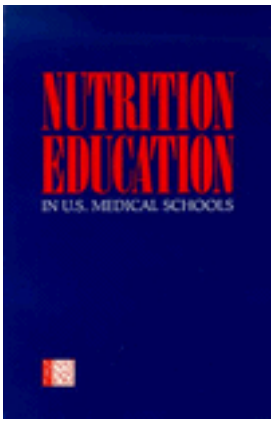

Nutrition Education in U.S. Medical Schools

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Nutrition Education in U.S. Medical Schools

Committee on Nutrition in Medical Education
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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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Preface

As the American public becomes increasingly aware of the importance of nutrition in health maintenance and disease prevention and treatment, physicians are frequently expected to provide their patients with accurate, up-to-date information and guidance concerning diet, food, and health. This increased public demand for nutrition information, along with growing recognition of the integral role of nutrition in health, has contributed to a heightened awareness within the medical community of the need to provide physicians with adequate training in this area.

The Food and Nutrition Board (FNB) of the National Research Council viewed the question of adequate and appropriate nutrition education in medical schools to be of sufficient national concern to warrant assessment. Thus, at the request of the Ruth Mott Fund and the William H. Donner Foundation, the Committee on Nutrition in Medical Education was established within the FNB and charged with examining three major issues: (1) How and to what extent is nutrition incorporated into medical school curricula? (2) What percentage of medical schools teaches nutrition? (3) How successfully is nutrition taught in different categories of medical schools, and what are the reasons for the success or failure of the programs? The committee was also asked to make recommendations, based on its analysis of these questions, concerning the role that nutrition should play in medical education and the feasibility of and strategies for implementing them. In doing so, it drew upon the wide range of expertise of its eight members, who have experience in academic, clinical, and administrative aspects of medical education. Collectively, the committee represented such disciplines as biochemistry, physiology, nutritional sciences, pediatrics, medicine, family practice, university administration, and science and health policy.

The report prepared by the committee begins with an Executive Summary, Chapter 1, which highlights the major findings and recommendations resulting from the study. The scientific, social, and economic forces that have shaped the role of nutrition in the medical curriculum during this century are discussed in Chapter 2. Chapter 3 directs the reader's attention to the ever-growing body of knowledge implicating nutrition as one of the etiological factors contributing to many forms of chronic and degenerative disease. The application of nutrition principles to patient care within the many medical specialties is illustrated. Chapter 4 contains summaries of previous conferences, congressional hearings, and surveys that have examined this subject as well as reviews of other relevant reports. This chapter also contains the results of an independent survey conducted by the committee to determine how and to what extent nutrition is incorporated into the curricula. The committee's review of nutrition-related questions on the National Board examinations and the view of the American Medical Student Association regarding nutrition education are also presented.

To assist medical schools in incorporating nutrition into their curricula, the committee developed an outline of core concepts to identify the basic body of nutrition knowledge that all graduating medical students should acquire during their medical training. These concepts, along with examples to illustrate specific kinds of information, are presented in Chapter 5. Chapter 6 is a summary of the committee's findings based on all the data that it analyzed. It also presents the strategies for effectively incorporating nutrition into the medical school curriculum.

The committee is grateful to all who contributed to the study. It wishes especially to acknowledge the contribution of the following consultants, who provided valuable information and expertise: Eleanor Young, University of Texas, San Antonio; Roland Weinsier, University of Alabama School of Medicine at Birmingham; Willard Visek, University of Illinois; Harold Lubin, American Medical Association; Maurice Shils and Barbara Howell, New York-New Jersey Regional Medical Center; and William Kassler, President of the American Medical Student Association.

Special thanks are also due to Edithe Levit, President of the National Board of Medical Examiners, and Robert Jewett, Deputy Vice President for Evaluation Programs, who were unfailingly helpful and supportive in providing the committee with information from the National Board examinations.

The following persons also provided valuable information and

insight that helped make this evaluation possible: James Schofield, Association of American Medical Colleges; Merrill S. Read, National Institutes of Health; and more than 45 deans, associate deans, and nutrition course coordinators who responded to our survey and provided support and encouragement.

The committee commends Susan Berkow, the FNB staff officer for the study, for her superior performance in supporting all aspects of the committee's work and in taking the initiative, wherever needed, to propose and apply innovative approaches to accomplishing the task. It also wishes to thank Frances Peter and Judy Grumpstrup-Scott, who provided patient and careful editorial assistance; Marianne La Veille for providing bibliographical material and other research support; and Barbara Miller for dedicated secretarial services.

The committee is particularly indebted to the officials of the Commission on Life Sciences and the Food and Nutrition Board: Frederick C. Robbins, Chairman of the Commission, for his invaluable support and assistance to the study, and Sushma Palmer, Executive Director of FNB, for her untiring dedication and commitment to excellence.

MYRON WINICK CHAIRMAN
COMMITTEE ON NUTRITION IN MEDICAL EDUCATION

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1

Executive Summary

Scientific conferences and congressional hearings held during the past two decades have repeatedly drawn attention to the need to upgrade the status of nutrition education in U.S. medical schools. Several factors convey a sense of urgency in addressing this need. As the general public has become more aware of advances in nutrition, consumer demands for advice on matters of diet and disease have grown. Simultaneously, health care professionals and legislators are becoming aware that strategies for disease prevention are a major hope for the future, that economic and social factors are dictating the development of alternative health care systems, and consequently, that primary health care providers, whether independent physicians or health maintenance organizations, must be equipped to meet new challenges. One of the challenges is the provision of sound nutritional guidance in the face of myriad forces that compete for the public's attention in the marketplace.

Attention to nutrition education in medical schools is not new. The scientific principles of nutrition were widely taught in U.S. medical schools during the early decades of this century. At that time, mounting evidence for the importance of dietary factors in maintaining health and preventing or curing deficiency diseases provided the primary impetus for emphasizing experimental and clinical nutrition in medical curricula.

Toward the middle of the century, however, the period of active identification and isolation of the major vitamins came to a close; fortified foods, nutrient supplements, and a more varied diet became readily available to most Americans; and the classic nutritional deficiency

diseases ceased to be a major public health problem in the United States. Partly as a consequence of these achievements, attention in the basic science curriculum of medical schools seemed to turn away from the physiological and biochemical aspects of nutrition to disciplines that encompass the fundamental principles of cellular function, such as cell biology and, more recently, molecular biology. The application of nutrition in clinical practice received less emphasis as the patterns of medical practice shifted from comprehensive care toward specialization and new technology whose association with nutrition was not yet recognized.

In the intervening years, the science of nutrition has advanced far beyond the assumption that overt symptoms of deficiency are the only attributes of malnutrition. Scientists now recognize that the functional correlates of poor nutrition may become subtly manifest at all stages of the life cycle—from curtailment of cell division and brain growth prenatally to deficits in learning capacity and behavior during childhood and adolescence and impairment in tissue function and metabolism during senescence. Among recent advances, nutrition research has elucidated the function, essentiality, and interaction of several trace minerals, uncovered the intricate role of nutrients in the immune response, and demonstrated that dietary factors, although not the sole determinants, are among lifestyle variables that may significantly influence the outcome of chronic degenerative diseases such as atherosclerosis and cancer.

Has medical education kept pace with the advances in nutrition science? Are medical students being equipped to convey the soundest nutritional advice to their patients and to apply the best therapeutic innovations in treating them? If not, what are the causes for this failure and what strategies are needed to initiate and sustain adequate teaching of nutrition in medical schools? To address these questions, the National Research Council established the Committee on Nutrition in Medical Education within the Food and Nutrition Board of its Commission on Life Sciences.

The scope of the present study was limited to the 4 years of undergraduate medical education. As a consequence, the committee was able to conduct a comprehensive study within a short time. The committee recognizes, how

ever, that the incorporation of nutrition education into postgraduate physician training programs and continuing education experiences is exceedingly important, and it supports evaluation efforts in this area.

The committee began its task by reviewing the results of many conferences and surveys of medical schools conducted during the past 20 years to examine this subject. Among the major deficiencies in nutrition education identified through these efforts were a failure to provide administrative and institutional support for teaching nutrition, a lack of adequately trained faculty, and the absence of a defined place for nutrition in the curriculum. Despite repeated recommendations to remedy these shortfalls, a widespread perception persists that nutrition is not given the same recognition in the medical curriculum as other scholarly disciplines. Although past surveys were invaluable in providing a qualitative baseline, their quantitative estimates were limited by narrowness of scope, questionable sampling techniques, and a failure to validate the results. The committee therefore conducted a new survey of 45 schools—approximately one-third of all U.S. medical schools. The initial selection was random. Additional schools were then selected from underrepresented categories so that the final sample of 45 represented a cross section of all schools. The survey was designed to determine the manner and extent to which nutrition is incorporated into the medical curriculum. (For a more detailed description, see Chapter 4).

To avoid many of the uninterpretable responses that marred the results of previous surveys, the committee directed a series of questions to a faculty member at each school with primary responsibility for teaching nutrition (e.g., a coordinator of nutrition education or a biochemistry department faculty member). The questions pertained to the number of hours devoted to nutrition in the required curriculum, the nature and scope of the program, the placement of nutrition in the curriculum, faculty training, and both administrative and financial support for the faculty. The questionnaire was sent to 46 schools, of which 45 responded. Thirty-nine of these replies were followed up by telephone interviews or by asking the respondents to send their curriculum outlines. The survey was followed by detailed telephone interviews with nutrition coordinators at nine of the medical schools

that the committee identified as having discrete nutrition programs. In addition, the committee consulted selected faculty members with primary responsibility for the nutrition curricula at a number of other schools to determine the origin and evolution of their programs. Although much of the information obtained was qualitative, it provided insight into factors that determine the success or failure of nutrition education in medical schools.

Recognizing that the National Board of Medical Examiners has a profound influence on medical education, principally through its annual examinations, the committee reviewed the data on student performance and the board's test questions from several recent examinations. In addition, it examined four recent surveys of graduating medical students conducted by the Liaison Committee on Medical Education of the American Medical Association and the Association of American Medical Colleges (AAMC), and it solicited the views of the American Medical Student Association—an organization that represents more than 30,000 medical students in the United States.

The committee also examined the funding practices of the National Institutes of Health and other public and private organizations as they relate to nutrition research and training in order to ascertain the emphasis accorded to nutrition and its possible impact on medical school teaching practices.

CONCLUSIONS AND RECOMMENDATIONS

The committee concluded that nutrition education programs in U.S. medical schools are largely inadequate to meet the present and future demands of the medical profession. This perception, reflecting results of prior surveys and conferences, was confirmed by the committee's independent survey and related investigations as outlined above.

The committee recommends that medical schools and their accreditation bodies, federal agencies, private foundations, and the scientific community make a concerted effort to upgrade the standards as detailed below. The committee recognizes the extraordinary demands placed on the medical education system of today. Nevertheless, it believes these changes could be achieved with minimal

disruption of existing curricular and administrative structures although in most cases this upgrading may require a major philosophical adjustment.

- The committee recommends to medical schools that the basic principles of nutrition be introduced simultaneously with other preclinical sciences as an independent course, and that the precepts of nutrition be reinforced later during clinical training to demonstrate their application to patient care. This recommendation stems from the recognition that the importance of nutrition is not sufficiently recognized by the faculty and that its impact is significantly diminished when it is not taught as a discrete entity. The present survey demonstrated that most schools teach some nutrition in one form or another; however, only two-thirds of them teach it in the first academic year and approximately 20% teach nutrition as a separate, required course. In medical schools, elective courses are distributed throughout the 4 years of the basic science curriculum and range in duration from less than 4 weeks to more than 10 weeks. Although many schools offer nutrition clerkships or electives, the results of both the committee's and the AAMC's surveys indicated that only a small segment of the student body takes advantage of these options. In contrast, required courses serve as a focal point for a discipline and significantly increase the probability that the student body has a uniform base of knowledge.
- The committee proposes that the following topics in nutrition become part of the basic curriculum of medical schools and, furthermore, that they be integrated into clinical clerkships: energy balance, role of specific nutrients and dietary components, nutrition in the life cycle, nutritional assessment, protein-energy malnutrition, the role of nutrition in disease prevention and treatment, and risks from poor dietary practices stemming from individual, social, and cultural diversity. To cover these core concepts adequately, a minimum of 25 to 30 classroom hours should be allocated to them during the preclinical years. At present, only 21 hours, on average, are given to these subjects. According to the committee's survey, there is great variation in the number of nutrition hours taught. For example, approximately 60% of the schools surveyed provide less than 20 hours in nutrition instruction and 20% teach less than 10 hours. Only 30%

teach 30 or more hours. The number and distribution of hours devoted to nutrition in clinical settings could not be determined with any degree of confidence.

