research, Education, and Backup to the Department of Defense as Part of the VA Mission

The current VA mission includes research, education, and backup to the Department of Defense in time of war. The data already referenced in this chapter indicate that the involvement of the VA physicians in research and teaching is clearly associated with affiliations, and it seems unlikely that these aspects of the mission could be sustained in the absence of affiliates.

To provide backup to the Department of Defense in time of war (see chapter 1), the VA would likely depend as well on the affiliation relationships to provide some highly specialized services, such as burn therapy and treatment of other extreme traumas.

If the affiliations are not maintained, it would be very difficult for the VA to perform these aspects of the current mission, in the committee's judgment. It can be argued that the research, education, and backup to the military provide extra benefits to the broader society, as well as helping to sustain a high-quality medical care system in the VA. Consequently, any deemphasis of affiliations that signals—correctly or not—that the VA has narrowed the scope of its mission could raise questions about the *net* benefit to American society of its substantial tax investment in the VA health care system.

Policy on Lack of Affiliation in Some Institutions

The affiliations panel reports a growing feeling on the part of the unaffiliated hospitals that they are being treated as "second class citizens." Chiefs of staff at these VAMCs say their facilities are not sufficiently staffed, and that the VA's method of resource allocation has not adequately reflected their needs, favoring instead the already "well-endowed" affiliated institutions. Staff in unaffiliated facilities claim they are not accorded the same status as their peers in affiliated facilities.

However, there is also reported to be increasing recognition of the positive value of, and potential for, new directions in affiliations, especially on the part of unaffiliated hospitals. Possibilities for new affiliation relationships involving secondary and primary VA facilities are increasing. This is generally seen as a positive trend, which is likely to upgrade patient care in those facilities. Consortia of hospitals—involving a medical school, a tertiary VAMC, and one or more smaller, less specialized VAMCs in the same geographic area—are indicative of this trend. (One example reported to the committee involves an innovative affiliation arrangement between a major New York medical center and three VAMCs in the region.) Other models could be developed that would affiliate the VAMC with a major community hospital offering tertiary services but not strongly linked to a medical school.

There appears to be growing recognition that affiliations could have benefits for these smaller, nontertiary care facilities—benefits that include the attraction and retention of highly trained staff, as well as improved morale and increased intellectual stimulation. Further, some academic centers are interested in the primary care patient pool served by some unaffiliated VAMCs; relationships between these two types of facilities may be beneficial to both parties.

Some panel members pointed out that even in the most highly affiliated institutions, there are some specialties or program areas that are not affiliated, especially in ambulatory care. As the demand for ambulatory and chronic care services grows, attention is increasingly being focused on the need for residency education in these settings. Expanding VA—medical school affiliations to include these types of services and facilities may prove to be vital to the VA's ability to provide high-quality patient care to the veteran population.

Through its affiliations, the VA has contributed to existing knowledge and quality of patient care in long-term as well as ambulatory care services. The interrelationships and interdependencies among services were mentioned as important features of affiliation: Services may need one another in order to be accredited, as in the case of surgery and radiology.

CONCLUSIONS AND RECOMMENDATIONS

Value of Affiliations for the VA Health Care System

The committee has reached a very firm conclusion that the overall effect of affiliations on the VA health care system is strongly positive. The benefits include:

- An improved ability to attract and retain well-qualified physicians and other health professionals;
- A wide spectrum of services provided by a pool of highly qualified physicians, both those on the VA staff and those whose services are made available to the VA through other relationships with the medical schools;
- Access to state-of-the-art tertiary care;
- Participation in the education of physicians, which is a mandated part of the VA mission and which cannot realistically take place currently in the absence of affiliations;
- Participation in medical and health services research, resulting in contributions to the advancement of medical knowledge and improved health services that benefit the general population as well as veterans.

Underlying all of the above is the assumption, and some inferential indications, that affiliations contribute significantly to improved quality of patient care.

In other parts of this report, the committee has urged the VA to continue the work currently being conducted by its Office of Quality Management to develop quality-of-care indicators. These indicators will be critical, not only for the full development of the physician requirements methodology, but also for a more definitive evaluation of the effect of affiliations on the quality of care. The development of structure and process measures—such as information on board eligibility and board certification, analysis of the matrix of quality measures and scores utilized by JCAHO, and further refinement of the availability of specific clinical services within all VA facilities—may all be useful interim steps. However, the full development of quality indicators will require a more sophisticated array of health outcome measures including, but going far beyond, mortality rates. In this effort, the VA should closely track the extensive effort and developmental work being done by many health services researchers and health care organizations on outcome-related quality measures.

Development and Expansion of Affiliations

The committee recommends that the VA explore strategies for developing and expanding affiliations to include facilities that currently are not affiliated. This recommendation follows logically from the previous conclusion that affiliations bring benefits to the VA medical care system. Given that conclusion, the committee believes there is no logical reason not to provide at least some of the benefits to veterans cared for in all VA facilities. Clearly these new affiliations would have to be tailored to the size of the facility and the scope of the services offered, as well as to other particular attributes of the facility. Such an expansion of affiliations would promote and encourage recruitment and retention of high-quality staff and many of the other benefits outlined in the previous conclusion.

The committee recognizes that new affiliations are not easily attained. Successful affiliations require that both the VAMC and the non-VA institution have a strong perception that the benefits are significant. Hence, to develop new affiliations, the VA should pay special attention to the attributes of successful affiliations. These include ample opportunities for research, for teaching, and for shared services, as well as an adequate support staff and a sound infrastructure at the VAMC.

Failure to consider extending affiliations could cause some to question the VA's commitment to quality of care for the entire veteran population being served.

The committee recommends that while maintaining and nurturing the current model of affiliations between VAMCs and medical schools, with its emphasis on tertiary care, the VA should work to develop innovative models of affiliation targeted specifically to the chronically ill, including those requiring psychiatric care and rehabilitation services. These innovative models would, in general, be oriented around and give emphasis to ambulatory and long-term care.

The nature of the VA patient population presents special opportunities, and needs, for the development of new models. The Geriatric Research, Education, and Clinical Centers (GRECCs) represent an example of a successful model already developed by the VA to meet the particular needs of the population being served. Other opportunities, emphasizing a broad array of health services research related to these patient care needs, could continue to make the VA health care system a resource for the benefit of the entire nation, as well as for the veteran beneficiaries. In developing these new ideas, the VA could emulate its fine record in the conduct of multi-institutional clinical trials. Equivalently, training opportunities focused in innovative ways on these particular patient care needs could make a major contribution to veterans and to the general population. A recent IOM report on financing graduate medical education in primary ambulatory care emphasized the need for strengthened environments for this particular educational purpose (Institute of Medicine, 1989). The VA is in a logical position to support its own purposes and the purposes of the broader society.

In developing these innovative affiliation approaches, the VA should explore the establishment of relationships with other medical institutions in addition to medical schools. The VA has already created the beginnings of a new model of affiliations with a recent program involving community-based health care institutions that are not primarily related to medical schools. Such arrangements would be consistent with the intent to extend the purposes of affiliations beyond providing access to acute services and state-of-the-art tertiary care. The committee believes that this extension represents an exciting opportunity for the VA that could help meet some of the staffing needs that are likely to be identified through the application of the proposed physician requirements methodology.

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Table 9.1 Mean Percentage of Physician FTEE Allocated to Direct Patient Care, by Specialty and RAM Group, for FY 1989[1]

	RAM Group					
Physician Specialty	1	2	3	4	5	6
Medicine	71.7	92.1	55.1	80.7	61.7	90.3
Surgery	72.4	92.3	61.4	81.9	67.4	71.5
Psychiatry	74.4	91.2	70.6	85.0	71.1	91.0
Neurology	65.0	2	69.0	82.8	69.0	79.7
Rehabilitation Medicine	96.0	92.3	81.7	92.9	81.1	93.1
Anesthesiology	93.3	97.8	78.8	91.2	77.5	79.2
Laboratory Medicine	86.9	94.8	71.8	87.6	83.5	90.8
Diagnostic Radiology	88.7	91.6	82.1	90.7	83.0	95.0
Nuclear Medicine	78.2	83.6	76.5	93.2	77.0	87.1
Radiation Oncology	2	2	88.4	2	79.5	2

[1] Data derived from VA Cost Distribution Report.
[2] No. direct patient care FTEE reported in this hospital group.

Table 9.2 Mean Percentage of Physician FTEE Allocated to Education,1 by Specialty and RAM Group, for FY 1989

	RAM Group					
Physician Specialty	1	2	3	4	5	6
Medicine	12.8	2.0	20.1	8.4	17.3	2.8
Surgery	19.1	2.9	23.1	8.4	21.4	7.4
Psychiatry	11.4	0.9	15.6	6.4	14.9	3.8
Neurology	15.7	2	13.1	6.6	14.8	8.8
Rehabilitation Medicine	1.0	0.8	11.4	1.5	10.3	0.8
Anesthesiology	6.0	1.2	14.9	6.0	16.7	8.1
Laboratory Medicine	5.2	0.8	11.4	1.6	5.3	1.4
Diagnostic Radiology	4.9	4.4	9.7	5.5	10.4	9.7
Nuclear Medicine	7.9	1.7	9.4	3.5	11.4	3.8
Radiation Oncology	2	2	8.4	2	7.5	2

[1] FTEE for education is defined as the sum of FTEE allocated in the Cost Distribution Report to the three "Education & Training" categories of Instruction, Administration, and Continuing Education.

[2] No direct patient care FTEE reported in this hospital group.

Table 9.3 Mean Percentage of Physician FTEE Allocated to Research, by Specialty and RAM Group, for FY 1989[1]

	RAM Group					
Physician Specialty	1	2	3	4	5	6
Medicine	10.7	0.0	21.1	2.7	16.8	1.1
Surgery	3.3	0.0	12.9	2.7	8.7	1.1
Psychiatry	4.8	0.7	10.1	1.7	10.2	1.6
Neurology	13.3	2	15.7	4.9	13.8	8.1
Rehabilitation Medicine	0.2	0.0	4.1	0.3	3.1	0.0
Anesthesiology	0.1	0.0	5.0	0.8	5.1	1.6
Laboratory Medicine	2.3	0.0	8.8	4.2	5.8	0.4
Diagnostic Radiology	0.6	0.0	4.8	0.7	4.5	0.0
Nuclear Medicine	8.3	0.7	10.3	1.0	7.6	1.3
Radiation Oncology	2	2	2.6	2	4.2	2

[1] Data derived from Cost Distribution Report.
[2] No direct patient care FTEE reported in this hospital group.

Table 9.4 Percentage of Specified Programs and Services in Medicine Formally Available at VAMCs During 1990, by RAM Group1

	Program and Service Category	
RAM Group[2]	General Services[3]	High-Tech Services
1 (*N* = 16)	57.4	16.7
2 (*N* = 34)	31.9	0.0
3 (*N* = 48)	74.5	33.3
4 (*N* = 15)	55.3	0.0
5 (*N* = 24)	78.7	50.0
6 (*N* = 22)	27.7	0.0

[1] Each reported figure is the median percentage availability within the corresponding RAM group. For example, the 16 VAMCs in RAM Group 1 varied in the fraction of all prespecified high-tech medical services offered, but the median facility offered access to 16.7 percent of such services.

[2] RAM Groups 1, 3, and 5 are affiliated (in order of increasing VAMC size). *N* = the number of facilities for which data were available in each RAM group.

[3] Defined in this study to include all programs and services not classified as high tech.

SOURCE: Clinical inventory conducted in 1990 by the VA Commission on the Future Structure of Veterans Health Care (see "References" above).

10

Nonphysician Practitioners

Early in the study the committee hypothesized that VA physician requirements—at present, but especially in the future—may be influenced by the availability of certain nonphysician practitioners (NPPs).

Included among these NPPs would be physician assistants (PAs), nurse practitioners (NPs), and other categories of providers, each of whom performs selected diagnostic and therapeutic patient care services under the supervision of a physician. In general, NPPs would affect physician requirements if (1) they can substitute directly for physicians in selected tasks or (2) work jointly with physicians in ways that boost net productivity.

The committee's interest in these providers was spurred by two considerations.

First, over the past 25 years or so, a substantial body of research has developed indicating that such NPPs can substitute for, or otherwise augment, the productivity of physicians in a range of private-and public-sector patient care settings (see, e.g., Becker et al., 1982; Cromwell and Rosenbach, 1990; Mendenhall et al., 1980; Office of Technology Assessment, 1986; and Spisso et al., 1990). Studies have concluded that in a variety of physician-supervised functions—ranging from physical evaluations to wound debridement to patient education to routine incisions—NPPs have rendered good-quality care efficiently and with high patient satisfaction. Many of these analyses reported the successful use of PAs and NPs in ambulatory and long-term care.

Second, the changing demographic structure of the VA patient population implies that an increasing proportion of patients will be over age 65, chronically ill, and will require care that may be appropriately delivered in ambulatory care or long-term care patient care areas (PCAs).

A natural question is whether an expanded use of NPPs, especially in primary care settings, can significantly increase physician productivity without compromising the quality of care.

To advise on how these and related issues might be investigated systematically, the committee established a nonphysician practitioners panel. In the course of the study, this panel examined the issues in some depth, conducting literature reviews and three field surveys that involved NPPs, their supervisors, and chiefs of staff in a national sample of VA medical centers (VAMCs). The panel's analyses, deliberations, and recommendations to the committee are contained in its complete report, found in Volume II, *Supplementary Papers*. The committee has benefited greatly from the panel's work.

In what follows, the committee summarizes its own views about the present and future roles of NPPs in the VA, especially as related to the central issue of physician requirements.

DEFINING THE NPP AND THE FOCUS OF THE ANALYSIS

With the concurrence of the committee, the NPP panel sought to develop a typology that would differentiate nonphysician providers according to the nature of their interaction with physicians in VAMC PCAs. To be included were all providers whose activities have a direct effect on physician workload. These analyses led to the definition of three groups of nonphysician providers:

- Category I—*Administrative/Operational Support Personnel*, which includes clerical support, medical records clerks, patient transporters, and others.
- Category II—*Clinical Complementary Service Personnel*, which includes nurses, podiatrists, optometrists, and such allied health professionals as occupational therapists, physical therapists, and speech therapists, among many other service personnel in the allied health technologies.
- Category III—*Direct Medical Service Personnel*, which includes PAs, NPs, clinical nurse specialists (CNSs), certified registered nurse anesthetists (CRNAs), psychologists, and clinical social workers.

Within this typology, it was hypothesized that personnel in Categories I and II boost physician productivity by functioning as "complementary inputs" to the physician in the production of workload in the PCAs. (See Volume II, *Supplementary Papers*, for a discussion of complementarity in this context.) It was hypothesized that providers in Category III increase productivity at the VAMC by directly substituting for the physician in certain designated tasks. Although these tasks are performed under supervision of the physician, the latter need not always be in the physical presence of the Category III provider and thus can concentrate on other patient care services.

Moreover, it was hypothesized that in a VA health care system of the future that gave increasing emphasis to ambulatory and long-term care, Category III providers—particularly PAs and NPs—could function satisfactorily in expanded roles in ways that would affect physician requirements.

In light of these factors and with the approval of the committee, the panel decided to focus almost entirely on Category III providers, designating this group as "nonphysician practitioners." Thus, throughout this chapter (and this report), NPP refers specifically to Category III providers.

The committee (and the panel) realized, however, that a typology can take one only so far. To examine the hypotheses above, variables representing the interaction between each type of NPP and the physician should be entered in the production function (PF) equations (see chapter 4); the resulting coefficient estimates (with some subsequent sensitivity analyses, as illustrated in chapter 7), would allow an examination of the overall effect on physician requirements. Similarly, from such analyses one could derive estimates of the effect of NPPs in ambulatory care and long-term care settings.

From the perspective of the expert judgment approaches to staffing, a similar strategy could be followed. Assumptions about the availability of NPPs could be built into the Staffing Algorithm Development Instrument (SADI) and the Detailed Staffing Exercise (DSE), thus allowing estimation of physician requirements conditional on the assumed distribution of NPPs in the VAMC.

But as the committee realized early on, there were some basic roadblocks to proceeding this way. The main problem was that current VA data systems do not permit one to obtain Full-Time-Equivalent Employees (FTEE) allocated to PCAs for most of the nonphysician providers listed above. Only for nurses (based in the VAMC nursing service), psychologists, and social workers are data on FTEE by PCA available presently on a national basis. [For these three, the VA has designated distinct cost centers in its Cost Distribution Report (CDR); see chapter 4.] For all others, including PAs and NPs, one can obtain total FTEE by VAMC, but not by PCA. Since the PFs are PCA specific, all variables used in them must likewise be PCA specific.

Instead, a type of "second-best" approach to analyzing NPP effects in the empirically based models was pursued. In particular, SUPPORT/MD, a PCA-specific variable appearing in a number of PF equations, includes (among the components of its numerator) the total PA and CRNA FTEE in the PCA; depending on the policies at a given VAMC, it may also include NP and CNS FTEE. Similarly, the PCA-specific variable NURSE/MD may include (in its numerator) both NP and CNS FTEE. However, the numerators of both variables will also contain much FTEE not pertaining to these four NPPs. Hence, the statistical performance of SUPPORT/MD and NURSE/MD can provide some very broad indications of the impact of NPPs. However, these variables can yield no direct insights into the specific productivity contributions of PAs, NPs, CNSs, or CRNAs.

In addition, the committee found that many observers of, and participants in, the VA health care system had views about the future roles of NPPs; but there had been little systematic collection and analysis of information relevant to this large issue.

In response, the committee directed the NPP panel to review the existing literature and to conduct one or more field surveys that would yield new data and insights.

INFERENCES FROM THE NPP SURVEYS

The first two surveys, conducted in late summer of 1990, were of selected NPPs and their supervisors in a stratified random national sample of VAMCs. The NPPs examined were PAs, NPs, CNSs, and CRNAs; because the time allocation across PCAs, and thus patterns of patient care, for psychologists and social workers can be inferred from existing CDR data, these two provider types were not included in the surveys.

The universe of VAMCs was stratified by VA region and RAM Group (see chapter 4 for definitions); of the 40 VAMCs contacted, 36 responded. The number of responding NPPs are as follows: PAs, 138; NPs, 67; CNSs, 57; and CRNAs, 26. A total of 172 supervising physicians responded.

Detailed analyses and discussions of these data, along with the questionnaires from which they were derived, are included in the NPP panel report. The committee found the following inferences particularly noteworthy:

- NPPs are able to allocate their time across PCAs, and to various activities within PCAs, in a comprehensive and coherent fashion. Hence, the committee concludes that it is feasible, from the NPP perspective, to collect FTEE data at the level of detail required by the empirically based models.
- On average, almost half of a PA's time is presently spent in the inpatient PCAs. Just under 40 percent is allocated to ambulatory care, and less than 10 percent is devoted to the long-term care PCAs of nursing home and intermediate care.
- Compared with PAs, NPs currently spend less time in inpatient care (under 30 percent, on average), more time in ambulatory care (about 47 percent), and more time also in long-term care (about 15 percent).

Thus, neither PAs nor NPs devote a significant percentage of time, on average, to long-term care at present. Although there are multiple interpretations of this result (see the NPP panel report in Volume II, *Supplementary Papers*), one plausible inference is that traditional patterns for using NPPs—particularly PAs—persist even as workload patterns begin shifting toward ambulatory care and long-term care. Another possible inference, of course, is that present workload levels simply do not require a high percentage of NPP time allocated to long-term care at the facilities surveyed.

The committee notes that because only 36 VAMCs were involved in the survey, it was not feasible to use the responses to construct NPP-specific variables for the PFs, which are estimated using the universe of VAMCs relevant to each PCA.

In remarks volunteered by the NPPs and their supervisors on the survey forms, there were some recurring themes:

• Many NPPs said that they were utilized below their trained potential, either because physicians did not know how to use them for the range of tasks they could perform, or preferred not to do so. A number of PAs and NPs wrote that they were hampered particularly by a lack of prescribing privileges. (The committee notes, however, that the VA has recently initiated pilot programs in which selected PAs are permitted to prescribe drugs according to specific protocols.)

Several NPPs indicated that they operated with maximum flexibility and independence—which the committee interprets to mean, with very little physician supervision.