The committee's survey also demonstrated considerable variation in the scope of topics included in nutrition courses. Some subjects, such as energy balance and obesity are covered in almost all schools, whereas others, such as the role of nutrition in health promotion and disease prevention, receive attention in only a few schools.

- The committee recommends that persons with strong backgrounds in nutrition science, research, and applications to clinical medicine be assigned to lead the development of nutrition programs in medical schools. Physician-nutritionists, well-versed in the clinical application of basic research, would be the ideal candidates. Currently, faculty leadership for nutrition programs is shared by M.D.s and Ph.D.s. In the nine schools identified through the survey as having well-established programs, M.D.s play a strong, central role in teaching nutrition and in demonstrating its application to clinical medicine. The committee encourages medical schools to involve M.D.s as well as Ph.D.s in the instruction of nutrition.

  There are variations in the administrative structure of U.S. medical schools and, as a consequence, differences in faculty responsibility. Because authority for nutrition education is often not centralized, the success of a program often depends heavily on individual initiative. In approximately 80% of the schools that teach nutrition, responsibility is shared by scholars engaged in basic sciences such as biochemistry, physiology, and pharmacology, or in clinical disciplines such as pediatrics, medicine, surgery, and gastroenterology. Faculty coordinators interviewed by the committee on average devoted 40% of their time to nutrition research. The committee determined, however, that although faculty training in nutrition science appears to be minimal in schools that place little emphasis on nutrition, renowned nutrition scientists in several medical schools do not seem to be engaged in teaching nutrition at their institutions. A strong research program in nutrition enhances the credibility of

the faculty and provides financial security, but nutrition research per se in medical schools does not guarantee that nutrition will be taught.

- To ensure permanence of the nutrition programs, the committee recommends that responsibility for the programs be vested in a separate department of nutrition or in a distinct clinical division of the medical school. Moreover, it recommends that each institution allocate funds for the support of at least one faculty position in nutrition. At present, faculty positions specifically designated for nutrition are rare. The financial burden attendant on meeting these goals may be partially offset by income generated from nutrition-related clinical support services within the hospital, but in the immediate future will have to be derived predominantly from research support or other sources.

  The committee supports the concept of diverse approaches in medical education and recognizes that each school must devise its own curriculum design, implementation strategy, and organizational structure. In its judgment, however, lack of organizational structure and administrative and financial support are the prime hindrances to the maintenance of nutrition programs in medical schools.
- The committee proposes that the National Board of Medical Examiners consider appointing advisors to review the distribution and quality of nutrition-related questions on board examinations and to establish a mechanism for communicating such findings and recommendations to board section chairmen. Such advisors could also identify areas of clinical nutrition that deserve coverage in the examination or provide new questions for consideration by the board committees. Of the approximately 6,000 examination questions reviewed by the committee, 3% to 4% had some relation to nutrition and the distribution of the questions on nutrition among the medical specialties was noticeably uneven. There were no questions on several topics deserving emphasis, e.g., osteoporosis, nutritional requirements of the elderly, total parenteral and enteral feeding techniques, and the relationship between nutrition and cancer.
- The committee recommends that the federal government and private foundations provide additional financial support for the development of teaching aids and the training

of a cohort of clinical scientists with competence in nutrition. Nutrition coordinators and faculty reported that the resources for teaching nutrition in medical schools are insufficient and that nutrition textbooks and ancillary aids, although plentiful, are unsuited to their needs. Both these deficits place additional demands on medical schools and are a deterrent to the development of nutrition programs. Although the committee encourages institutional sharing of faculty and resources as an interim measure, the long-term survival of nutrition programs is dependent on increases in funds from federal and private sources.

- To evaluate existing programs more accurately and to assist in planning for the future, the committee recommends that a mechanism be established to monitor periodically changes in the status of nutrition education in medical schools. One device would be to include more exploratory questions on nutrition in the annual survey of medical school curricula conducted by the AAMC. These questions should be directed at persons with primary responsibility for the program. The committee also encourages each medical school to' monitor its own program to ensure that it remains abreast of advances in nutrition. Finally, the committee recommends that in approximately 5 years, an authoritative body such as the Food and Nutrition Board of the National Research Council reexamine the status of nutrition in U.S. medical schools. The absence of a reliable surveillance mechanism thus far has severely hampered the ability to define the dimensions of the problem and to characterize progress.

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All the elements outlined above—placement of nutrition in the curriculum, scope and duration of courses, financial and administrative support for faculty and research, attention by accreditation bodies that influence medical education, and mechanisms for monitoring progress—are essential to ensure that nutrition programs are initiated and that existing ones are rejuvenated and sustained. The committee recognizes the difficulties that attend any curricular change in undergraduate medical education. Nonetheless, it believes that most medical schools could implement the above recommendations now without major re-allocation of funds or displacement of other disciplines.

2

Historical Perspective

Early in the century, scientific principles of nutrition were widely taught in the medical schools of the United States. Later, as research in nutrition declined, there was a parallel decline of interest in nutrition education. Today, specific courses that teach the science of nutrition are found in a minority of U.S. medical schools.

EARLY NUTRITION RESEARCH AND MEDICAL EDUCATION

During the early 1900s researchers discovered evidence for the importance of specific components of foods in maintaining health and in curing or preventing many recently identified deficiency diseases. These advances came at a time when medical education was under scrutiny. In 1902, W. G. Thompson, a professor of medicine at Cornell University Medical College, expressed concern about the absence of nutrition in medical education:

> The subject of the dietetic treatment of disease has not received the attention in medical literature which it deserves, and it is to be regretted that in the curriculum of medical colleges it is usually either omitted or is disposed of in one or two brief lectures at the end of a course in therapeutics. One cannot fail to be impressed with the meager notice given to the necessity of feeding patients properly, and the subject is usually dismissed with brief

> and indefinite phrases such as: "the value of nutritious diet requires more mention, ... a proper but restricted diet is recommended," or "the patient should be carefully fed" (Thompson, 1902).

Eight years later, Flexner (1910) characterized medical education in the United States as lacking structure, uniformity, and a strong scientific base.

THE GOLDEN AGE OF NUTRITION

Following investigations during the first two decades of this century on metabolism and energy requirements by the distinguished nutritional physiologists Graham Lusk and Wilbur Atwater and the vitamin hypothesis proposed by Sir Frederick Gowland Hopkins, medical educators increasingly began to support the teaching of nutrition principles (Darby, 1977). The pioneering work on vitamins by such scientists as Casimir Funk and the discovery of essential nutrients and their relationship to the prevention of deficiency diseases then led to a burgeoning interest in experimental and clinical nutrition. These years would later come to be known as a golden age of nutrition (Darby, 1976). Other important research during the first two decades of this century included the now classic epidemiological studies of Goldberger; the determination of energy values for carbohydrates, fats, and proteins by Atwater; and Elmer McCollum's early work with vitamins and, later, trace minerals.

McCollum also encouraged the teaching of nutrition in medical schools. In his textbook Newer Knowledge in Nutrition (McCollum et al., 1918), which was widely used in medical schools, McCollum pointed out that many of the recent advances in nutrition knowledge had resulted from severe food shortages following World War I. This new knowledge, he claimed, should be taught in medical schools and made available to practicing physicians. Examination of several of the most commonly used biochemistry textbooks in medical schools during the 1920s and 1930s reveals that nutrition and foods were indeed emphasized (Bodansky, 1927; Lusk, 1917; Osler et al., 1938). Of the 16 chapters in Meyer Bodansky's Introduction to Physiological Chemistry (Bodansky, 1927), three chapters described the chemistry of carbohydrates, fats, and

proteins; two described digestion and absorption; four described intermediary metabolism; and one each described animal calorimetry and animal nutrition.

In 1934 Bodansky enlarged his second edition by 200 pages and expanded the nutrition section to include a discussion of protein requirements, the indispensability of fat, and the role of vitamins (Bodansky, 1934). He also added new chapters on sources and composition of foodstuffs. These additions were due in part to advances in nutrition science since the first edition. For example, during the 1920s and 1930s ascorbic acid had been isolated and synthesized, linoleic acid was identified as an essential fatty acid, and other vitamins and trace elements were shown to be essential to the diet (Darby, 1976; Todhunter, 1976).

During the 1930s and 1940s many of the important micro-nutrients were isolated and synthesized, and medical educators were engaged in teaching students the biochemical and clinical aspects of nutrition (Darby, 1976; Todhunter, 1976). In addition, new organizations were formed to foster nutrition education in the medical school curriculum and to encourage the application of nutrition principles in medical practice. For example, the American Medical Association's (AMA) Council on Medical Education and Hospitals among other tasks studied the role of nutrition in medical education. The council reported that all but three medical schools in the United States taught a basic biochemistry course during the first year and those three schools taught it in the second year (Weiskotten et al., 1940). The Weiskotten report, as well as medical education textbooks that were commonly used in the 1930s (Bodansky, 1934; Harrow and Sherwin, 1935; Hawk and Bergeim, 1926; Osler et al., 1938), indicate that faculty in biochemistry, pediatrics, physiology, medicine, and, to a lesser extent, pathology participated in presenting basic and applied concepts of nutrition to first- and second-year medical students. It was uncommon, however, for nutrition to be offered as a separate course (Weiskotten et al., 1940).

DECLINE OF THE GOLDEN AGE

In 1948 a vitamin found to protect against pernicious anemia was simultaneously isolated in the .United Kingdom

(Smith and Parker, 1948) and in the United States (Rickes et al., 1948). In 1949, when it was identified and accepted as vitamin B12, the period of active identification and isolation of the major vitamins appeared to be ending (Mehlman, 1976). Concern for the classic deficiency diseases also diminished as they ceased to be a major public health problem in the United States. Furthermore, advances in food technology, especially the advent of food fortification and supplementation and the expanding food distribution and marketing systems, brought a more varied, nutritionally adequate diet within the reach of many Americans. Not yet knowing the role of nutrition in lowering the risk of coronary heart disease, stroke, hypertension, and cancer, most medical educators began to believe that the scientific basis for nutrition could be adequately taught in biochemistry and physiology courses. With a shift of interest in biochemistry and physiology toward cell biology and molecular biology, nutritional problems no longer offered the same intellectual challenge, and biochemists, once deeply concerned with nutritional problems, shifted their focus away from nutrition toward the molecular basis of gene structure and enzyme and endocrine function.

During the 1950s and 1960s nutrition was relegated to a low priority in the curriculum and no longer was taught as an independent course. Moreover, there was an increase in the number of subspecialities and specialized faculty, each with its own claim on the medical curriculum, and nutrition became fragmented and integrated into several basic science courses so that its principles were overlooked or became difficult to identify. Accordingly, their relevance to clinical practice was overlooked (Harlan et al., 1968; Mueller, 1967; Shank, 1966; Stare, 1959). For example, courses in biochemistry provided detailed descriptions of metabolism; however, little attention was given to the food sources that provide the substrates for these reactions. Similarly, although physiology dealt with digestion and absorption, the nutrient requirements of the human organism were generally not emphasized (Shank, 1966). The relevance of nutrition to clinical medicine was further diminished as medical practice shifted toward therapeutics and the use of new technology and away from prevention and comprehensive care. Results from a survey of medical schools in 1958 indicated that 12 of 60 schools (20%) offered a special course in nutrition

(High, 1958). Thus, nutrition was no longer as important a part of the medical curriculum as it once had been.

RESURGENCE OF INTEREST IN NUTRITION IN MEDICAL EDUCATION

In the early 1960s there was a growing awareness in the medical community that nutrition education for physicians was inadequate and that physicians would find it increasingly difficult to advise their patients regarding questions of diet and health.