- The supervisors were generally pleased with the quality of care rendered by NPPs and urged the VA to consider expanding their use, particularly in long-term care. Most indicated that competent physician supervision is important, and a few noted that they simply did not have time to supervise NPPs properly.
- An undercurrent in both the NPP and the supervisor responses is that all participants need to be better educated about the current and potential roles of these practitioners. The committee and the panel decided that these perceptions should be investigated more systematically, with a focus on those responsible for clinical decision making at the VAMC. Thus, a third survey, directed at the chiefs of staff (COS) at the 40 VAMCs in the original sample, was conducted in January 1991; 34 COS responded satisfactorily.

  The questions pertained to policy issues regarding the utilization of NPPs (how the VAMC sets its policy, what role the state practice acts play within the facility policy, and whether the VA should have a comprehensive national policy); the potential roles for practitioners in inpatient, ambulatory, and long-term care; policies the VA could adopt to increase the utilization of NPPs in these three areas; and the issue of continuing education for physicians and NPPs. A thorough analysis of their responses is contained in the NPP panel report (Volume II, *Supplementary Papers*). The committee took note of the following points:
- The majority of the responding COS believe that the VA should do more on a national level to support and encourage the appropriate utilization of

NPPs. Many expressed both a frustration with the restrictiveness of state practice acts and a need for additional clarification from VA Central Office on the scope of activities recommended for these practitioners. When asked if the VA should develop a national policy regarding the use of each NPP, 75 percent responded in the affirmative. They urged that such a policy should more clearly delineate the functional roles and responsibilities of the NPPs and their physician supervisors. They favored a policy that would clarify the relationship between the provisions of the practice acts, the practice standards of each NPP, and what is permissible inside a VAMC. Most COS explicitly advocated flexibility in the application of a VA national policy at the facility level.

- Many of the COS urged that PA/NP duties be expanded in several particular areas. The most prominently mentioned area was drug prescribing. More than a third of the respondents volunteered that selected practitioners should be granted privileges to perform this function. The committee feels that it is in no position at the moment to address the advisability of any particular innovative function for NPPs. However, the committee believes that the VA should actively investigate the appropriateness of such functions, and of expanded roles for NPPs in the patient care process, when there is significant supporting evidence.
- Virtually all responding COS supported the use of NPPs in inpatient settings, and a number gave detailed responses about routine as well as innovative ways these practitioners could be further deployed in ambulatory and long-term care.
- The majority of the COS felt that staff physicians needed education about the appropriate use of NPPs. A number of approaches were suggested, but most said that a facility should develop an ongoing in-service program. Several COS suggested that each incoming staff physician be oriented to the use of NPPs at that facility.

CONCLUSIONS AND RECOMMENDATIONS

The committee's views, focusing on four nonphysician practitioners (PAs, NPs, CRNAs, and CNSs), are summarized below.

Integration of NPPs into the Physician Staffing Methodology

The committee believes that the degree to which these four types of NPPs are utilized has a direct effect on physician requirements. Therefore, the committee urges the VA to account more precisely for the influence of these NPPs, in both the empirically based and the expert judgment approaches to physician staffing, by incorporating the following:

- For the empirically based models, the VA should establish CDR cost centers for each of these NPPs. At present, the total FTEE of each type of NPP is available at the facility level but not allocated across PCAs. If each of these NPPs was given a designated CDR cost center—as is the case presently for physicians (by specialty), nurses, psychologists, and social workers—it would be possible to analyze them explicitly in the PF and the inverse production function (IPF) variants of the empirically based models. At present, these NPPs are reflected (indirectly) in the PF and the IPF equations only through their inclusion in the SUPPORT/MD and NURSE/MD variables, as noted earlier.
- For the expert judgment models, NPPs are already explicitly included (see Figures 5.1 and 5.2). However, in subsequent versions of the SADI and the DSE that the VA may choose to create, these NPPs should be recognized with greater specificity. In particular, the assumed number of each NPP in every PCA should be specified in these staffing instruments.

Continuing Education for Physicians and NPPs

From the analysis of the NPP panel survey data and commentary, the committee concludes that the utilization of these practitioners is more dependent on the attitudes and knowledge of individual physicians than on the training and the clinical skill level of the NPP. Before the VA can utilize NPPs in an efficient manner consistent with quality care, education programs for VA physicians must be established. The committee recommends that these be conducted on an ongoing basis, first with a centralized program for senior VA management staff, then with programs established at every VAMC.

To support this recommendation for continuing education, the committee recommends that the VA also

- Pursue and establish, wherever possible, academic affiliations with NPP training programs. Not only would this provide physicians with first-hand experience with the strengths and limitations of these practitioners, it would stimulate NPP recruitment.
- Require and actively support the participation by NPPs in their own continuing education, as another way to increase physician confidence in these practitioners. The committee feels that this would allow the NPP not only to maintain current skills, but to learn new techniques within any given specialty or setting. This would permit the NPP to continue to benefit from the clinical expertise within the VA. But by also encouraging the NPP to pursue education and training at outside sites, the VA would establish a mechanism that allows staff physicians to learn (indirectly) about innovative uses of NPPs.

The committee understands that such affiliation and continuing education programs now exist in various forms at some VAMCs. The committee recommends that the VA explore their establishment across the board.

A National Policy for Appropriate Utilization of Npps

Because physician knowledge and attitudes regarding NPPs vary greatly across (and even within) VAMCs, there is wide variation in the activities actually performed by NPPs. This view was underscored by the survey results discussed earlier in this chapter.

From these, the committee concludes that much of this variation in NPP use is due to variations in a facility's or a physician's interpretation of the NPP role, response to various state regulations and licensing arrangements, and the quality of organized supervision. An underlying factor is the absence of a comprehensive VA national policy that establishes clear guidelines for *all* NPPs.

For PAs and CRNAs, national guidelines presently exist that serve to define their general scope of practice by listing specific permissible functions. The activities that may be delegated to the *individual NPP* are, in fact, determined entirely at the VAMC level by its clinical executive board. This board approves the specific terms of the clinical privileges held by each practicing NPP at the facility. The committee applauds the efforts undertaken thus far to establish national guidelines for these two NPPs, especially the relatively detailed policies developed for PAs.

The committee urges the VA to develop explicit national policies on the appropriate use of *all* NPPs through a careful evaluation of existing evidence on the efficiency and quality of their clinical practice. These policies should be reviewed and revised periodically, should be consistent across the system, and should permit individual VAMCs the flexibility to tailor their use of NPPs to local conditions in ways that promote the quality and efficiency of VA health care.

National VA policies for each NPP should establish explicit guidelines for the practitioner's potential roles, responsibilities, and appropriate utilization in the VA system. The policies should encourage the appropriate use of NPPs by explicitly addressing, for each type of NPP, a range of expected requirements: training and skill level, continuing education for the NPP, physician supervision, peer review, continuing education for staff physicians, and administrative procedures for allowing certain practitioners with advanced training and experience to perform innovative functions under physician supervision.

For each type of NPP, the national guidelines could include a specific list of functions for which there is evidence, in each case, that a well-trained and supervised practitioner can render care of appropriate quality. The national guidelines would also provide each facility with the autonomy to determine additional functions such as drug prescribing, which could be performed by NPPs with specific levels of training and experience. These additional functions would be performed under physician supervision and could, in addition, require the establishment of a specific supervisory structure (e.g., team conferences, protocols) to monitor the quality of care.

The aim here (and a difficult one) is to promote a strong, coherent VA national policy on NPP use, while preserving the concept that individual VAMCs have both the autonomy to explore innovative uses of NPPs and the responsibility to ensure that the quality of care is protected through appropriate supervision.

In the course of establishing these policies, the VA should seek to clarify whether the "federal enclave" doctrine exempts the individual VAMC from the clinical provisions of its state medical practice act, so that each may establish unambiguously its own NPP practice policies under guidance from VA Central Office. Once this principle is ruled upon, the VA will be in a stronger position to promulgate its own positions on innovative uses of NPPs that are currently forbidden by many states.

As knowledge about the appropriate and effective use of NPPs continues to grow, the VA should periodically and thoroughly review its national policies on the use of these practitioners.

As analyses emerge indicating that specified functions can be performed efficiently by NPPs with no anticipated loss in quality, the VA should incorporate these functions in its guidelines. This information should be communicated promptly to chiefs of staff, service chiefs, and clinicians (to the latter through the continuing education programs recommended above). Similarly, when the weight of evidence indicates that the NPP's performance of a function does not promote efficiency or quality, the function should be removed from the guidelines.

The importance of this recommendation is that these guidelines (as they are updated over time) are expected to be a major factor in the determination of the privileges accorded by the VAMC to each practitioner.

Additional Studies and Analyses

The committee concludes that much was learned from the NPP Panel's surveys. A number of particular research questions have been suggested, and these should be pursued by the VA in broader-scale analyses.

The committee recommends that the VA establish research projects to examine extensively the different systemwide uses of these four types of NPPs.

At present, there are numerous opportunities to observe NPPs in various settings, for various functions, in varying degrees both inside and outside the VA. The VA should take advantage of these "natural experiments" to evaluate the appropriate (and inappropriate) uses of NPPs under a variety of practice conditions.

As evidence from these evaluations accumulates over time, the VA's ability to establish appropriate NPP policies will be greatly enhanced.

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11

Conclusions and Recommendations

In this final chapter of the report, the committee presents its conclusions and recommendations on how the Department of Veterans Affairs (VA) should determine physician requirements. Also summarized are the committee's views on two important related topics, VA-medical school affiliations and nonphysician practitioners.

Most of the points below, and the committee's reasoning behind them, have already appeared in the course of the first 10 chapters. However, a question not addressed earlier concerns the steps the VA should take to ensure that the physician requirements methodology is further refined in the near term, then maintained and improved over time. This issue is discussed near the end of the chapter.

As a prelude, the main elements of the committee's charge are reiterated.

The central purpose of this study has been to develop a methodology to assist the VA in answering a basic, but extraordinarily complex, question: To accomplish its principal mission-related responsibilities of patient care, education, and research, how many physicians does the VA require?

Specifically, the VA asked the Institute of Medicine (IOM) to develop "a sound methodology for estimating the number of physicians, by specialty groupings, required for the efficient delivery of high quality physician services" (Institute of Medicine, 1987) in all programs and facilities operated by the Veterans Health Administration (VHA), which has responsibility for all VA physician-related activities.