The AMA Council on Foods and Nutrition reported that nutrition in the U.S. medical schools received "inadequate recognition, support and attention" (White et al., 1961). In 1963, as a result of this evaluation, the AMA council and the Nutrition Foundation sponsored a nationwide conference in Chicopee Falls, Massachusetts, that enabled practicing physicians, teaching and research scientists, and administrators from medical schools and granting agencies to share ideas about improving nutrition in medical education. In their recommendations (AMA, 1963), the conferees urged that each medical school should designate a committee to develop a teaching program in nutrition; medical internship and residence programs should include a defined, supervised clinical nutrition experience; and industry and government should allocate funds to support research and training for health professionals in nutrition. The AMA Council on Foods and Nutrition formally concluded that there was inadequate recognition and support for nutrition in U.S. medical education at both the undergraduate and postgraduate levels and that expansion and improvement of present programs were essential.

There were other instances of institutions or groups recognizing the inadequacy of nutrition in medical education. In 1969 a Senate Select Subcommittee on Nutrition and Human Needs (U.S. Congress, 1969) heard testimony from more than 200 witnesses on nutritional deficiency in America. In the same year a White House Conference on Food, Nutrition, and Health led by Jean Mayer was convened (White House Conference, 1969). Attendees concluded that nutrition in medical education was inadequate and recommended that funds be made available for future program development. However, despite this growing interest in nutrition education for medical students, a 1971 survey

(Phillips, 1971) of second-year medical students concluded that students' knowledge of the essential concepts of nutrition as defined by the White House conferees was generally inadequate.

Although some medical schools showed progress in improving nutrition education during the decade following the Chicopee Conference by developing specific courses or programs (Christakis, 1972; Frankle et al., 1972; Harlan, 1968), many of the recommendations, such as the development of specific departments and faculty positions, were not widely implemented (Mueller, 1967). Furthermore, of the 23 new medical schools that were established in the United States from 1960 to 1971, most were not planning nutrition programs (White et al., 1972). Therefore, the Williamsburg Conference (White et al., 1972) was organized in 1972 to reinforce the Chicopee Conference recommendations and to develop additional guidelines. Among other recommendations, the conferees urged that federal funds be allocated for research and training of physicians and other health professionals in nutrition. This effort, they felt, would enhance nutrition in medical education at the undergraduate, graduate, and postdoctoral levels.

PUBLIC AND PROFESSIONAL AWARENESS

Public and professional awareness of the inadequacies in nutrition education for physicians and other healthcare professionals was further stimulated by Charles E. Butterworth's article, "The Skeleton in the Hospital Closet," which appeared in Nutrition Today (Butterworth, 1974). Although Butterworth had not specifically addressed the issue of nutrition education, proponents of nutrition education attributed his descriptions of malnutrition among hospitalized patients to physicians' ignorance of the principles of nutrition (Long, 1982).

In an effort to locate and describe these inadequacies and determine the status of nutrition in U.S. medical schools, the AMA Department of Foods and Nutrition during 1976 conducted a mail survey of the 114 accredited U.S. medical schools (Cyborski, 1977). Of the 102 schools responding, fewer than 20% offered a required nutrition course, whereas 95% taught nutrition topics within the framework of other courses. Many schools reported the

availability of electives, clinical clerkships, research opportunities, and postgraduate training in nutrition.

The final section of the AMA survey requested comments on perceived trends in nutrition at each institution. Approximately one-third of the respondents reported an increased interest in nutrition at their institution by faculty and, in particular, by students. The most commonly cited limitations to increasing nutrition instruction in medical education were lack of funds, inadequate training of physicians in clinical nutrition, and the amount of time available in the curriculum.

The AMA survey was repeated 2 years later (Geiger, 1979). Questionnaires were sent to 124 accredited U.S. medical schools, and 118 schools responded. Although the survey findings appeared to show a slight increase in the amount of nutrition information presented in medical school curricula since 1976 (25% of schools required a course in nutrition), the results were incomplete. Deans were not able to identify the number of hours devoted to nutrition topics, particularly when the topics were integrated into other courses or incorporated into clinical clerkships.

A PUBLIC POLICY ISSUE

During the late 1960s and 1970s the political climate prompted a heightened social awareness of existing malnutrition, hunger, and chronic disease in the United States and aroused medical as well as political concern. Congress responded by holding hearings on nutrition and human needs (U.S. Congress, 1977a,b,c) as well as on the training in nutrition that is provided to physicians and other health professionals (U.S. Congress, 1978, 1979). At the latter hearing (U.S. Congress, 1979), the U.S. General Accounting Office (GAO) reviewed the federal government's efforts to foster nutrition in medical education. The GAO testified that in spite of its importance to health, nutrition was not taught adequately in many medical schools, and it recommended an increase in federal funds to improve nutrition in medical education (GAO, 1980). In addition, consultants were requested by the Senate Subcommittee on Nutrition of the Committee on Agriculture, Nutrition, Forestry to evaluate the adequacy of nutrition-related questions on the 1978 National Board

examinations. In the reviewers' judgment, the quantity of nutrition questions was low (3% to 4% of total examination questions were related to nutrition), and the quality and topical distribution of questions was poor (U.S. Congress, 1979). For example, they reported that were no questions on Recommended Dietary Allowances and nutritional assessment, and several questions addressed acute nutritional deficiency diseases that were primarily a health problem outside the United States.

At the same time as the Congressional hearings on the adequacy of medical education, the first Surgeon General's report on health promotion and disease prevention was released (DHEW, 1979a). The report, entitled Healthy People, cited accumulating research evidence that diet plays an important role in human health and that most Americans consult their private physicians or other medical care deliverers for nutritional guidance. The report advised that action be initiated to remedy the current deficiencies in medical education.

Three reports that further demonstrated federal concern about nutrition were issued jointly by Congress and the Office of Science and Technology Policy (OSTP) (Executive Office of the President, 1977, 1980, 1982). In these reports the federally supported nutrition programs were assessed for their effectiveness, and strategies for improvement were recommended. Furthermore, the 1980 and 1982 reports indicated the need to establish a more precise relationship between diet and chronic and degenerative disease as well as the need for further research.

The federal government began to increase its funding for nutrition research, research training, and education activities following the initial stimulation by the White House Conference in 1969 and subsequent congressional interest during the 1970s. The increased availability of resources helped to expand nutrition research and training programs and thereby contributed to research that provided early evidence associating diet and chronic disease. For example, the Nutrition Coordinating Committee was formed within the National Institutes of Health (NIH) to develop, monitor, and coordinate major research, training, and funding efforts in nutrition at NIH. Among other accomplishments, the committee helped establish the Clinical Nutrition Research Units (CNRUs)—a program designed to foster and stimulate scholarly research related to

nutrition and health maintenance and disease treatment. A major function of the CNRUs was to provide a focus around which nutrition education in medical schools would operate. Seven units were funded under this program (DHEW, 1979b).

Thus, once again there was resurgent excitement in the area of diet and health. Although the emphasis had shifted dramatically from the treatment of deficiency diseases to the prevention of chronic disease, it was not yet understood how this change would involve physicians and their methods of patient care.

In 1979, the federal government demonstrated its support for improving and strengthening nutrition in medical education by sponsoring grants (U.S. Code, 1976) for curriculum development in applied nutrition. Although this support was truncated after 2 years, it helped to establish the National Workshop on Nutrition Education in' Health Professional Schools, sponsored by the Emory University School of Medicine (1981). The workshop speakers summarized epidemiological data and basic clinical research that showed a strong association between current dietary patterns and the so-called killer diseases. Based on their findings, the participants reported that prevention of these nutrition-related disorders was the best and most cost-effective strategy for conquering these diseases.

NIH also sponsored the Workshop on Physician Education in Cancer Nutrition, because it had noted a significant lack of courses addressing the relationship of nutrition and cancer in U.S. medical schools (NCI, 1980). The workshop participants explored the educational needs of physicians at various levels of training and recommended specific courses and teaching methods for improving the teaching of the relationship between nutrition and cancer in medical education.

Each year since its inception in 1977, NIH's Nutrition Coordinating Committee prepares the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training for the preceding year, which summarizes major research achievements and directions for future research. Reports from the last several years (DHEW, 1979b; DHHS, 1980, 1981, 1982, 1983, 1984) reflect important advances. For example, total parenteral

nutrition and other forms of nutrition support have broadened the treatment possibilities for hospitalized and other patients; knowledge of premature infant care has grown, and the survival rate of these infants is increasing; understanding of the critical relationship between maternal nutritional status, fetal health, and pregnancy outcome has grown, and intervention strategies to lower the incidence of low birth-weight infants and infant mortality have been established; the relationship of obesity to such disease states as diabetes, coronary heart disease, cancer, stroke, and hypertension has been investigated; and research on the role of nutrition in disease prevention and health promotion has intensified.

Despite the increasing evidence that nutrition has an important effect on health promotion and disease prevention, the results of the 1981-1982 Liaison Committee on Medical Education (LCME) survey (AAMC, 1982b) indicated that only 46 of 125 schools polled (37%) had a required nutrition course. Results from the 1982-1983 LCME survey (AAMC, 1983c) were similar; few changes had occurred in the nutrition curriculum since the previous survey. And in fact, the 1983-1984 Association of American Medical Colleges Curriculum Directory (AAMC, 1983a) indicates that only 22% of medical schools have a clearly defined course in nutrition. Not surprisingly then, the majority of graduating medical students responding to recent annual AAMC Graduation Questionnaires (AAMC, 1981, 1982a, 1983b, 1984a) perceived that the nutrition instruction they received was insufficient (see Table 4-2 in Chapter 4, p. 71). According to these questionnaires, students also perceived that the time devoted to prevention was inadequate.

Although these data provide some insight into the status of nutrition in medical education, the statistics must be interpreted carefully for the following reasons. Many schools are not able to document the number of educational hours devoted to nutrition. The approaches to incorporating nutrition in medical education are varied, and the amount of attention devoted to nutrition instruction during the preclinical and clinical years (Howard and Bigaouette, 1983) depends on the structure of each curriculum as well as on the interest and skill of faculty members. Unfortunately, those factors make it Difficult to determine with certainty the extent to which nutrition is included in medical curricula.

NUTRITION IN MEDICAL EDUCATION ABROAD

Inadequate nutrition education in medical schools has also been recognized and examined in the United Kingdom (Gray, 1983) and Australia (Commonwealth Department of Health and National Health and Medical Research Council, 1983). Each of these countries issued strong policy statements and recommended strategies for ensuring that nutrition instruction in medical education keep pace with growing knowledge in science and technology and the increasing evidence that diet is integrally related to health. For example, the British task force (Gray, 1983) proposed, among other approaches, that the teaching of nutrition should begin at the preclinical stage, should be a component of the basic sciences as well as clinical medicine, and should be housed in a specific academic unit within the medical school in order that training may be clearly focused. Similar issues are gaining the attention of medical educators in the United States. For example, the latest report by the AAMC, although it does not specifically refer to nutrition, recommends that "medical students' general professional education should include an emphasis on the physician's responsibility to work with individual patients and communities to promote health and prevent disease" (AAMC, 1984b).

SUMMARY

The emphasis on nutrition education in U.S. medical schools, once a major part of the curriculum during the early 1900s, began to diminish following the isolation and identification of the essential nutrients and the belief that no further advances in nutrition were likely. Major advances in nutrition science and technology did occur during the middle of this century, but these advances were not accompanied by an increased emphasis on nutrition in medical education. Today, nutrition is reemerging as a recognized and vitally important component of health, and once again, research is flourishing. A renewed commitment among human health professionals toward disease prevention and disease treatment is creating new challenges for research and patient care. These advances, together with the public's present concern about nutrition and expectations that physicians should provide sound

dietary advice, have influenced medical schools to consider giving more emphasis to nutrition in their curricula.