The VA designated as the primary objective for the study the development of a "mathematical/statistical methodology, incorporating both empirically derived and professional judgment based values in the methodology's algorithms, which translates quantitative measures of ... mission related workload demands . . . into numerical estimates of physician staff requirements" (Institute of Medicine, 1987). Data for these analyses would be derived from three sources:

- The VA's own information systems, reflecting what may be characterized as "internal" performance norms;
- "External" (to the VA) physician performance norms, as gathered directly or else inferred from other public-and private-sector health care organizations; and
- Expert panels, which would evaluate the models, the data used in them, and external norms—and, in light of these assessments, recommend modifications to either the models or their physician staffing recommendations.

The committee determined that the overall methodology should be capable of assessing:

- The number of physicians required, at the present time, to meet the current patient care workload at VA medical centers (VAMCs). These assessments would be conditional on assumptions about the scope and case acuity of the workload; number and type of residents; availability of nonphysician resources (nurses, support staff, and other productivity-influencing factors); and the commitment of the VAMCs to teaching, research, continuing education, and other activities beyond direct patient care.
- Future VA physician requirements, taking explicit account of possible changes in the volume, mix, and case acuity of service demands resulting from the aging of the veteran population. The methodology should likewise be flexible enough to incorporate (in the future) projected changes in other factors influencing utilization, such as the distribution of veterans across eligibility-for-care categories and the proportion of females in the eligible population.
- The net effect on VA staff physician requirements of possible changes in the number, type, and intensity of VA-medical school affiliation relationships. In addition, there should be analyses of the potential effect of such changes on the VA's ability to accomplish the physician education component of its mission, both now and in the future.

Over the years, the VA has published staffing guidelines for most health care provider categories, but not for physicians. This omission reflects the genuine complexities—clinical, economic, administrative, political—that abound in attempting to estimate just how many doctors are required to meet the VA's mission.

In the majority of VAMCs, that mission is multipurpose: patient care, education, and research. In most of these activities, the VA staff physician is not a solo performer but works with a number of others—residents, non-VA consulting physicians, nurses, nonphysician practitioners, and other support staff. Hence, the number of staff physicians required, in any specific context, will be influenced by the availability and productivity of these other providers, who may function as complements to or substitutes for staff physicians. Nonpersonnel factors, such as the availability of critical capital equipment or floor space, may also be important. The amounts of time set aside for research, classroom instruction, continuing education, administrative activities, and professional development all should figure directly into the computation of total physician requirements.

CHOOSING AMONG ALTERNATIVE APPROACHES TO PHYSICIAN STAFFING

The central issue facing the VA decision maker is determining which methodological approach(es) should be adopted. Three general approaches were investigated:

1. The analyses in chapter 4 demonstrated how physician requirements can be derived from statistical models estimated from existing VA data. Specifically, the committee developed the Empirically Based Physician Staffing Models (EBPSM) with two, complementary variants—the production function (PF) and the inverse production function (IPF).
2. In chapter 5, two alternative formulations of an expert judgment model for physician staffing were introduced—one based on the Detailed Staffing Exercise (DSE) and the other on the Staffing Algorithm Development Instrument (SADI).
3. Another approach also discussed in that chapter would involve using non-VA physician staffing criteria, or external norms, for guiding the decision about physician requirements in the VA.

(A fourth approach is to adopt no new methodology. The committee rejects this option—and all others not based on operating principles that are clearly specified, logically defensible, and appropriate for policy making by some reasonable criteria.)

Over the final months of the study, the committee examined four alternative decision strategies for using these staffing approaches to derive the total physician Full-Time-Equivalent Employees (FTEE), by specialty, required for a given VAMC. The strategies called, in turn, for the VA decision maker to

A. Adopt one dominant approach for each specialty (e.g., medicine) or clinical program area (e.g., ambulatory care). For example, the core of the methodology could be an empirically based model, but expert panels could be appointed to evaluate its staffing recommendations—and the model itself. Whether or not all specialties and program areas would be guided by the *same dominant* approach would be a separate decision.

B. Use two or more approaches in conjunction to derive a range of physician staffing estimates There would be no formal model or algorithm for either justifying or reconciling differences among the approaches. Instead, the VA decision maker would have a menu of physician staffing estimates, each defensibly derived, from which to choose.

C. Use two or more approaches in conjunction to derive a range of physician staffing estimates sensitive to assumptions about budgetary and other constraints. This strategy differs from strategy B only in its advocacy of sensitivity analysis, optimization models, and related techniques to help the VA decision maker investigate important "what if" questions. These techniques were discussed and illustrated in chapter 7.

D. Through some integrative process (e.g., mathematical weighting scheme), combine physician staffing results from two or more approaches to produce either a single FTEE estimate or a range of estimates.

In the committee's terminology, this integration could be accomplished holistically (Strategy D. 1) to produce, in a single weighted-average calculation, an overall FTEE total for each specialty or program area. Or it could be implemented in a disaggregated format (Strategy D.2), which allows for different weights to be applied to the different component parts of physician FTEE; the total required FTEE in a VA specialty or a program area at the VAMC would be the sum of these weighted components.

The sensitivity analyses noted above could be conducted as well under either variant of this strategy.

As an overall framework for determining VA physician requirements (given workload and other factors), the committee endorses Strategy D.2, the disaggregated weighted-average variant of D. In chapter 6, this was termed the *Reconciliation Strategy*. The formulation of the strategy presented there is reproduced below using (for illustration) internal medicine, the PF variant of the EBPSM, and the SADI variant of the expert judgment models:

$$\text{Physician FTEE Requirements in Medicine} = [X_1 + b(X_2 - X_1)] + [R_1 + c(R_2 - R_1)] + [C_1 + d(C_2 - C_1)] \qquad (6.1)$$

where

X_1	=	total internist FTEE (staff, contract, non-VA consultants), as derived from the PF variant of the EBPSM and other facility-specific data, for direct care on medicine inpatient and

		outpatient patient care areas (PCAs), consultations on all other PCAs, resident training in PCAs and in classroom, administration by chief and others, and leaves of absence;
X_2	=	the same as X_1, but derived from the SADI;
R_1	=	internist research FTEE, as derived from an empirically based approach;
R_2	=	the same as R_1, but derived from the SADI;
C_1	=	internist FTEE for continuing education, as derived from an empirically based approach;
C_2	=	the same as C_1, but derived from the SADI; and
b, c, d	=	weighting parameters, each lying on the [0,1] interval.

By varying the parameters *b, c*, and *d* jointly across their ranges (the unit interval in each case), a corresponding range of physician FTEE estimates is generated.

Regarding the interpretation of the Reconciliation Strategy, the committee emphasizes the following:

- The formula for deriving FTEE in each of the three components of Equation 6.1 consists of two terms, the Empirically Driven Baseline and the Modifier. Thus, for patient care, resident education, administration, and leaves of absence, the Empirically Driven Baseline is X_1, and the Modifier is $b(X_2\text{-}X_1)$.

  This configuration of the Reconciliation Strategy conveys a particular policy perspective: In determining physician requirements for each specialty or program area, the first step is to derive FTEE estimates from a variant of the EBPSM—either the IPF or the PF. The second step is to investigate whether the Baseline FTEE estimate should be modified in light of factors threatening the validity of the empirically based model. As discussed in chapters 3 and 5, these factors fall into two broad groups of data-related problems—simple measurement and recording errors, and "clinically inappropriate" observations relating physician FTEE and workload (i.e., input-output relationships skewed by current VA resource constraints and other factors). To the degree that the validity of the Baseline estimate is threatened, one applies the Modifier. At the extremes, the Modifier can dominate entirely or have no influence at all.

This articulation of the Reconciliation Strategy reflects the committee's view that there are clear advantages—organizational and methodological—to building a physician requirements methodology around an empirically based model—if the important statistical and clinical assumptions are met. If they are not, then modification of the empirically driven estimates, whether through expert judgment staffing assessments or the application of external norms, is in order.

- Operationalizing the Reconciliation Strategy would require two types of policy choices from the VA decision maker. For each FTEE component (i.e., *X, R*, and *C*), which empirically based approach should be selected? Likewise, what expert judgment approach (SADI or DSE) should be used in calculating the Modifier? Given these, what are the most appropriate values for the weighting parameters *b, c*, and *d*?. Once these parameters are set, the "compromise" between the Baseline and the Modifier is effectively accomplished. Parameter values between the 0-1 endpoints would reflect the VA decision maker's view that "due weight" should be accorded to both the Empirically Driven Baseline and the Modifier.
- Hence, the Reconciliation Strategy offers considerable flexibility in determining physician requirements across specialties and program areas. For specialty A, the "*X*" component of FTEE might be computed as a weighted average of results from the PF model and the DSE. For specialty B, the "core" approaches to staffing reflected in the weighted average might be the IPF and the SADI. Even assuming that the VA decision maker were to select the same core approaches for both specialties, the weighting parameters *b, c*, and *d* could vary between the two.

Some observers might point out, with concern, that this framework is so flexible that it fails to constrain the VA decision maker—that virtually any FTEE level could be selected. There are two responses to this. First, to determine physician requirements according to the version of the Reconciliation Strategy is to work within the FTEE boundaries established by the empirically based and expert judgment models, specifically the PF, IPF, SADI, and DSE approaches. Not every physician allocation is compatible with the Reconciliation Strategy. Second, the VA decision maker *already* possesses the authority to establish physician staffing levels. The relevant issue for the committee was how data, from a variety of sources, might best be analyzed and evaluated to derive physician FTEE levels that are "most appropriate" by criteria that are well defined and openly acknowledged.

It follows that the Reconciliation Strategy should not be viewed as a preset staffing formula, but as a *framework for choosing* FTEE requirements.

- It frequently would not be practical for a VAMC to realize instantaneously the new "target" level of physician staffing in a given specialty that emerges from application of the Reconciliation Strategy. To achieve and then accommodate any significant increase in physician FTEE, additional physicians must be recruited; and some adjustments would likely be required in support personnel, equipment, or space.

Hence, where there is a significant difference between the current staffing level and the target derived through the Reconciliation Strategy, the committee recommends that the VA consider phasing in the target by establishing an intermediate target.

An intermediate target should not be viewed as a vehicle for making merely cosmetic or symbolic changes in staffing; rather, it is intended to be a level as close to the target as material considerations permit. The implication is that a VAMC should proceed toward its staffing targets as rapidly as possible, subject to resource and organizational constraints.