Nutrition research can be viewed in three historic stages. The first stage began in the early 1900s and included the discovery of vitamins, the elucidation of many of the basic nutrient requirements, and the widespread teaching of nutrition principles in medical schools. During the second stage, the research emphasis shifted to the molecular basis of nutrition and subcellular function, and the perceived importance of nutrition education for physicians declined. The third stage, which we are now entering, focuses on the emerging epidemiological and clinical evidence that links nutrition to the etiology and prevention of disease and on the implications of this knowledge for planning public health programs and policy. Economic and social factors are now influencing the ways in which medical care is financed, delivered, and perceived. These forces should serve to redirect the emphasis of health care delivery from therapeutics to prevention. As a result, it will be necessary to revise medical education to prepare future physicians for the new demands of their profession.

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3

Rationale for Including Nutrition Instruction in Medical Education

During the last 20 years, an enormous body of scientific data has emerged linking diet and food selection patterns to the maintenance of health and the prevention of some chronic diseases. Evidence supporting this association, its individual and public health implications, and the scientific rationale for requiring medical students to learn basic nutrition principles and their application to patient care is presented in the following discussion. It is not the purpose of this chapter to summarize or evaluate all data associating nutrition with the major causes of morbidity and mortality in the United States. Rather, the committee has selected some examples and discussed them in light of their relationship to preventive and therapeutic medical care.

Major developments in medical research and technology in recent decades have led to the conquest of many diseases with nutritional or infectious origin. For example, the isolation and identification of many essential nutrients and the elucidation of their roles, together with the enrichment and fortification of selected foods and the availability of nutrient supplements, have resulted in the virtual elimination of vitamin and mineral deficiency disease in the United States. In addition, as general sanitation conditions improved and the use of antibiotics and other drugs became more widespread, concern about infectious diseases has diminished. As a result of these developments and new data linking environmental factors and lifestyle to health and illness, medical attention is shifting to the prevention and treatment of chronic and degenerative diseases, most of which have a

complex etiology. Diet is not only a factor in the etiology of these diseases but also is important in their treatment.

Nutritional factors are implicated in the etiology of 6 of the 10 leading causes of death in the United States: heart disease, cerebrovascular disease, cancer, adult-onset (type II) diabetes, arteriosclerosis, and alcohol-induced cirrhosis (DHEW, 1979; DHHS, 1983). The role of diet in both the prevention and treatment of many conditions, such as obesity, osteoporosis, gastrointestinal disorders, low birth weight, dental caries, iron-deficiency anemia, and certain vitamin and mineral deficiencies, is clearly documented (DHEW, 1979; DHHS, 1983).

Advances in basic nutrition knowledge and medical technology have also dramatically affected health care in the United States. The development of nutritionally sound intervention techniques, such as parenteral and enteral nutrition, have prompted new approaches to the management of patients with a variety of needs, ranging from premature infants to patients undergoing surgery and those suffering from burns, trauma, infection, metabolic disorders, or certain forms of cancer (Fischer, 1976; Wilmore et al., 1977).

Nutrition and its association with health have attracted much attention in the news media. For example, newspapers, such as The New York Times, The Washington Post, and The Wall Street Journal, regularly carry columns and lead articles concerning diet and nutrition as do Time, Newsweek, and The U.S. News and World Report. Many popular magazines, such as Ladies Home Journal, Good Housekeeping, and Runner's World, also feature articles on nutrition, and a vast assortment of nutrition-related books has been published. Clearly, the U.S. public is concerned about nutrition, and many Americans are better informed than in the past on matters of diet and health. There are growing expectations that physicians should be able to provide accurate, current nutrition information and guidance.

Ample evidence, some of it presented below, supports the association of nutrition with disease prevention, health maintenance, acute care delivery, and other aspects of medical practice. Therefore, if the

objectives of medical education are to prepare future physicians to deliver health care effectively and to keep pace with the changing needs of their patients and new scientific discoveries, then nutrition must be considered a part of the formal training of all medical students.

EVIDENCE ASSOCIATING NUTRITION WITH DISEASE PREVENTION AND HEALTH PROMOTION AND MAINTENANCE

Cardiovascular Disease

The presence of a nutritional component in the etiology of some diseases points to the need for adequate nutritional knowledge among physicians. The most striking example is cardiovascular disease, currently the leading cause of death in the U.S. adult population, as it has been for more than 40 years (DHHS, 1984a,b). Approximately 43 million Americans are affected by one or more forms of heart, blood vessel, or cerebrovascular disease, including hypertension, coronary heart disease, and stroke (AHA, 1984). It is projected that as many as 1.5 million Americans will have a heart attack in 1985, and more than 0.5 million of them will die during this year (DHHS, 1984a). The social and economic consequences of cardiovascular disease are equally immense. The American Heart Association (AHA) estimated that the cost of cardiovascular disorders exceeds $72 billion annually: $59 billion in direct health expenditures and $13 billion in productivity lost through illness and disability (AHA, 1985).

These staggering economic and social consequences still exist despite the steady decline in death rates due to coronary heart disease in the United States since the late 1960s (NHLBI, 1981a; Stamlet, 1985b; Walker, 1983). This decline has been attributed, in part, to improvements in lifestyle and related risk factors, including changes in diet (Pell and Fayerweather, 1985; Stamler, 1985a,b). Surveys show that by the late 1970s, two-thirds of Americans had changed their eating patterns because of health concerns (Jones, 1977; NHLBI, 1981b; Stamlet, 1983). Correspondingly, since the early 1960s there has been a reduction in the per capita consumption of foods high in cholesterol and saturated fat—beef, fat-containing dairy

products, eggs, and lard—and an increase in the consumption of fish and vegetable fats and oils (Welsh and Marston, 1982).

Among those risk factors strongly associated with coronary heart disease, high blood cholesterol is one of the most clearly established. The National Institutes of Health (NIH) Consensus Development Conference on Lowering Blood Cholesterol to Prevent Heart Disease concluded that the blood cholesterol level of most Americans is undesirably high (NHLBI, 1985). The conferees agreed that these high levels are due, in large part, to Americans' still higher-than-recommended dietary intake of saturated fat and cholesterol and that appropriate dietary changes would reduce blood cholesterol level in many persons. The AHA Committee on Nutrition has issued similar guidelines (AHA, 1982). Prevention, including nutritional counselling by informed primary care physicians, will be a critical component to the success of the national effort to reduce the incidence of cardiovascular disease (Harlan and Stross, 1985; Rahimtoola, 1985).

High blood pressure affects approximately 38 million adults in the United States. Many of these people are aware of their conditions but do not receive treatment or their blood pressure is inadequately controlled (AHA, 1985). Lifestyle factors, especially diet, have been cited as some of the many contributors to the continued prevalence of high blood pressure in the United States (Harlan et al., 1983; Levy and Moskowitz, 1982). For example, obesity, dietary sodium, and alcohol have been associated with hypertension in some individuals, and there is evidence that other dietary factors, including potassium, calcium, magnesium, chloride, and perhaps even carbohydrates, may affect blood pressure regulation in some susceptible persons (Harlan et al., 1984; McCarron and Kotchen, 1983; McCarron et al, 1984).

Public response to education programs designed to lower high blood pressure and to ensure the maintenance of normal levels has been striking, according to the Hypertension Detection and Follow-up Program Cooperative Group (1982) and the Veterans Administration Cooperative Study Group on Antihypertensive Agents (1967). A stronger emphasis on preventive care during medical education would assist students in developing the skills and attitudes for effective intervention.

Malnutrition

Malnutrition is one of the leading factors in the disability and death of children in developing nations. The World Bank (Alderman, 1980) and the Food and Agriculture Organization (FAO, 1981) of the United Nations estimate that as many as 800 million persons may suffer from caloric deficiency and that at least 450 million are children. Malnutrition is frequently not mentioned on death certificates as the cause of death. Consequently, mortality due to malnutrition among infants and young children is often underestimated (WHO, 1981).

Malnutrition is not confined to developing countries. Recent data from studies in the United States (DHHS, 1983) indicate that from 10% to 15% of the infants and children of migratory workers and some poor rural populations suffer growth retardation because of dietary inadequacies. In addition, iron and folic acid deficiencies are common among pregnant and lactating women in the United States (DHHS, 1983).

Malnutrition can lead to illness or death, but more commonly results in generalized functional impairment. In children living under conditions of poverty and deprivation, malnutrition retards growth and contributes to poor motor and intellectual development (Winick, 1976). In adults, it reduces performance in the workplace. Results of animal studies and clinical data indicate that some specific nutritional deficiencies as well as general malnutrition may alter immune function, thereby affecting response to infection and disease in both children and adults (Beach et al., 1982; Gershwin et al., 1985; Suskind, 1977).

Public health professionals must diagnose nutritional problems at the community and national levels as well as internationally. Medical students in the United States need to be aware of the magnitude and severity of malnutrition and associated health problems and of their social consequences both in the United States and throughout the world. Only with this awareness can appropriate public health programs and other intervention strategies be planned.

Several investigators have reported severe malnutrition among hospitalized patients in the United States (Bistrian et al., 1976; Bollet and Owens, 1983; Butterworth, 1974; Parsons et al., 1980; Thompson et al., 1984). Mullen and coworkers (1979, 1980) reported that the lower the nutritional status of hospitalized patients, the worse the prognosis for recovery from the primary disease. There is evidence that a patient's nutritional status may influence the outcome of cancer therapy (Donaldson and Lenon, 1979).

Obesity

Obesity (overnutrition) is the most prevalent form of malnutrition in the United States. The National Center for Health Statistics reported that Americans on the average weigh more now than they did 10 years ago (Abraham et al., 1983, and in press). Thirty-two percent of the men and 63% of the women in this country are 10% or more above "ideal weight," and 18% of the men and 24% of the women weigh 20% or more (Abraham et al., 1983). Obesity is associated with elevated blood pressure, blood lipid levels, and blood glucose (Garrison et al., 1980; Kannel et al., 1979; Noppa et al., 1978). Castelli (1984) reported that weight is a powerful predictor of virtually all cardiovascular end points in men and women. Obesity is a risk factor for, or is associated in some way with, diabetes, complications of pregnancy, osteoarthritis, some cancers and infections, and impaired psychosocial function (Stewart and Brook, 1983).

Although the definition of ideal weight is controversial (Knapp, 1983), and appropriate body weight standards and methods of measurement continue to prompt debate (Abraham et al., 1983; Simopoulos and Van Itallie, 1984), there is general consensus among researchers that mortality increases with increasing amounts of excess weight (Hubert et al., 1983; Lew and Garfinkel, 1979; McCue, 1981; Society of Actuaries and Association of Life Insurance Medical Directors of America, 1980; Vandenbroucke et al., 1984). Severely overweight persons, especially those who are overweight at younger ages, have markedly higher mortality rates than do people of average weight (Drenick et al., 1980).

If physicians are to assume a more active role in caring for overweight persons, assisting patients in

weight reduction, or encouraging them to maintain a weight that is closer to ideal, they will require the appropriate knowledge, skill, and attitude.

Cancer

The role of nutrition in the etiology and the prevention of some cancers is becoming more apparent. For example, several cancers, especially cancer of the breast and colon, have been associated with a high fat diet (NRC, 1982), and interim dietary guidelines to lower cancer risk have been proposed (ACS, 1984; NCI, 1984; NRC, 1982). Nutritional rehabilitation and support are integral parts of the treatment regimen for cancer patients (van Eys et al., 1979; Wollard, 1979). The metabolic stress of cancer, the interactions between nutrients and drugs, and the host-tumor relationship are subjects of active research. It is important that medical education emphasize the relevance of nutrition principles to cancer prevention and treatment and that students are prepared to assess new findings regarding the relationships between diet, nutrition, and cancer and their implications for patient care.

Osteoporosis

Osteoporosis is a major cause of bone fractures in postmenopausal women and the cause of significant morbidity among elderly persons (Avioli, 1984). Inadequate calcium, vitamin D, estrogens, and fluoride are among the many factors that have been implicated in the etiology of this disease (Armbrecht, 1984; Avioli, 1984). Studies are under way (DHHS, 1984c,d) to examine the influence of nutritional factors on calcium absorption and excretion, the metabolic factors contributing to alterations in bone structure, and practical means for preventing and treat-its osteoporosis. Because osteoporosis affects the elderly and because the median age of the U.S. population continues to increase (Kane and Kane, 1980), new research findings and their applications to the clinical management of this disease are becoming increasingly important.