These increments (or decrements) in staffing would provide the VA with natural experiments for analyzing prospectively and rigorously whether the new physician FTEE levels lead to the hypothesized changes in access to care, indicators of the quality of care, and other measures of system performance.

USING THE RECONCILIATION STRATEGY TO CALCULATE PHYSICIAN FTEE

Within the "umbrella" of the Reconciliation Strategy, how exactly (by specialty and program area) should VA physician FTEE levels be calculated? On this, the committee sought and received advice from its six specialty and two clinical program panels. Their detailed recommendations are included in Volume II, *Supplementary Papers*, and summarized in the appendix to chapter 6 of this report. The study has benefited greatly from the panels' analyses and recommendations. But the committee underscores that the conclusions reported below are entirely its own, reflecting, it is hoped, a balanced and multidisciplinary perspective. The discussion below is organized around the three FTEE components delineated in Equation 6.1.

Total Physician FTEE (VA and Non-VA) For Direct Care, Resident Education, Administration, and Leaves

The eight panels have demonstrated on a small scale the types of analyses that the VA decision maker should undertake to determine physician requirements across the system for this dominant component of FTEE. For each of three actual VAMCs studied in depth (four, in the case of psychiatry), the current physician staffing level (including physician FTEE not in the Cost Distribution Report) was noted; the PF and the IPF variants of the EBPSM were applied (as appropriate); and the DSE and the SADI expert judgment models were brought to bear. Only after considering the current FTEE level *and* the empirically based estimates *and* the expert judgment-based estimates did each panel reach a conclusion about appropriate staffing methodology.

Although the panels' conclusions varied (see the appendix to chapter 6), all conducted their analyses within the framework of the Reconciliation Strategy; so should the VA.

The committee's main charge was to develop a methodology, not implement it. The panels' main charge was to test and refine the methodology. Only after the Reconciliation Strategy has been applied to a significantly larger sample of VAMCs will there exist the breadth of empirical information required to reach a *generalizable* conclusion about whether the PF, IPF, DSE, SADI, or some weighted combination of these is preferred for a given specialty or program area.

On the basis of the analyses summarized in chapters 4 through 7, the committee reached the following conclusions regarding empirically based and expert judgment approaches to analyzing this major component of physician FTEE:

The PF and the IPF are potentially complementary variants of the EBPSM, and either is a viable candidate for helping generate the Baseline estimates for this component of physician FTEE.

The PF allows physician FTEE to be derived by PCA within the VAMC, while taking account of the productive contributions of residents, nonphysician providers, and other factors. The degree to which these substitute for VA staff physicians can be examined.

However, an acceptable PF cannot be estimated for specialties lacking a well-defined PCA. Hence, for laboratory medicine, diagnostic radiology, nuclear medicine, radiation oncology, and anesthesiology, no PF model was presented.

In addition, physician FTEE will be acknowledged in the PF model only to the extent that it is associated statistically with the production of workload. If a given specialty renders care on a given PCA but is not shown statistically to contribute to patient throughput, that specialty's FTEE variable will not be included in the PCA's PF; when total required FTEE for that specialty is subsequently derived for the facility, none will be shown associated with that PCA.

As specified in this study, the IPF generates a direct estimation of physician requirements at the facility level; because of this higher level of aggregation, it is less vulnerable than the PF to measurement errors due to misclassification of FTEE within the VAMC Cost Distribution Report (CDR). The IPF permits statements about statistical confidence to be constructed around physician FTEE predictions (in contrast to the PF, which permits confidence statements about the workload expected from a given set of physician and nonphysician inputs).

However, no acceptable IPF model can be estimated for VA program areas that are multidisciplinary. Thus, there is no IPF presented for either ambulatory care or long-term care.

In contrast to the PF, the IPF acknowledges all FTEE recorded in a given specialty at the VAMC *regardless* of the degree to which it is associated with the production of workload.

The IPF permits examination of actual versus predicted physician FTEE, by specialty, at a given VAMC, whereas the PF permits analysis of actual versus predicted workload, by PCA, at that same VAMC. Hence, the IPF and the PF can provide complementary insights into the relationship between workload and the physician staffing required to meet it (see chapter 7).

To derive expert judgment FTEE estimates for use in the Modifier term in Equation 6.1, the most promising approach is a methodology built around the SADI.

The specialty and clinical program panel analyses indicate, in sum, that it is feasible to develop SADIs for all specialties and VA program areas. Task time estimates were derived exhibiting strong face validity and yielding physician requirements for selected VAMCs that were generally plausible and acceptable to panel participants (see chapter 5 and the appendix to chapter 6).

Because the SADI focuses on the time required by physicians to perform specific tasks and functions, it is particularly suitable for the procedure-oriented specialties and compatible with all specialties.

Like the DSE, the SADI permits the derivation of physician FTEE requirements for VA programs, services, or procedures that are either in the planning stage or sufficiently new that valid empirical data are not available.

Because DSEs would have to be individually crafted for each VAMC assessed, applying this instrument across the system would be cumbersome and labor intensive.

Hence, the committee recommends the following: the VA, without delay, should apply the SADIs either across the board or to a representative sample of VAMCs; analyze the results; revise the instruments on the basis of what is learned; reapply the SADIs to VAMCs across the system; and, finally, integrate the resulting FTEE estimates into a Reconciliation Strategy-based assessment of physician requirements via Equation 6.1.

Regarding parameter *b*, denoting the relative weight accorded the Empirically Driven Baseline versus the Modifier in the Reconciliation Strategy, the committee recommends that it be determined on a facility-specific or facility-group basis. This contrasts with a policy of establishing, for each specialty, *one* value of *b* (or *one* range of values) to be applied to all VAMCs.

At any point in time, facilities will differ substantially in how well staffed they are relative to the system norm, in the accuracy of the CDR data allocating physician FTEE to activities and PCAs, and in factors affecting staffing that may not be captured in any data base. Allowing b to vary gives the VA decision maker the flexibility to translate knowledge of such local factors into the overall determination about the relative emphasis accorded the Baseline and Modifier terms in Equation 6.1.

The proposed methodology is intended to help the VA determine the quantity of physicians, measured in FTEE, required to meet the mission-related demands of the VAMC. But, the committee does recognize that staff physicians in full-time administrative positions in Central Office and at other sites external to the VAMC have contributed significantly to patient care, education, and research. However, the committee regards the determination of FTEE for these purposes as traditionally a matter of administrative discretion and, in any event, beyond its technical competence. Similarly, although determining physician FTEE for full-time administrative positions at the VAMC does fall within the committee's defined purview, that, too, is better calculated on a site-by-site basis rather than through the application of formal staffing models.[1]

[1] 1. In chapter 6, the committee offers its own detailed recommendations for how physician FTEE should be computed for the following subcomponents of component *X*:

- Staff Physicians—Direct Care (across all PCAs), Education of Residents, Administration, Leaves of Absence;
- Contract Physicians;
- Purchased FTEE for Night and Weekend Coverage; and
- Consulting and Attending (C&A) and Without-Compensation (WOC) Physicians.
- For staff physician FTEE devoted to direct care, to resident education, and to administration, the nature of the required calculation depends in each case on whether the Reconciliation Strategy is to be implemented using the PF, IPF, SADI, or DSE—or some weighted average of an empirically based and an expert judgment model. As noted again in the text above, the committee regards both the PF and IPF as viable empirically based models; between the two expert judgment approaches, the SADI is preferred. However, for a given specialty or clinical program, the relative weight assigned to the Empirically Driven Baseline versus the (expert judgment) Modifier in the Reconciliation Strategy should, in principle, be determined by the VA decision maker on a site-by-site basis.
- As discussed in Chapter 6, the choice of procedures to calculate FTEE for contract physicians and C&A and WOC physicians depends in both cases on whether an empirically based or expert judgment approach—or some weighted combination—is chosen. However, the committee did make additional specific recommendations in chapter 6 regarding the computation of certain of the subcomponents of *X*:
- In the expert judgment staffing models, the leaves-of-absence component of total physician FTEE should be calculated as the FTEE equivalent of the annual leave to which the VA physician is entitled. (In the empirically based models, the FTEE allowance for leaves is presumably already reflected, implicitly, in the observed data.)

Staff Physician FTEE for Research

The amount of research FTEE built into overall physician requirements should be related to measurable indicators of research productivity and excellence. Not all VAMCs should be accorded the same level of research FTEE.

Possible indicators—all potentially computable at the facility level and also by specialty—include the amount of VA and non-VA research funding obtained, the quantity of peer-reviewed papers published in scholarly journals, or (most simply) the amount of FTEE currently allocated by the specialty to research in the VA CDR.

Adopting any such empirically driven approach to determining research FTEE in the Reconciliation Strategy implies that $c = 0$ in Equation 6.1.

In principle, the committee's preferred approach is to link research FTEE earned to dollars of research support raised. This could be accomplished through specialty-specific statistical analyses taking the following general form: R_1 = f(VA Research Dollars Raised, Non-VA Research Dollars Raised, Specialty-Specific Characteristics, Facility-Specific Characteristics). Once estimated, the model could be used to derive the expected amount of research FTEE, $\hat{R}_1$, for a given specialty at a given VAMC as a function of right-hand-side variable values specific to that specialty and VAMC.

A significant limitation, however, is that data presently available systemwide can link research dollars (by funding source) to facility, but not to specialty or program area within the facility. If funding data were collected annually for each VAMC by cost center, specialty-specific models could be estimated directly. (Multidisciplinary research would have to be analyzed in a somewhat more elaborate model that accommodates two or more specialties simultaneously.)

Until the appropriate data emerge, the committee recommends an interim approach in which the VA decision maker allocates research FTEE by specialty on the basis of the specialty's currently reported research FTEE level.

When computing physician requirements through either the SADI or the DSE expert judgment approaches, additional FTEE for off-hour (night and weekend) coverage should be incorporated only for the emergency and the admitting & screening functions of ambulatory care.

On the other hand, for either the PF or the IPF variant of the EBPSM, hours purchased for nights and weekends are already implicitly included in FTEE estimates to the extent that these hours are provided either by staff physicians (whose FTEE are already in the CDR) or by contract physicians. Hence, no further FTEE adjustments to either empirically based model is required to account for night and weekend coverage.