NUTRITIONAL NEEDS OF SELECTED POPULATION SUBGROUPS AND THE GENERAL PUBLIC

Both physicians and patients need to be aware of how nutritional needs change throughout the life cycle and the

consequences of poor nutrition during infancy, childhood, adolescence, adulthood (including pregnancy, lactation, and menopause), and old age. The following paragraphs contain discussions of some specific needs of certain populations at different life stages and the integral role of nutrition in primary care medicine and various medical specialties.

Nutrition and the Outcome of Pregnancy

Managing normal and high-risk pregnancies to ensure optimal fetal growth and development and neonatal health requires close attention to nutrition by both mother and physician. Physicians now widely accept the importance of adequate weight gain and maintenance of optimal nutritional status (i.e., intake of adequate amounts of both micro- and macronutrients) during pregnancy (Hurley, 1980).

For a woman who begins her pregnancy at normal weight, the optimum weight gain is at least 12 kg. An underweight woman should gain even more (Rosso, 1985). Evidence from laboratory studies in rats suggests that poor weight gain is associated with inadequate expansion of maternal blood volume, which in turn reduces the expected increase in cardiac output and blood flow to the uterus and placenta (Rosso and Kava, 1980). Thus, poor nutritional status before pregnancy and inadequate weight gain and nutrient intake during gestation may negatively affect fetal weight gain, thereby increasing the risk of low birth weight and neonatal mortality (Dobbing, 1981; NRC, 1970; Worthington et al., 1977). The United States ranks 18th among nations for infant mortality, a major cause of which is low birth weight. The U.S. Public Health Service has specified that proper nutrition should be encouraged as one of the strategies to prevent the occurrence of low birth weight infants (Brandt, 1984).

Obesity during pregnancy poses other nutritional and medical concerns. For example, the efficacy of recommending low calorie diets to this group of women is seriously questioned. There is evidence suggesting that very low-calorie diets consumed during pregnancy may induce changes in metabolism that may result in undesirable sequela in the fetus, including low birth weight (Rosso, 1985).

The management of normal pregnancies to promote optimal fetal growth also requires a knowledge of nutrition and the ability to prescribe a diet that supplies adequate amounts of all essential nutrients while restricting intake of deleterious substances. Among the dietary constituents that may adversely affect the fetus are alcohol (Marbury et al., 1983; Mills et al., 1984) and caffeine (Nightingale and Flamm, 1983).

Infancy and Childhood

The importance of nutrition in the health care of infants and children is widely recognized. Adequate nutritional intake is a fundamental requirement for optimal growth and development, and there is concern that childhood obesity may be a precursor of such adult diseases as arteriosclerosis and hypertension. Competent counselling regarding the merits of breast-feeding, the selection of appropriate formulas, proper timing for introducing solid food, and the need for vitamin-mineral supplementation are all areas in which the pediatrician can provide professional support. In addition, the pediatrician should be able to guide parents in the selection of diets adequate in energy, protein, iron, and other essential nutrients to promote optimal growth throughout infancy and childhood.

Increasing numbers of children with genetic disorders and other disabilities are now kept alive and often require complex nutritional care. The consequences of various inborn errors, such as disorders of amino acid, carbohydrate, or lipid metabolism, can be moderated by dietary intervention (Palmer and Zeman, 1983). The role that the pediatrician can play in providing early diagnosis and treatment can be exceedingly important to the survival and well-being of these children.

Nutrition and the Elderly

The growing number of elderly persons in the United States (Kane and Kane, 1980), especially those who are institutionalized, are at high risk for certain nutritional deficiencies (Prendergast, 1984). Several physiological factors may affect the nutritional status of the elderly, for example, poor dental health, diminished sensitivity to taste and smell, increased need for some nutrients, high nutrient losses or malabsorption related to changes in gastrointestinal function, or moderately

reduced efficiency of digestion (Armbrecht et al., 1984; Roe, 1983). Such complicating circumstances as isolation, bereavement, physical disabilities, and inappropriate diets contribute to inadequate nutrient intake (Coe and Miller, 1984). Primary care physicians and specialists who are responsible for medical care of the aged must therefore be aware of their unique health problems and nutritional needs.

Selected Nutritional Concerns of the General Public

Many people are modifying their lifestyle by, for example, increasing their activity, altering their diets, and in general, accepting greater responsibility for their own well-being (Jones and Weimer, 1981; Louis Harris and Associates Inc., 1979; Stamler, 1978). For example, the relationship of diet and exercise to the maintenance of health has become a concern of many persons. Although there is limited evidence that certain diets optimize athletic performance, other evidence indicates that proper exercise combined with dietary modification may improve cardiovascular fitness, induce weight loss, and reduce the risk of osteoporosis (Zohman et al., 1979). Thus, exercise combined with dietary modification is rapidly becoming a major tool in both preventive and therapeutic medicine.

Some segments of the general population are adopting such nontraditional dietary patterns as vegetarianism. Although some vegetarian diets may be consistent with good health, others, if not supplemented, may increase the risk of specific nutritional deficiencies (Goldsmith, 1983; Herbert, 1983). Still other self-restricted diets, such as many of the popularly promoted weight reduction diets (Dwyer, 1980), are often nutritionally inadequate and should be supplemented or revised. Many physicians may not have sufficient experience or training in the area of nutrition to guide patients appropriately in the selection of foods that may ensure their nutritional well-being (Cooper-Stephenson and Theologides, 1981; Krause and Fox, 1977; Modrow et al., 1980).

Physicians as well as patients may be susceptible to the many inaccurate and sometimes dangerous claims and inducements offered by the rapidly expanding food supplement industry. Advertisements do not warn

consumers about potential toxic effects from excessive intake of micronutrients at more than 100% of the RDAs (NRC, 1980).

Food supplement industry sales were reported to be $1.7 billion for 1981, with an estimated annual growth between 11% and 15% (Alter, 1981; Raven, 1981). The sales of so-called natural vitamins grew by 20% in 1980, new vitamin formulations continue to appear, and promotion of the products continues to be vigorous (Raven, 1981). The data accumulated thus far, although not complete, suggest that approximately 40% to 50% of the adult U.S. population daily ingests some kind of micronutrient supplement (Stewart et al., n.d.). Physicians must be aware of potentially deleterious effects and long-term consequences of oversupplementation so that they can guide their patients accordingly.

NUTRITION AND ACUTE CARE

Nutrition has been implicated as a causative factor in many diseases but may also be efficacious in treatment. Following are a few examples of the many ways diet can be used as a management tool.

Diabetes

Nutrition may be involved in the etiology of diabetes, and, certainly, knowledge of nutrition is necessary for its management. In some type II diabetics, weight loss may be the only necessary treatment (Turner and Thomas, 1981). A low-fat, high complex carbohydrate diet providing frequent meals and controlled intake of refined sugar helps to stabilize the level of blood sugar, minimize the danger of cardiovascular complications, and is a fundamental part of the treatment of diabetes (Bierman, 1985; Zeman and Hansen, 1983).

Gastrointestinal Disorders

Dietary fiber may play a role in both preventing and managing gastrointestinal disorders (Inglett and Falkehag, 1979). Data indicate that dietary fiber protects the intestinal tract against potential carcinogens, influences bacterial metabolism, and affects the absorption rates of several nutrients, including glucose (Anderson, 1985;

Burkitt et al., 1972; Kritchevsky, 1981). Fiber intake is also an important component of therapy for such conditions as malabsorption disorders, sprue, celiac disease, ileitis, and short-bowel syndrome. The use of special diets is extremely important in the management of patients suffering from a variety of gastrointestinal disorders to both prevent or alleviate symptoms.

SUPPLEMENTAL FEEDING TECHNIQUES

Nutritional support techniques, such as total parenteral nutrition (TPN), parenteral nutrition, enteral diets, and specifically designed supplementary formulas (Wilmore et al., 1977), have ushered in a new era in the treatment and management of surgical and medical patients (Mullen et al., 1979, 1980; Thompson et al., 1984). In addition to minimizing postoperative starvation and infectious complications associated with malnutrition and impaired immune function, these techniques also provide nutritional support for patients with a catabolic response to injury, burn, stress, and infection. Parenteral nutrition therapy and the use of defined formulas are also important tools in the treatment of patients with renal disease and patients suffering from the cachexia frequently associated with cancer. The use of TPN and specifically designed formulas have increased the average survival rate of premature and very small-for-date infants, who have unique nutritional requirements. Critical to the use of these preparations is medical training that includes instruction in the principles of nutritional assessment and the theoretical and practical aspects of nutritionally sound intervention techniques.

Investigators are continuing to recognize the importance of an increasing number of micronutrients (NRC, in press). TPN solutions, once lacking many essential nutrients, are now routinely supplemented with such nutrients as biotin, zinc, copper, chromium, and manganese (Danford, 1984; Shils, 1984; Shils et al., 1979); however, they still do not contain several other nutrients known or believed to be essential for humans (e.g., iron, iodine, molybdenum, selenium, vanadium, nickel) (Rudman and Williams, 1985). Furthermore, the metabolism of intravenously administered nutrients differs from that of nutrients administered by mouth. Quite possibly, undiagnosed nutritional deficiencies may be a consequence

of prolonged parenteral and enteral feeding. Therefore, as the frequency of supplemental feeding continues to increase, physicians must learn about these new developments and be prepared to monitor carefully the nutritional status of their patients.

Eating Disorders

Schwabe and coworkers (1981) reported that anorexia nervosa, a disorder of self-starvation, occurs in approximately 1 of every 200 white, adolescent girls in Western countries. Although the symptoms of anorexia can be corrected if the patient is diagnosed and treated promptly, Crisp (1983) reported that an estimated 5% to 15% of anorexia nervosa patients die, following the loss of nearly one-half their normal body weight.

Bulimia, an eating disorder characterized by binge eating followed by various methods of purging, appears to be increasing with alarming frequency among adolescent women in the United States (Halmi et al ., 1981). Although bulimia follows a more chronic course than anorexia nervosa (Harris, 1983), this eating disorder may also be associated with potentially dangerous medical complications, such as gastric dilatation (Mitchell et al., 1982), post-binge pancreatitis (Gryboski et al., 1980), and cardiac compromise (Heymsfield et al., 1978).

Proper nutritional management is exceedingly important in the treatment and management of both these eating disorders. It may also assist in reducing the potential secondary medical complications associated with them.

DRUG-NUTRIENT AND NUTRIENT-NUTRIENT INTERACTION

Evidence suggests that prescription drugs, over-the-counter drugs, and other chemical substances can profoundly affect nutritional status. Conversely, nutritional status can affect the efficacy and toxicity of ingested drugs (Roe, 1983). Among the many effects noted are suppression of appetite by certain drugs (Sullivan and Cheng, 1978), interference with the absorption of many nutrients by alcohol (Wilson and Hoyumpa, 1979), and the interference by some oral contraceptives with the metabolism of specific nutrients, such as vitamin B6 and folate (Hathcock and Coon, 1978).

In addition to the interactions of nutrients with drugs, nutrients can also interact with each other. One nutrient may influence the absorption and bioavailability of another. For example, evidence indicates that both protein and phosphorus affect the calcium requirements of humans (Schuette and Linksweiler, 1984), and vitamin C enhances the absorption of iron (Hallberg, 1984).

THE TEAM APPROACH TO PATIENT CARE

The team approach is now used in many areas of medicine. Thus cooperation among physicians, dietitians, and nutritionists is likely to influence disease prevention and patient care. Nutrition education in medical schools can complement and supplement the expertise of dietitians and other health professionals. Collaborative efforts have been attempted in centers treating heart attack and stroke patients and in such government-sponsored programs as the Women, Infants, and Children (WIC) Program of the Department of Health and Human Services, which provides medical care, nutritional counseling, and food to high-risk pregnant women and high-risk infants and children.