Staff Physician FTEE for Continuing Education

Continuing education for staff physicians should be an important component of any VA quality assurance program. **The committee therefore recommends that a certain minimum amount of continuing education FTEE be expected for all specialties at all VAMCs.**

The committee proposes that the minimum commitment for any VA physician be no less than 60 hours per year—the time equivalent of what the American Medical Association requires for qualification for its Physician Recognition Award for Continuing Medical Education (American Medical Association, 1986). This translates into about 0.03 FTEE per full-time physician.

The committee regards this as a bare minimum, however, and believes that a higher floor allocation—for example, 80 hours per year—is both defensible and feasible. This would translate into about 0.04 FTEE per full-time physician.

If these minimums are regarded as based on expert judgment, then it is as if $d = 1$ in Equation 6.1.

EXTERNAL NORMS

Without exception, the specialty and clinical program panels concluded that the non-VA staffing criteria developed in the study were of limited usefulness in determining VA physician requirements. *After reviewing these external norm analyses, the committee concurs*.

Most analyses involved the application of simple staffing ratios—for example, patient days/physician FTEE (for inpatient and long-term care) and patient visits/physician FTEE (for ambulatory care)—to determine the implied level of appropriate physician staffing at the illustrative VAMCs examined in this study. These ratios were either published or directly computable from published data (e.g., Department of Defense criteria) or else were inferred from observed staffing patterns at selected non-VA treatment sites.

In most instances, applying these simple ratios to derive VA FTEE levels was technically straightforward. But across specialties and program areas, there were recurring concerns: comparability of patients between non-VA and VA sites; variations across sites in the definition of an FTEE; the effects of for-profit incentives on the number and workload production of physicians in certain private-sector sites; and skepticism about whether non-VA staffing patterns have, in fact, emerged from a conscious consideration of their effect on the quality of care.

These difficulties notwithstanding, the committee believes that useful external norms can be developed. A necessary (though not sufficient) condition is that physician staffing ratios be "conditional" constructs, computed as a function of case mix and acuity, the availability of nonphysician personnel, and other factors affecting total requirements. Such ratios could be used to generate implied physician staffing at VAMCs, conditional on these factors.

In other words, external norm criteria should be applied at the level of detail and specificity already characterizing the expert judgment staffing exercises and the empirically based models.

To accomplish this, a detailed examination of physician staffing levels in relationship to workload and other factors affecting physician productivity would need to be undertaken at each non-VA facility selected for analysis. The committee recommends that the VA pursue these more detailed external norm analyses.

COMMITTEE PERSPECTIVE ON OVERALL ADEQUACY OF PHYSICIAN STAFFING IN THE VA

The primary purpose of the study has been to develop a physician staffing methodology. Physician requirements have been computed selectively for specific specialties and sites, but this was always for demonstrating or testing a method or model. Thus, there are inherent limitations in the committee's ability to address the question, by specialty and program area, of whether current physician staffing in the VA is adequate overall.

Although the estimated empirically based models were used to derive physician requirements for all VAMCs (see chapter 4), such was not the case here for the expert judgment models. Both the SADI and the final versions of the DSE were applied only to the three (for psychiatry, four) VAMCs chosen as test sites for developing and refining these approaches (see chapter 5). Only for these facilities were estimates made of physician requirements, via the panel analyses, by all applicable empirically based and expert judgment approaches (see the appendix to chapter 6).

Without exception, the panels declined to render a *quantitative* recommendation about whether the VA system was adequately staffed with physicians. Most panels did reach *qualitative* judgments about staffing adequacy, however, based on the test-site analyses and the general observations of individual panel members—VA as well as non-VA—with years of experience working in VAMCs.

The committee's own conclusions are as follows:

- *Relying solely on analyses performed in this study, it is not possible to reach sound* quantitative *conclusions on whether current VA physician staffing levels are adequate* in the aggregate. Though an important question, it is not one the committee was asked to address.

- However, the approach selected for determining physician FTEE for patient care, resident education, administration, and leaves (component *X* in Equation 6.1) does bear some logical connection to the *qualitative* judgment about whether staffing is adequate. To adopt an empirically based model—with its reliance on workload and FTEE data from the current system—for a given specialty or program area at a given point in time is *logically* consistent with the following qualitative judgment: Although individual VAMCs may have too many or too few of these physicians relative to VA systemwide productivity norms, the specialty or program is, *in the aggregate*, neither significantly understaffed nor overstaffed.

Adopting either of the expert judgment approaches for a specialty or program area at a point in time is *logically* compatible with either of two conclusions:

1. While a given VAMC may have too many or too few physicians, the VA system as a whole is inappropriately staffed at that point in time. Hence, the SADI or the DSE becomes the means to help move the system away from the status quo; or
2. The empirically based models are either conceptually inadequate or estimated with flawed data, so that expert judgment approaches are preferred on technical grounds. Note that the committee is not selecting among approaches here, but merely pointing out the logical implications of the relevant choices.

- A major difficulty in drawing valid inferences about VA staffing adequacy is the absence of data relating physician FTEE (in any specialty or program) to measures of patient access and quality of care. Recent efforts by the VA Office of Quality Management to develop quality indices are noted in chapter 2. Analytical models for deriving staffing levels that meet or exceed such quality standards are presented in chapter 7. Until these linkages can be analyzed, inferences about the relationship between physician staffing intensity and patient outcomes will have to be derived by expert judgment, informed by the relevant available data.
- A close reading of the panels' final reports (see Volume II, *Supplementary Papers*) and their meeting transcripts (unpublished) reveals a recurring theme, enunciated in qualitative terms: In most specialties and program areas, the VA currently has too few physicians in aggregate; in no case does it have too many.

In keeping with the report's focus on methodology rather than the adequacy of specific staffing levels, the committee acknowledges the panels' views, but takes no formal position on their specific conclusions about the adequacy of current staffing. *But, these panel conclusions, emerging after months of careful deliberation by the panels, bear sufficient policy significance to warrant immediate investigation by the VA*.

The proposed physician requirements methodology provides the means to do this. Specifically, the following should be undertaken:

After the SADI has been further tested and refined (see chapter 5), the Reconciliation Strategy should be applied across the system to determine which specialties or programs at which VAMCs are significantly understaffed. At a selected sample of these, the VA should provide the additional resources to bring physician staffing up to the recommended target levels (or intermediate target levels, as the local situation dictates).

The effect of improved physician staffing on indicators of access and quality should then be formally evaluated.

VA CENTRAL OFFICE AND THE VAMC: PROMOTING AN DIALOGUE

In chapter 7, important issues related to the implementation and policy applications of the methodology were discussed. The committee's views can be summarized as follows:

By its very structure and logic, the Reconciliation Strategy implies that the allocation of physician FTEE across the system would become more centrally directed; at present, each VAMC has broad discretion to establish physician FTEE levels, subject only to constraints involving its total budget and total assigned personnel ceiling. Under the Reconciliation Strategy, all facilities would be judged by the same criteria within each specialty or program area. There is the presumption that facilities facing similar mission-related demands would be prescribed similar physician FTEE levels.

The committee was not asked to consider the budgetary costs of meeting VA physician requirements or how, if at all, the methodology could or should be linked to the budget process. However, the committee can envision a resource management policy in which that portion of the VAMC budget allocated to staff physicians is established in accordance with the FTEE targets (and intermediate targets) derived through applications of the Reconciliation Strategy.

The committee does believe that the likelihood of the physician staffing methodology influencing VA physician staffing is substantially greater if the methodology is made an integral part of the budget process at the facility level. Therefore, the committee recommends that the VA take steps to achieve this integration concurrently with the implementation of the methodology.

For the Reconciliation Strategy to be successfully implemented and to improve over time, there must be strong channels of communication between VA

Central Office and each VAMC. And the dialogue must be an active, two-way interchange. There are two reasons why this is crucial.

First, the acceptability of specific physician staffing levels—and of the methodology that produced them—is likely to be greater if they emerge from a process that genuinely engages the local facility.

Second, good two-way communication will enhance the quality of the decision process itself, increasing the likelihood that the physician staffing levels adopted are indeed appropriate. Any broadly applicable methodology for determining VA physician requirements will necessarily use models that are simplifications of reality. No true model will incorporate every factor that could influence the number of physicians required at every VAMC. In addition, certain important variables may have to be omitted simply because the data are missing or inadequate. Measurement errors may occur for some variables in ways known to the local VAMC but not apparent to decision makers in Central Office. Moreover, the greater the flow of good information between Central Office and the VAMCs, the less likely it is that individual participants will be able to "game the system" successfully.

How might this dialogue work in practice? Applying the Reconciliation Strategy, VA Central Office would derive, for all physician specialties and program areas at a given VAMC, FTEE targets and (as needed) intermediate targets (see chapter 6). Whatever differences exist between actual and targeted staffing would be communicated to the facility, along with information describing how the targets were computed.

The facility would be expected to respond. If it agreed with the recommendations, there would be little more to debate (except perhaps where the funds would be obtained to meet proposed staffing increases). If the facility takes exception to the targets, it might wish to introduce supporting evidence not generally available at Central Office or discuss further the interpretation of existing data. Thus, the final determination of appropriate targets and intermediate targets for physician FTEE would be as informed as possible.

Also, occasions may arise when the facility would request new (typically additional) physician staffing levels in a specialty or program area as part of a proposed expansion of services. The Reconciliation Strategy could be applied to generate evidence either supporting, or failing to support, the facility's request.

Quite intentionally, the proposed dialogue between Central Office and the VAMCs—and the Reconciliation Strategy itself—is oriented around the interpretation and evaluation of formal models for staffing.

Such models allow all parties in the decision process to analyze a range of "what if" questions important to the interpretation, policy application, and validation of the methodology. In chapter 7, it is shown how management techniques such as sensitivity analysis, outlier analysis, and linear programming can be used to enrich the information base available to VA Central Office and the VAMCs. These analyses would be facilitated if the physician requirements methodology were incorporated into a larger VA "decision support system" that promotes a comprehensive integration of resource planning and budgeting.

PROJECTING FUTURE VA PATIENT WORKLOAD

Estimates of future physician requirements hinge crucially on estimates of future patient workload. The models adopted by the committee for projecting inpatient, ambulatory, and LTC workload have several noteworthy features (see chapter 8).

- In their structure and logic, all three represent adaptations of existing workload projection models used presently in VA strategic planning. The major difference in each case is that workload is expressed here in the form of a weighted-work-unit (WWU) index (see chapter 4) rather than in terms of patient days or visits, as in the VA models.
- These models produce workload projections that are adjusted for anticipated changes in the age structure of the veteran population over time. They could be adapted readily to adjust also for changes in the distribution of the veteran population by gender or eligibility-for-care categories.
- The workload projections from these models can be input directly into both the PF and the IPF variants of the empirically based models to derive future physician requirements, by VAMC and PCA within each VAMC. Although these projections are not *directly* applicable to the expert judgment staffing models, it is shown in chapter 8 how they can be used to obtain indirect estimates of workload at the level of detail required by the SADI and the DSE.

AFFILIATIONS WITH MEDICAL SCHOOLS

The committee's views about VA-medical school affiliation relationships, presented at length in chapter 9, are summarized below.

The Value of Affiliations For the VA Health Care System

The committee has reached a very firm conclusion that the overall effect of affiliations on the VA health care system is strongly positive. These benefits include:

- An improved ability to attract and retain well-qualified physicians and other health professionals;

- A wide spectrum of services provided by a pool of highly qualified physicians, both those on the VA staff and those whose services are made available to the VA through other relationships with the medical schools;
- Access to state-of-the-art tertiary care;
- Participation in the education of physicians, which is a mandated part of the VA mission and which cannot realistically take place currently in the absence of affiliations;
- Participation in medical and health services research, resulting in contributions to medical knowledge and improved health services, that benefits the general population as well as veterans.

Underlying all of the above factors is the assumption, and some inferential indications, that affiliations contribute significantly to improving the quality of patient care.

In other parts of this report, the committee has urged the VA to continue its work, being led by the VA Office of Quality Management, to develop quality-of-care indicators. These indicators will be critical not only for the full development of the physician requirements methodology, but also for a more definitive evaluation of the effect of affiliations.

These analyses should focus not only on structure and process indicators of quality, but on outcome indicators that include, but go beyond, mortality measures. In these efforts, the VA should track closely the extensive efforts and developmental work being done by many health services researchers and health care organizations on outcome-related quality measures.

Development and Expansion of Affiliations

The committee recommends that the VA explore strategies for developing and expanding affiliations to include facilities that currently are not affiliated. This recommendation follows logically from the previous conclusion that affiliations bring benefits to the VA health care system. Given that conclusion, the committee believes that there is no logical reason not to provide at least some of these benefits to veterans cared for in all VA facilities. Such an expansion of affiliations would assist the recruitment and retention of high-quality staff and promote achievement of the other benefits outlined above.

The committee further recommends that while maintaining and nurturing the current model of affiliations between VAMCs and medical schools, with its emphasis on tertiary care, the VA should work to develop innovative models of affiliation targeted specifically to the chronically ill, including those requiring psychiatric care and rehabilitation services. These innovative models would, in general, be oriented around and give emphasis to ambulatory and long-term care.

The nature of the VA patient population presents special opportunities, and needs, for the development of new models. The Geriatric Research, Education, and Clinical Centers (GRECCs) serve to illustrate a successful model already developed by the VA to meet the particular needs of the population being served. Other opportunities—emphasizing a broad array of research related to these patient care needs, including health services research and research on health outcomes—could continue to make the VA health care system a resource for the benefit of the entire nation, as well as for veterans. Similarly, training opportunities focused in innovative ways on these particular patient care needs could make a major contribution to veterans and to the general population. The VA is in a logical position to support its own purposes and the purposes of the broader society.

In developing these innovative affiliation approaches, the VA should explore the establishment of relationships with other medical institutions *in addition* to medical schools. The VA already has created the beginnings of a new model of affiliations with a recent program connecting VAMCs to community-based health care institutions not primarily related to medical schools.

The committee believes that this type of extension represents an exciting opportunity that could help the VA meet its physician requirements, especially for primary care, in the years ahead.

NONPHYSICIAN PRACTITIONERS

Early in the study the committee hypothesized that VA physician requirements—at present, but especially in the future—may be influenced by the availability of certain nonphysician practitioners (NPPs).

The committee's interest in NPPs was spurred by two considerations: (1) a substantial literature indicating that these practitioners can enhance physician productivity while maintaining the quality of care; and (2) the changing demographic structure of the VA patient population, which will increase the demand for ambulatory care and long-term care—arenas in which NPPs may be particularly productive.

In chapter 10 the committee presented recommendations on the present and future role of four types of NPPs: physician assistants, nurse practitioners, certified registered nurse anesthetists, and clinical nurse specialists.

Integration of NPPs Into Physician Staffing Methodology

The committee believes that the degree to which these four types of NPPs are utilized either in complementary or substitutive roles has a direct effect on physician requirements. Therefore, the committee urges the VA to account more precisely for the influence of these NPPs, in both the empirically based and the expert judgment approaches to physician staffing, by incorporating the following:

- For the empirically based models, the VA should establish CDR cost centers for each of these NPPs. At present, the total FTEE of each type of NPP is available at the facility level, but not allocated across PCAs. If each NPP there were given a designated CDR cost center—as is the case presently for physicians (by specialty), nurses, psychologists, and social workers—it would be possible to analyze them explicitly in the PF and the IPF variants of the empirically based models. At present, these NPPs are reflected in the PF and IPF equations only through their inclusion in the SUPPORT/MD and NURSE/MD variables (see chapter 10).
- For the expert judgment models, NPPs are already explicitly recognized (see Figures 5.1 and 5.2). However, in subsequent versions of the SADI and the DSE that the VA may choose to create, these NPPs should be incorporated with greater specificity than at present. In particular, the assumed number of each of the four types in each relevant PCA should be built into these staffing instruments.

Continuing Education For Physicians and NPPs

From the NPP panel survey data and commentary, the committee concludes that the utilization of NPPs is more dependent on the particular attitudes and knowledge bases of individual physicians than on the training and clinical skill level of the NPP. Before the VA can begin to utilize NPPs in an efficient manner consistent with quality care, ongoing education programs for VA physicians must be established. The committee recommends that this physician education effort be initiated on an ongoing basis with a centralized program for senior VA management staff, and that, over time, programs be established at every VAMC.

To support this recommendation of continuing education for physicians on the role and utilization of NPPs, the committee recommends that the VA pursue and establish, wherever possible, academic affiliations with these NPP training programs. The VA should also require and actively support the participation of NPPs in continuing education related to their roles and functions.

Setting National Guidelines For Appropriate Scope of Practice For NPPs

National guidelines on the use of NPPs should be strengthened where they exist, established where they do not, and updated on a regular basis over time. They should be orchestrated in a way that allows the VAMC adequate flexibility for innovation and quality control.

As knowledge about the appropriate and effective use of NPPs continues to grow, the VA should periodically and thoroughly review its national policies on the use of these practitioners. For PAs and CRNAs, such policies already serve to establish the boundaries of practice, by listing specific permissible functions in various arenas of activity; the subset of these activities that may be delegated to the *individual* NPP has traditionally been determined entirely at the facility level. Because physician attitudes and knowledge bases regarding NPPs vary greatly across (and even within) VAMCs, there is wide variation in the activities actually performed by NPPs. This view was underscored in survey results presented to the committee by its NPP panel.

As analyses emerge indicating that specified functions can be performed efficiently by NPPs with no anticipated loss in quality, the VA should give priority designation to these functions in its guidelines. This information should be communicated promptly to chiefs of staff, service chiefs, and clinicians (to the latter via the continuing education programs recommended above). Similarly, when the weight of evidence indicates that the NPP's performance of a function does not promote efficiency or quality, the function should be removed from the guidelines (if it was there); and this action also should be communicated promptly. The outcome of these studies should influence not only the specific functions that NPPs perform, but their overall roles *vis à vis* physicians in the patient care process.

At present, explicit national guidelines on the utilization of NPs and CNSs do not exist. The committee urges the VA to develop such guidelines through a careful evaluation of existing evidence on their efficient and appropriate utilization.

Additional Studies and Analysis

To promote the development and diffusion of new information about the appropriate use of NPPs, the VA should support research projects that examine the range of activities now performed by these practitioners across the system. The focus should be on innovative uses of NPPs that hold promise for increasing access to care while not compromising quality.

At present, there are numerous opportunities to observe NPPs in a variety of settings, in different specialties, and for various functions, inside as well as outside the VA. The VA should take advantage of these "natural experiments" to evaluate the appropriate (and inappropriate) uses of NPPs across a range of practice conditions.

FURTHER DEVELOPMENT OF THE PHYSICIAN STAFFING METHODOLOGY

The committee concludes that the task of developing a methodology to determine the number of physicians required by the VA is best pursued in an "evolutionary" fashion. The methodology recommended in this report should be regarded not only as a concrete beginning, but as a springboard to further experimentation and analyses. These would serve to test the validity of the statistical and expert judgment models as well as the overall appropriateness of staffing recommendations from clinical and economic perspectives. In the course of this report, the committee has presented a number of proposals for testing, refining, and extending the current methodology.

In what follows, specific steps that the VA should take to launch this evolution are discussed.

Refining and Extending the EBPSM

The VA should test, evaluate, and revise (as needed) the EBPSM on an ongoing basis. With the demands on the VA health care system in dynamic transition, the EBPSM should not be treated as a static construct.

Improving the Accuracy of Data from the VA CDR

The VA should consider several options for strengthening the empirical foundation of these models:

- Each VAMC is now required to have a data validation committee. These committees should be actively encouraged to work aggressively at quality control.
- Positive incentives should be instituted for individual physicians and administrators to fill out CDR worksheets accurately—or penalties should be assessed for evident errors.
- For short, concentrated periods, physicians and administrators should be required to track how physician time is being allocated across activities; the results could be compared with the corresponding FTEE allocation in the CDR.