The importance of the team approach is best exemplified by its use in the field of total parenteral and enteral nutrition. These teams include a physician (often more than one) skilled in the techniques of intravenous nutrition and competent in the nutritional management of a wide variety of patients, a nurse with special training in nutrition, a dietitian (usually with graduate-level training in nutrition), and a pharmacist trained to prepare the various solutions. The team's leaders are most often physicians. Hence, it is their responsibility not only to be aware of nutrition but also to recognize and use to the greatest extent possible the skills and knowledge of the other team members.

SUMMARY

A resurgent interest in the vital role of nutrition throughout the human life cycle has been stimulated by recent research elucidating the interrelationships between nutrition and various aspects of health, such as chronic diseases, reproduction, and immune function. These new findings and the growing awareness that environmental

factors and life style are important determinants of wellness are affecting all aspects of health care and, not surprisingly, the training of health professionals.

The major change in emphasis from disease treatment and acute care to disease prevention and the promotion of good health requires education of both physicians and patients. Therefore, physicians must be able to incorporate nutrition principles into their patient care and must be prepared to assess the clinical implications of future advances in nutrition-related research. Medical students will have difficulty fulfilling these expectations unless their professional training provides them with a sound understanding of the relationship of nutrition to metabolism, physiology, toxicology, pharmacology, and the other basic sciences, as well as to clinical medicine.

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4

Current Programs

Medical educators, legislators, and science and health policymakers have expressed concern that nutrition education in medical schools is not adequate to prepare future physicians for their responsibilities (see Chapter 2). In its study of this issue, the committee identified the following questions that, when answered, should reflect the teaching of nutrition in U.S. medical schools:

- How many hours of the required curriculum are clearly identified as nutrition education?
- In the overall structure of the curriculum, where are the required nutrition education hours located?
- Within the discipline of nutrition, what subject areas are taught?
- How adequate are current nutrition teaching materials?
- What methods are used to assess the nutrition knowledge of medical students?
- How is the faculty responsibililty for nutrition education structured?
- Regarding the faculty members who teach nutrition, what is their training, their current responsibilities within the medical school, and their sources of support?
- What factors have contributed to successful integration of nutrition into the curriculum of those schools that currently have a program?

- What administrative and financial considerations are relevant to the successful incorporation of nutrition into the curriculum?
- How do faculty and students perceive the adequacy of current nutrition teaching practices?

To answer these questions, the committee (1) reviewed recent surveys of medical school teaching practices; (2) designed and conducted a separate, independent survey; (3) conducted detailed interviews with faculty members who have responsibility for designing and coordinating nutrition programs at selected U.S. medical schools that have established nutrition programs; (4) invited selected nutrition course coordinators to testify before the committee; (5) requested comments from the American Medical Student Association and reviewed previous reports of medical student opinion; (6) evaluated and reviewed questions relating to nutrition on three recent National Board examinations; and (7) examined the current funding practices for nutrition research and training by the National Institutes of Health (NIH) and other public and private organizations.

SURVEYS OF MEDICAL SCHOOL CURRICULA

Previous Surveys

Surveys of nutrition education in medical schools have been conducted by persons and organizations, especially the American Medical Association (AMA), for more than 25 years. The historical aspects of these reports are presented in Chapter 2. The earliest surveys, conducted in the late 1950s, indicated that approximately 20% of the responding schools offered required nutrition courses. By the late 1970s, the percentage of schools requiring nutrition education had increased to 27%. The percentage increased during the 1980s, but then dropped by 1984, according to results of the annual curriculum questionnaire sent to all U.S. medical schools by the joint Liaison Committee on Medical Education (LCME), which is composed of representatives of the AMA and the Association of American Medical Colleges (AAMC) (see Table 4-1).

Each year all schools were asked if they offered a required course in nutrition, if nutrition was incorporated

into another course, and if there were elective opportunities for courses, clerkships, or research in nutrition. In the most recent survey (1983-1984) of 127 medical schools, 34 schools (27%) reported a separate course in nutrition, and 84 schools (66%) indicated that nutrition was taught as a part of another course. Sixteen schools (13%) reported both a separate nutrition course and nutrition topics included in other courses; 21 schools (17%) reported neither a nutrition course nor nutrition topics in other courses (AAMC, 1984a).

These results indicate that many U.S. medical schools do not teach nutrition. In many schools, however, these annual curriculum questionnaires may be completed by administrative assistants who either are not sufficiently familiar with their curriculum or may mot be provided with accurate information to determine whether a subject such as nutrition is included. The committee determined that in many cases these persons do not check the data with faculty members who are responsible for nutrition courses at the surveyed school. For example, many of the responses to the AAMC questionnaire were inconsistent with responses to the committee's survey. Furthermore,

TABLE 4-1 Percentage of Positive Responses to Selected Questions Regarding Nutrition in the Annual Survey Conducted by the Liaison Committee on Medical Education Between 1979 and 1984a

	Positive Responses (%) by Year (N = Number of Schools Responding)				
Question	1979-1980 (N = 125)	1980-1981 (N = 125)	1981-1982 (N = 125)	1982-1983 (N = 127)	1983-1984 (N = 127)
Does your curriculum have a nutrition course, identified as such, that is required?	24	32	37	35	27
If you do mot have a separate nutrition course, is nutrition incorporated into some other course?	51	61	61	61	66
Do you have nutrition courses, identified as such, that can be taken as electives?	54	66	57	65	64

[a] Data from AAMC, 1980, 1981b, 1982b, 1983c, 1984c.

questions on previous surveys have been designed only to determine if a separate nutrition course is offered or if nutrition is included as part of another course. Although some general information was gathered, no information was obtained concerning the specific number of hours assigned to nutrition in the curriculum or allocated to specific subject areas. After reviewing the results from these questionnaires, it became apparent to the committee that the surveys alone could not provide an accurate measure of the status of nutrition education in medical schools.

In recent years, several medical schools have examined the nutrition content of their curricula. Some reports of these examinations were reviewed by this committee, which found that particular nutrition-related topics were incorporated into the teaching of other subjects and could not be identified as nutrition per se. In addition, the committee learned that the teaching of some nutrition-related topics was duplicated, and in some cases, important topics were not taught at all. From these observations the committee concluded that a reliable assessment of the nutrition content of a curriculum can be obtained only if informed faculty members review various sections of the curriculum and report the extent to which nutrition is included.

The Committee's Survey

Because previous surveys did not provide a reliable and detailed description of the current status of nutrition education in U.S. medical schools, the committee designed its own survey in an attempt to overcome these shortcomings.

The committee first identified a faculty member with responsibility for teaching nutrition who could respond to the questions. It then requested a course outline to document the information provided by the faculty members. Because this approach required a substantial amount of time and effort, the committee decided to limit its survey to 46 schools. Initially, every fourth school was selected from an alphabetical listing of the 127 accredited U.S. medical schools in the AAMC 1983-1984 Curriculum Directory (AAMC, 1983a). Several additional schools were then added to the sample to ensure that it represented a cross section of the schools (e.g., state and private, recently

established and older). (See Appendix A for a list of the schools and general description of their characteristics.)

The specific objectives of the committee's survey were to determine (1) the proportion of schools that offer or teach nutrition as an identifiable subject although not necessarily as a separate course, (2) whether specific faculty members have organizational responsibility for nutrition, (3) the approximate number of hours assigned to nutrition in the required curriculum, (4) the departments or courses in which nutrition is taught, and (5) the nutrition topics that are included in the curriculum. The committee sought only limited information on elective courses in nutrition because such courses do not necessarily benefit all students. In addition, it was not possible to estimate the amount of time devoted to clinical nutrition teaching in hospitals and clinics because these experiences are usually not common to all students, are poorly documented, or vary with the clinical setting.

The committee made the initial contact in the survey by writing a letter to the dean of each school that explained the committee's charge and the purpose of the survey. A preliminary questionnaire (Questionnaire Part I) (Appendix B) and letter were then sent to each school's associate dean for academic affairs or an equivalent administrator. The information requested concerned the general characteristics of the school, the inclusion of nutrition in the curriculum, and the identification of faculty person(s) responsible for nutrition education.

Another letter and Questionnaire Part III (Appendix C) were then sent to the identified faculty person or, if no such person was identified, to the chairman of the biochemistry department, asking that person to corroborate the information about nutrition obtained from the administrator. This person was also asked to specify which nutrition topics were taught in various sections of the required curriculum and the number of hours assigned to each topic. Ultimately, responses in some form were obtained from 45 of the 46 schools contacted. Only one faculty member was unable to identify any portion of the curriculum devoted to nutrition; however, he indicated that a nutrition course was planned for the future. In all, 39 schools furnished sufficient information in the form of course outlines or detailed descriptions of nutrition topics either on the questionnaire or during

telephone interviews to corroborate the estimated total number of hours of nutrition. The responses from these 39 schools thus formed the basis of the analysis of the survey results.

Possible sources of error could have resulted in over-estimation or underestimation. The nutrition content of the curriculum might have been underestimated if the responding faculty members were not sure whether certain topics were covered in courses with which they were unfamiliar. An overestimate might have resulted if the respondent identified parts of lectures as nutrition related when, in fact, they should have been classified as biochemistry, physiology, gastroenterology, or another discipline.

The committee found discrepancies between responses to the preliminary questionnaire (usually completed by administrators) and those to the second questionnaire (completed by faculty). That is, on the preliminary questionnaire only 27 schools could identify a section of their curriculum with nutrition components, in contrast to 39 schools on the second questionnaire. In several cases, the committee subsequently obtained detailed outlines of required nutrition courses from schools that initially reported that the subject was not taught. This discrepancy reveals that reliable information about curricula may not be available from administrative offices in many medical schools.

According to information obtained from course outlines, detailed responses to the questionnaires, or telephone interviews with faculty at the 39 schools that provided reliable information, the average total required number of identified nutrition hours is 21 (range, 3 to 56 hours) (see Figure 4-1). The committee determined that the distribution of nutrition teaching time among schools is not symmetrical: 20% of schools teach less than 10 hours, 59% teach less than 20 hours, 30% teach 30 hours or more, and 10% teach 40 hours or more. No significant difference was found between the average number of hours of nutrition taught in public versus private schools. The distribution of hours taught in these two groups of schools was also similar.

Most of the nutrition instruction was reported to be offered by 65% of the 39 schools surveyed during the first

year, by 24% of the schools during the second year, and by 11% of the schools during the third year. Nutrition is taught, at least in part, as a separate course in 33% of the schools that reported teaching nutrition in the required curriculum. Only 18% of the schools reported that nutrition is taught entirely as a separate, free-standing course. In comparison, the AAMC 1983-1984 Curriculum Directory (AAMC, 1983a) lists 22 (17%) of all U.S. medical schools as offering nutrition as a separate course. However, the committee found that the responses from one-third of the schools that completed both the AAMC and this committee's survey were discrepant.

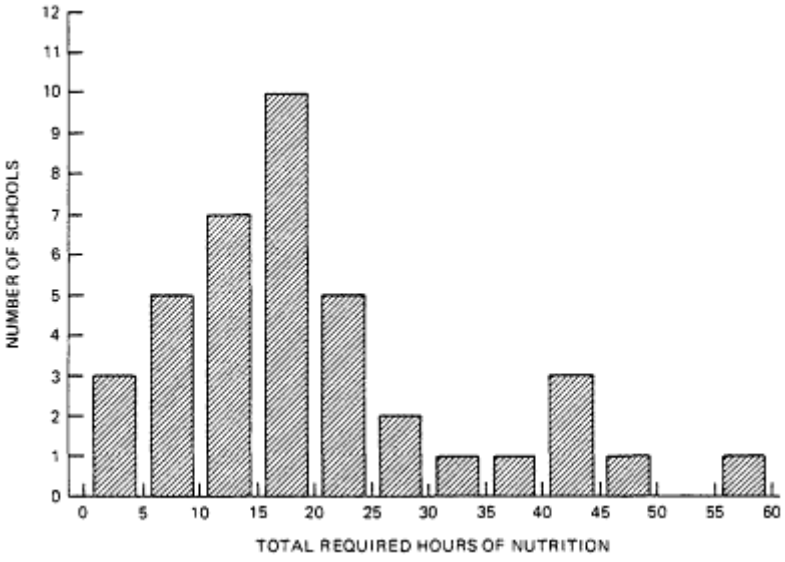

Figure 4-1.
Total required class hours of nutrition in curriculum.

Elective courses in nutrition were reportedly offered in 64% of the 39 schools that provided reliable responses. Frequently, various sources in the same school gave different responses to questions related to elective courses, but the committee made no special effort to corroborate the information. [The 1983-1984 LCME survey (AAMC, 1984c) indicates that 64% of all 127 U.S. medical schools offer electives in nutrition.] The survey responses also indicated that elective courses are distributed throughout the

4-year curriculum and that their Duration ranges from less than 4 weeks to more than 10 weeks. Less than 33% of medical students take nutrition electives in any of the 29 schools that provided this information. According to recent AAMC Medical Student Graduation Questionnaire Surveys, only 6% to 7% of all medical students take elective courses or clerkships in nutrition (AAMC 1982a, 1983b). These results imply that nutrition that is taught in elective programs does not benefit most medical students.

Nutrition topics included in the required curriculum of the 34 schools that provided this information are summarized in Figure 4-2. Four of the topics are taught by fewer than 25% of the 34 schools. More than 75% of the schools teach 15 of the topics, including the basic aspects of energy balance and specific topics, such as obesity, vitamin A, and other subjects listed in Questionnaire Part III (Appendix C). More than 50% of the schools teach an additional 12 topics, including various aspects of nutrition in the life cycle and the role of nutrition in disease prevention and treatment. All schools reported teaching something about obesity, but only 15% of them provide their students with information about the nutritional aspects of preventing dental disease—one of the most dramatic disease prevention successes in recent years in the United States (DHHS, 1981a; Glass, 1982).

NUTRITION EDUCATION PROGRAMS AT SELECTED MEDICAL SCHOOLS

In addition to information obtained from the general survey, the committee gathered more detailed information regarding program development and implementation by inviting speakers from selected institutions to discuss their nutrition programs and by extensive telephone interviews based on Questionnaire Part II (Appendix D). In all, one representative from the AMA, 12 from individual schools, and one from the New York-New Jersey Regional Program for Nutrition Education were interviewed (Appendixes D and E). The sample was not representative of medical schools in general, because the institutions that were selected were those that had made a deliberate effort to organize nutrition education.

The committee's overall impressions of nutrition education efforts at these institutions, as well as pertinent

findings from the literature, are summarized below according to faculty leadership, curricular organization, and problems of implementation.

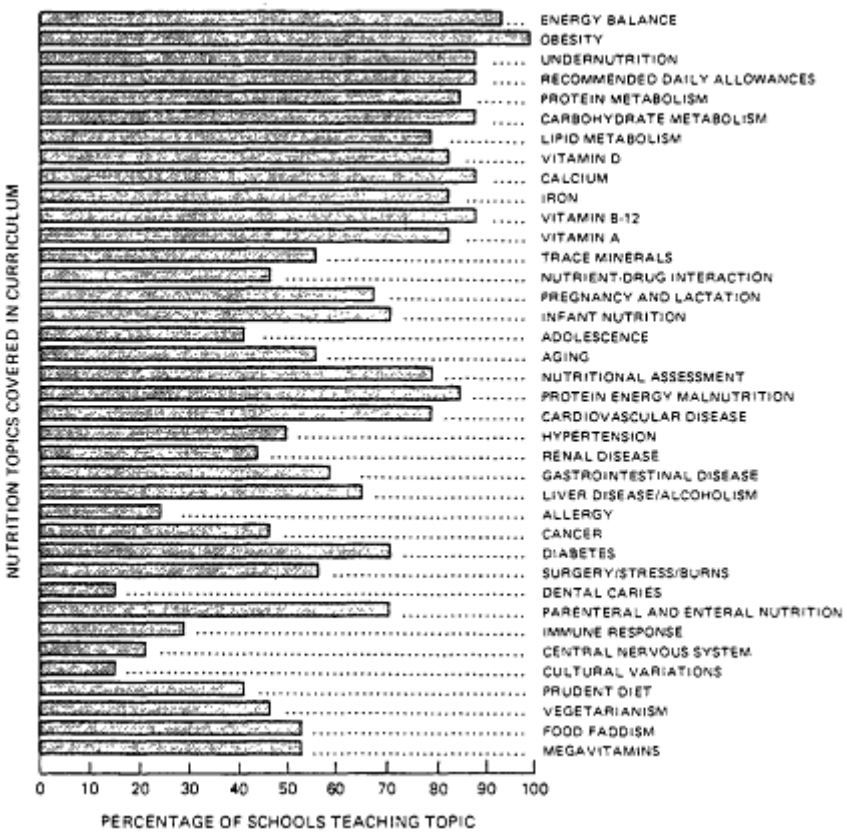

Figure 4-2.
Nutrition topics covered in the curriculum of 34 medical schools.

Faculty. Successful organization of nutrition teaching in medical schools depends on the leadership of faculty who are committed to nutrition education. Of the 12 schools interviewed, the committee found that this leadership is provided by an approximately equal number of M.D.s and Ph.D.s who represent various disciplines within the basic sciences and clinical departments. Only two of them have a graduate degree or other formal training in

nutrition. Although these faculty members are strongly committed to teaching, they are also heavily engaged in research, which accounts for an average of 40% of their time. Most frequently, teaching responsibilities in nutrition are shared by faculty members who also represent various basic science and clinical disciplines.

Several consultants to the committee strongly emphasized that effective integration of nutrition into the clinical training of medical students depends on the active participation of M.D. as well as Ph.D. faculty members. Physicians who are knowledgeable about nutrition are convincing role models because they are able to demonstrate the application of nutrition in clinical practice. I~ all the well-established nutrition programs evaluated in detail by the committee, physicians play an active role, even when faculty with Ph.D.s from basic science departments are responsible for organizing the curriculum. Furthermore, although dietitians and pharmacists are also involved in teaching nutrition principles, the committee's consultants stressed that their impact is limited unless there is a physician who is responsible for instruction and participates on the team that provides nutritional care.

A few schools acknowledged a marked shortage of faculty members with adequate backgrounds for teaching nutrition. For example, schools in the New York-New Jersey metropolitan area noted this shortage and, as a result, established the New York-New Jersey Regional Center for Nutrition Education at the New York Academy of Medicine. This center serves as a resource planning and evaluation agency for faculty in 10 medical schools and other allied health-profession institutions (DHHS, 1983; Shils, 1984).

Because of the apparent success of this regional center for nutrition education, similar interinstitutional regional networks are being developed in other parts of the country. For example, the South Eastern Regional Medical Education in Nutrition (SERMEN) Program, a four-state network based at the Medical College of Georgia, has recently been established (Weinsier et al., 1985). One of the early activities of the faculty participants in SERMEN was the identification of those aspects of nutrition with which medical students should be familiar. This information will assist the SERMEN project in the development of future nutrition programs.

Another effort to assist and encourage multiinstitutional sharing of nutrition resources is the development and testing of a National Nutrition Test-Item Bank (NNTIB) developed at the University of Alabama to serve as a national resource for scientifically accurate and technically correct test questions (Weinsier et al., 1983). Using the NNTIB as a test question resource, the SERMEN participants developed and administered an examination to senior level medical students at the 11 participating schools to assess their nutritional knowledge as objectively as possible. Preliminary results indicate that student performance varies significantly between schools and among topics within the same school (Weinsier et al., 1985). This information promises to be of great value in helping schools improve their nutrition education programs.

Because the schools interviewed already had a nutrition coordinator in place, they understandably did not cite a shortage of interested and trained faculty as the major limiting factor to incorporating nutrition in their curriculum. The committee believes, however, on the basis of its discussion with administrators and faculty at the 45 schools who responded to Questionnaire Parts I and III (Appendixes B and C), that inadequate faculty training or low interest in nutrition is a significant factor limiting nutrition education. Testimony from several experts at recent congressional hearings on the nutrition training of health professionals (U.S. Congress, 1983) and recent federal reports that have evaluated the subject (Executive Office of the President, 1977, 1980, 1982) support this belief.

Curricular Organization. There are many variations in the way in which nutrition is incorporated into medical school curricula. Most commonly, it is taught as a block in the second half of the first year. Most of the consultants believe that nutrition should be a separate required course; a few believe that after an introductory block, nutrition should be integrated wherever relevant throughout the curriculum. Cohen and coworkers (1981) reported that students who take a separate course in nutrition acquire more knowledge than they do when nutrition is integrated into another course. Most schools that offer nutrition instruction first teach general biochemistry, followed by nutrition as a separate course or in conjunction with endocrinology or gastroenterology. In only

a few schools, nutrition courses are required in the third and fourth clinical years.

Although it was not possible to assess nutrition education provided during clinical clerkships for the reasons stated above, nutrition education in the clinical setting is essential for the application of basic nutrition concepts in clinical practice. Several consultants strongly stated that the improvement of nutrition teaching in clinical settings should receive primary emphasis; otherwise, increased classroom teaching of nutrition would not be relevant. Many others stressed the importance of clinical reinforcement and application of nutrition principles (Cooper-Stephenson and Theologides, 1981; Gautreau and Monsen, 1979; Weinsier, 1982; White and Geiger, 1980). They believe that a division of nutrition within one of the major clinical departments at a medical school would increase visibility of and improve student training in clinical nutrition. A recent report by the British Nutrition Foundation (Gray, 1983) similarly emphasizes the need for a clearly defined clinical unit that includes nutrition.

All faculty coordinators interviewed believe that time constraints are a major limitation to the teaching of nutrition to medical students. Of 12 coordinators, 10 reported that their schools teach an average of 28 required hours of nutrition (range, 8 to 56 hours)—an amount they believe to be "just adequate." At the other two schools, which teach 48 and 50 hours, the coordinators reported that the amount of time was "inadequate." These perceptions were frequently related to recent increases or decreases in the time available for nutrition instruction.

Among the schools interviewed, there was no indication that a particular textbook or teaching material was preferred. At least one-half of the schools recommend as a reference one of three major textbooks on nutrition; however, these texts are not required reading. Other schools use shorter handbooks, which provide limited coverage. Although many nutrition textbooks for medical students have been published (Read, 1983), the responsible faculty person in all schools interviewed reported that most textbooks do not meet instructional needs. Therefore, the instructors prepare their own syllabi. A few medical schools have collaborated in the development of video tapes designed to teach nutrition to medical students.

Implementing a Nutrition Curriculum. The 12 schools interviewed by the committee were chosen because they had had a more successful experience with implementing nutrition teaching in the curriculum than had other schools. Time constraints were again identified as a major impediment in implementation of new nutrition programs.

Generally, the idea of increasing nutrition instruction has been supported by both students and faculty (Cohen et al., 1981; Gallagher and Vivian, 1979). In many schools, students have made persistent requests to the faculty to increase nutrition teaching. The faculty members at the 45 surveyed schools and information provided to the committee by invited speakers revealed that increased instruction in nutrition often followed the arrival of new faculty with special interests in nutrition or the intervention of a dean or other administrator. Schools with interdepartmental responsibility for the curriculum (systems approach) and schools undergoing major revisions of their curriculum may be more amenable to the introduction of new subjects such as nutrition.

The committee obtained scant information from schools that have not taught much nutrition, so it can only conjecture about what factors are responsible. Certainly, competition for available curricular time by newly emerging subspecialities and disciplines has had an impact of the relative importance assigned to nutrition. Among the schools that teach the least amount of nutrition are some that have the best reputations for superior academic strength. Perhaps a strong, well-established, research-oriented faculty might resist encroachments on its limited teaching time and perceive nutrition as less important than other areas of modern medical science. Furthermore, schools lacking an established emphasis on preventive approaches to health may be more resistant to implementing nutrition programs (Robson et al., 1979) since nutrition plays an prominant role in preventive medicine. It was the committee's impression that instruction in the principles of preventive medicine is still not fully endorsed by many medical school faculty and that there is also a philosophical barrier to the incorporation of nutrition into the mainstream of medical education. Well-organized faculty representation of nutrition, particularly at the clinical level, would be expected to improve this situation; however, the committee identified several schools that have well-known nutrition experts on their faculty

but do not use them to teach nutrition to medical students at their own institutions. Perhaps the most important single factor in improving the amount and quality of nutrition teaching, as judged by the faculty at the surveyed schools, is the commitment of individual faculty members to nutrition education so that they will initiate the necessary changes and, above all, invest the necessary time.