Developing Improved and New Variables for the EBPSM

The scope of the VA national data system should be broadened to permit the refinement of existing variables and the construction of potentially important new variables for use in the EBPSM:

- At present, it is not possible to distinguish full-time (FT) and various levels of part-time (PT) physician FTEE in the national CDR accounts, though the data are available in the VA payroll system. This information should be integrated into the CDR accounts to yield specialty-specific observations on the amount of physician FTEE, by FT or PT category, allocated to each PCA at all VAMCs.
- The CDR should be amended so that physician FTEE for resident education, research, and administration *not* occurring in the PCAs can be clearly distinguished.
- It is also not possible at present to distinguish physicians by subspecialty in the national CDR accounts. Investigations exploring the merits of including subspecialty FTEE in the PF equations and of producing IPFs specific to subspecialty should be undertaken, and they will require this more detailed FTEE data.
- The VA should strongly consider focused, time-limited surveys to collect information, by specialty, on the amount of FTEE contributed at VAMCs by C&A and WOC physicians.
- Data on the type, amount, and vintage of capital equipment affecting the efficient delivery of high-quality care should be made available for each PCA in all VAMCs.
- The CDR should be amended so that it is possible to obtain direct observations on the allocation of residency time, by postgraduate year (PGY), to all PCAs in the VAMC.
- As noted in the previous section, the VA should modify the CDR national accounts so that model-relevant FTEE data for four types of NPPs are available at the PCA level. This would require establishing distinct CDR cost centers for PAs, NPs, CRNAs, and CNSs.
- The strong statistical performance of most PF and IPF equations provides *prima facie* evidence supporting the validity of the workload measures used. But the VA should consider further analyses testing whether there are other output variables, derivable from existing VA data, that are more sensitively related to physician time requirements.
- Studies of the relationship between the intensity of physician staffing and indicators of the quality of care should be pursued, as indicated earlier.

Further Methodological Development

The committee recommends that the VA periodically review the selection of variables and functional form for each PF and IPF equation.

Over time, a number of factors affecting the PF and the IPF equations can be expected to change, at varying rates: the mix and acuity level of cases presenting at VAMCs, medical technology, practice patterns, the range of services offered by the VA, and the quality and scope of data from the CDR and other sources.

Consequently, it is important that all equations be reestimated periodically to test whether these various secular changes indicate that the models should be modified—either in their mathematical form or in the variables that make them up. The present data systems would permit reanalysis of these equations on an annual basis.

Moreover, as multiple years (and, hence, samples) of data accumulate, it will become possible to undertake certain innovative, split-sample methods of internal model validation, such as bootstrapping.

Evaluating and Refining the SADI

The committee has recommended that the expert judgment component of the physician requirements methodology be built around application of the SADI. However, the committee does regard the SADIs developed in this study as first-generation instruments, requiring additional evaluation and refinement.

Because the SADI approach emerged late in the study, it was not feasible to use a modified Delphi method, the committee's preferred approach, to derive physician activity-time estimates. The SADI estimates reported in chapter 5 and in the appendix to chapter 6 are based, instead, on staffing judgments elicited through one mail survey of all panel members; in a sense, they can be viewed as the results from the initial iteration of a modified Delphi process.

To build upon this first-generation model, the committee recommends the following:

1. **The VA should proceed immediately to apply these SADIs to all VAMCs, or at least a large representative sample.** For the four VAMCs analyzed by the specialty and clinical program panels, staff members were able to obtain the required facility-specific workload and related data by phone and mail (on a voluntary basis) in a matter of days.
2. **Following an evaluation of these applications, each SADI should be considered for revision.** The focus initially would be on:

- Appropriate designation of activity time categories, with special attention to new programs and services (e.g., hospital-based home care);
- Appropriate specification of the type and the range of workload for each category, with special attention to whether case acuity is sufficiently differentiated; and
- Adequate delineation of factors influencing physician productivity, such as residents (by specialty and PGY), NPPs (by type), nursing and support staff, and certain items of capital equipment.

The challenge is to construct a SADI with enough detail to capture significant distinctions while omitting factors that have little influence on physician time allocations.

In this vein, the committee notes that throughout the study there was persistent discussion about the importance of nonphysician personnel of all types (nurses, various support staff, and NPPs—including psychologists and clinical social workers) in promoting the quality and efficiency of VA health care. The potential influence of these various providers on workload productivity was formally acknowledged in both the SADI and the EBPSM (particularly the PF variant)—to the extent that current data permitted.

Subsequent versions of the SADI should be structured to examine more precisely the contributions of these nonphysician providers. This would require that physician activity times for each PCA be estimated as a function of the assumed mix of all nonphysician personnel (not just NPPs) judged to be pertinent to the appropriate operation of that PCA.

Over time, the VA should investigate several other issues important to the validity, reliability, and relevance of the SADI approach, including:

- The reliability and consistency of the expert judges' physician activity time estimates;
- The feasibility of deriving from experts not simply point estimates, but *probability distributions* for the physician time required to perform various activities in the SADI. As discussed in Volume II, *Supplementary Papers*, such a probabilistic treatment of the SADI would permit the VA to develop statistical confidence statements about each of the staffing recommendations emerging from application of the instrument.
- The availability and appropriateness of observational (empirical) data from which to derive alternative estimates of these physician activity times;
- The subsequent integration of expert judgment and empirically derived activity time estimates through Bayesian statistical analysis (see Volume II, *Supplementary Papers*).

External Norms

To pursue the more detailed external norm analyses recommended by the committee, the VA should initiate a sequence of analyses as detailed below.

- Select a small number of clinical sites whose patient populations and scope of services are reasonably comparable to the VA's;
- From each site, collect data on workload, physician FTEE, nonphysician FTEE, and other descriptive information in sufficient detail that average physician time per unit of workload can be computed conditional upon patient characteristics (e.g., age, DRG classification); the availability of residents, nurses, NPPs, and support staff; and other productivity-influencing factors.
- These non-VA physician task times—which at this point would be at a level of detail comparable to those in the SADI—could be applied to the workload data from any given VAMC to derive an implied total quantity of physician FTEE required. This staffing estimate could then be compared with physician requirements for the facility as derived from the SADI and with the actual level of physician FTEE there.

The VA should explore this and other scenarios for applying norms to all specialties and program areas.

Extending the Workload Projection Models

The precision and specificity, and thus the policy usefulness, of the workload projections required by the physician staffing models would be enhanced if veteran utilization of the VA system could be analyzed as a function of factors known to influence the demand for care. These include income, health insurance coverage, perceived quality of care, availability of alternative sources of care, and distance from the VAMC, as well as age, gender, and eligibility-for-care status.

In addition, projection models such as those used by the VA currently and adopted here (see chapter 8) do not exploit the total information embedded in a given data set as efficiently as standard statistically based demand models. In particular, to investigate the joint and possibly interactive influence on utilization of two or more explanatory variables is a much more cumbersome undertaking. Statements about statistical precision and confidence are simply not possible with projection models since they are not derived statistically in the first place.

The committee urges the VA to pursue the patient demand analyses described above.

Moving the Process Forward

There are a number of ways the VA could organize and support the analyses recommended above: a task force staffed principally from within the VA and coordinated through the office of the chief medical director; a targeted program of grants for which VA health services researchers, and possibly others, would be invited to compete; a program of contracts to perform specific analytical tasks related to testing or extending the methodology; or some combination of these approaches.

With respect to these alternative approaches, the committee makes no specific recommendation. But it does recommend that the analyses proceed according to a two-phase process, defined roughly as follows:

- Phase I—an intensive period of analysis to evaluate and refine the SADIs, producing second-generation instruments in each case; to begin constructing new data and variables, as recommended, for the EBPSM; to undertake a more intensive application of external norms; and to produce first-generation versions of demand-based workload estimation models for inpatient, ambulatory, and long-term care.
- Phase II—an ongoing operation in which the VA (through its designated analysts) periodically reevaluates and possibly revises the SADIs, the EBPSM, external norms, and the workload models. The implications of these revisions for the content and execution of the Reconciliation Strategy would be analyzed.

With the veteran population aging, with technology ever changing, with practice patterns evolving in the non-VA sector, it is crucial that the physician requirements methodology be reexamined on a regular basis.

The committee estimates that Phase I could be completed within 24 months; Phase II would represent an ongoing commitment by the VA to ensure the continuing quality of its physician staffing policies.

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Appendixes

Appendix A

Rosters of Study Committee Panels and VALiaison Committee

The rosters below list the members of the panels appointed to provide advice and guidance to the study on specific areas of interest, as well as the members of the VA Liaison Committee. An* following a name denotes membership in the Institute of Medicine; a† indicates that the individual was a member of the study committee. The reader should note that the title of a panel member does not necessarily reflect all of his or her academic and clinical appointments.

Data and Methodology Panel

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Appendix B

List of Abbreviations

ADC — Average daily census
BDOC — Bed—days of care
BMTU — Bone marrow transplant unit
CAPWWU — Capitation Weighted Work Unit
C&A — Consulting and attending (physician)
CCU — Coronary care unit
CDR — Cost Distribution Report
CNS — Clinical nurse specialist
COGME — Council on Graduate Medical Education
COS — Chiefs of staff
CRNA — Certified registered nurse anesthetist
DoD — Department of Defense
DRG — Diagnosis—related group
DSE — Detailed Staffing Exercise
EBPSM — Empirically Based Physician Staffing Models
FT — Full—time
FTEE — Full—Time—Equivalent Employees
FY — Fiscal year
GEU — Geriatric evaluation unit
GMENAC — Graduate Medical Education National Advisory Committee
GRECC — Geriatric Research, Education, and Clinical Center
HMO — Health maintenance organization
HBHC — Hospital—based home care
ICU — Intensive care unit
IHS — Indian Health Service
IOM — Institute of Medicine
IPF — Inverse production function
JCAHO — Joint Commission on the Accreditation of Healthcare Organizations
LOS — Length of stay
LP — Linear programming
LTC — Long—term care
MAD — Mean absolute deviation

MEDIPP — Medical District Initiated Program Planning
MICU — Medical intensive care unit
NP — Nurse practitioner
NPP — Nonphysician practitioner
OPS — Other Physician Services (serving to define one of six ambulatory PCAs at the VAMC)
PA — Physician assistant
PCA — Patient care area
PF — Production function
PGY — Postgraduate year
PSA — Primary service area
PT — Part—time
PTF — Patient Treatment File
PTSD — Post—traumatic stress disorder
RAM — Resource Allocation Methodology
RBRVS — Resource—Based Relative Value Scale
RMS — Rehabilitation medicine service
RPM — Resource Planning and Management (methodology)
RUG — Resource Utilization Group
RUGWWU — Resource Utilization Group Weighted Work Unit
SADI — Staffing Algorithm Development Instrument
SCI — Spinal cord injury
SICU — Surgical intensive care unit
VA — Department of Veterans Affairs
VAMC — Department of Veterans Affairs Medical Center
VHA — Veterans Health Administration
WOC — Without—compensation (physician)
WWU — Weighted Work Unit