MEDICAL STUDENT OPINION

Recent medical school graduates have criticized the lack of nutrition in their medical education. Of the 10,000 students responding to recent LCME Graduation Questionnaires (AAMC, 1981b, 1982b, 1983c, 1984c), more than 60% reported that the attention devoted to nutrition was inadequate. Table 4-2 compares student ratings of the adequacy of nutrition instruction with their ratings of the adequacy of other selected subjects. These data indicate that more than 60% of the medical students surveyed perceive that nutrition and preventive care receive inadequate attention. In contrast, they generally believe that the basic medical sciences and care of the elderly receive adequate instruction.

The committee determined that student interest in nutrition is increasing and that nutrition education at many schools has been initiated at student request. Many of the committee's consultants reported an increasing student participation in both elective and selective nutrition courses. Several nutrition coordinators described positive student response to programs in which specific therapeutic diets are provided for student sampling. Dunphy and Bratton (1980), among others, have reported similar findings. Several of the committee's consultants also reported that their schools offer very popular clinical clerkships or practicums during the third and fourth years (Weinsier, 1982).

At some of the schools interviewed and at other schools as well (Cohen et al., 1981), the interest generated by a nutrition elective or other nonrequired nutrition-related activity subsequently led to the development of a required course. In one school where nutrition courses had been required for several years, student support was reported to be excellent (Weinsier, 1982).

TABLE 4-2 Adequacy of Instruction Time Devoted to Selected Subjects, as Rated by Graduating Medical Students, 1981-1984[a]

Selected Subject	Percentage of Respondents, by Year and Rating (N = Number of Students Responding)[b]											
	1981 (N = 10,689)			1982 (N = 10,839)			1983 (N = 10,398)			1984 (N = 10,451)		
	E	A	I	E	A	I	E	A	I	E	A	I
Nutrition	1	35	64	1	36	63	1	39	60	1	38	61
Preventive care	2	35	63	5	33	62	12	38	60	1	38	61
Basic medical sciences	18	74	8	17	78	7	20	74	6	20	75	5
Care of the elderly	2	58	40	2	59	39	2	60	38	2	62	36

[a]Adapted from American Association of Medical Colleges (AAMC) Medical Student Graduation Questionnaires (AAMC, 1981a, 1982a, 1983b, 1984b).
[b]E = excessive; A = appropriate; I = inadequate.

To examine more broadly the student perspective on nutrition in medical education, the committee solicited the views of the American Medical Student Association (AMSA). AMSA represents more than 30,000 medical students at 140 allopathic and osteopathic schools in the United States. AMSA operates through task forces, which represent a programmatic arm of the organization. The Nutrition and Preventive Medicine Task Force is one of AMSA's most active task forces, representing more than 2,000 students. Although the statement prepared by AMSA (Appendix F) for the committee primarily provides anecdotal information, this information strongly corroborates the findings of the committee. Among several observations, AMSA reported the following: (1) When nutrition is incorporated into another course, it is too often mentioned only briefly. Because it is not emphasized, a student can complete a course without realizing that nutrition had been covered. (2) The preclinical course should emphasize the application of nutrition principles to the major public health problems (e.g., obesity, heart disease, diabetes) rather than only to metabolism. (3) A clearly defined, separate course in nutrition is needed, as well as an opportunity for clinical reinforcement of the basic instruction.

NATIONAL BOARD EXAMINATIONS

The National Board examinations are a comprehensive set of questions designed to reflect the measureable content

of current undergraduate medical education in U.S. medical schools. Although it is not the intent of the National Board of Medical Examiners (NBME) to influence the curricular content or the number of hours assigned to particular subjects that are taught at each of the U.S. medical schools, some schools have nevertheless used the subject distribution of National Board examination questions as one of several criteria for rearranging their medical curricula. 'Furthermore, many schools use NBME scores to assist in student evaluation and as criteria for graduation (AAMC, 1984a).

In recognition of the NBME's notable effect on the evolution of medical education, the committee reviewed the results of three recent National Board examinations (1980, 1982, 1984) to determine the distribution and degree of challenge of nutrition-related questions. To assess the effectiveness of nutrition instruction, it compared student performance on questions related to nutrition with performance on questions on other disciplines. It also assessed the topical distribution by assigning each nutrition-related question a core curriculum category (see Chapter 5). After reviewing approximately 6,000 test questions, the committee made several observations, which are summarized below.

- Of all questions in Parts I and II of the National Board examinations offered in 1980, 1982, and 1984, approximately 3% to 4% tested student knowledge of nutrition. In Part I, the highest concentration of nutrition-related questions were found in the biochemistry (ranging from 7% to 12% of all questions) and physiology (6%) sections. The highest concentration of nutrition-related questions in Part II of the examinations were invariably included in the pediatrics section (ranging from 9% to 18% of all questions).
- There was no difference between student performance on nutrition-related test items and their performance on all test items.
- Of the 192 nutrition-related questions, approximately 12% concerned obesity, undernutrition, and starvation. The following concepts were also well represented: lipids and essential fatty acids, vitamins and minerals, iron, nutrition in pregnancy and lactation, and early infant

feeding. No test questions were identified in the following areas: vitamin A, nutrition in the aged, food intolerances and allergies, nutrition and cancer, parenteral and enteral nutrition, the role of nutrition in the immune response, osteoporosis, and food fads and popular diets. (For more detailed information, see Appendix G.)

The committee believes that for 1980, 1982, and 1984, many of the nutrition-related questions on the National Board examinations were relevant and challenging. However, the distribution of topics was not satisfactory. For example, the number of questions relating to pediatrics and infant feeding was high, but there were no questions concerning such other important areas as the association between nutrition and cancer and techniques of total parenteral and enteral feeding. Interestingly, many of the topics not included on the examinations were among those identified by the SERMEN Program as extremely important for medical students (Weinsier et al., 1985).

FUNDING OF NUTRITION RESEARCH AND RESEARCH TRAINING

The National Institutes of Health (NIH) provides the majority of the financial support for nutrition research and research training programs in the United States. Table 4-3 shows that although the number of trainees supported by NIH has increased in the past several years, the amount of financial support for these trainees has remained relatively constant. Total NIH nutrition research and research training expenditures increased between 1978 and 1983, the largest increases occurring between 1978 and 1979, but total funds for 1982 actually decreased. Although core grants to Clinical Nutrition Research Units (CNRUs) were established in 1979 to create a focus on clinical nutrition in biomedical research institutions, to improve the education of medical students and staff, and to enhance patient care and promote good health by emphasizing clinical nutrition, these awards constitute only a small portion (1.6%) of the total NIH nutrition program. Four CNRUs were funded in 1979 and three more in 1980. Although they have made significant contributions to nutrition research and training, there has been no further expansion of the program (Executive Office of the President, 1983). The Health Resources Service Administration

also supports clinical training in nutrition, albeit with extremely limited funds (Executive Office of the President, 1982).

Several private organizations and philanthropic foundations have also provided support for nutrition research and training. For example, the AMA and the American Society for Clinical Nutrition offer some support for research projects for a limited number of undergraduate medical students. Organizations such as the Nutrition Foundation and the National Dairy Council provide research and training support at the postgraduate level. In addition, one of the three awards presented by the Metropolitan Life Foundation between 1980 and 1982 was for development of nutrition education programs in medical schools (Young, 1983). However, private organizations generally have not provided sufficient funding to support training of faculty for teaching nutrition.

SUMMARY

The committee used various resources to assess the adequacy of nutrition in U.S. medical schools: its own survey, and interviews with administrators, faculty members, and students from 49 medical schools. Furthermore, it reviewed previous surveys, transcripts from congressional hearings, and other published reports to assess the adequacy of teaching practices in nutrition and to identify the factors that may be associated with successful introduction of nutrition into the medical curriculum. Much of the data available to the committee from previous surveys, from consultation with faculty and students, and from its own survey was qualitative. Therefore, a highly scientific analysis was not feasible. The committee believes, however, that although the data are difficult to quantify precisely with any degree of confidence, the questionnaire and interview responses were reliable enough to provide a general indication of current status of nutrition education in U.S. medical schools and to serve as a basis for identifying the problems therein and some solutions:

- An average of 21 hours of nutrition are taught within the required curricula of U.S. medical schools, but the range is wide: from 3 to 56 hours. More than half the schools provide less than 20 hours.

- In two-thirds of the schools that teach nutrition, the subject is most frequently taught in the first academic year in combination with other subjects, and nutrition-related concepts are frequently not identified as such. Thus, it is possible for a student to complete a course without realizing that nutrition has been included. Currently, one-third of the schools teach nutrition in part as a separate course, and only 20% report that nutrition is taught entirely as a separate course. The committee could not accurately determine the amount of clinical teaching time devoted to nutrition. Nutrition electives are taught in two-thirds of the schools sampled; however, less than one-third of students participate in these courses.
- The distribution of nutrition subjects that are taught is uneven. Whereas such topics as energy balance and essential nutrients are taught by more than three-fourths of the schools, the role of nutrition and disease prevention and treatment is taught by less than one-half of the schools.
- The committee reviewed approximately 6,000 questions from National Board examinations administered in 1980, 1982, and 1984. Of these, 3% to 4% were, at least in part, related to nutrition; however, the distribution of questions among the basic sciences and clinical specialties was uneven. Several topics, such as obesity and undernutrition, were strongly emphasized. Such topics as osteoporosis and the relationship between nutrition and cancer were overlooked. Nutrition knowledge, as measured by performance on the nutrition-related questions on the National Board examinations, was equal to student knowledge in other subjects.
- There is no shortage of nutrition textbooks; however, the faculty members who teach nutrition concur that most are inadequate to meet their needs and that they must therefore develop their own materials.
- There is no clear pattern of faculty responsibility for nutrition at U.S. medical schools. In the committee's judgment, faculty responsibility for nutrition teaching is not clearly defined and depends on the individual school and the individual faculty person who teaches the course. Most faculty who have initiated the teaching of nutrition have a strong commitment to the subject. Among those

TABLE 4-3 National Institutes of Health (NIH) Expenditures for Biomedical and Behavioral Nutrition Research and Training, Fiscal Years 1978-1983a

	Number of Expenditures and Dollar Cost (in thousands)					
	Fiscal Year 1978		Fiscal Year 1979		Fiscal Year 1980	
Type of Expenditure	Number	Cost, dollars	Number	Cost, dollars	Number	Cost, dollars
Extramural						
Research grants	809	44,586	1,100	60,683	1,213	68,472
Program projects	52	7,316	65	9,962	84	16,758
Contracts	137	20,467	200	24,755	200	17,168
Centers	64	9,232	91	12,035	89	11,055
General research support		13,210		13,427		10,282
Reimbursement agreements	9	881	11	1,142	16	1,636
Training	169[b]	2,419	297[b]	3,023	333[b]	3,829
Research career development awards	37[b]	1,129	30[b]	1,063	37[b]	1,150
New, young, and academic investigator awards[c]	11[b]	343	18[b]	507	44[b]	989
Subtotal	1,288	99,583	1,812	126,597	2,018	131,339
Intramural:						
Projects	79	6,047	49	6,241	72	7,282
Training	31[b]	668	36[b]	1,014	20[b]	500
Subtotal	110	6,715	85	7,255	85	7,782
NIH total nutrition research and training	1,398	106,298	1,877	13.3,852	2,110	139,121

[a] Data from DHHS, 1979, 1980, 1981b, 1982, 1983, and 1984.
[b] Number of persons.

	Fiscal Year 1981		Fiscal Year 1982		Fiscal Year 1983	
Type of Expenditure	Number	Cost, dollars	Number	Cost, dollars	Number	Cost, dollars
Extramural						
Research grants	1,302	73,451	1,318	77,378	1,355	87,370
Program projects	79	15,959	83	16,499	83	19,243
Contracts	171	16,425	148	8,188	108	12,957
Centers	93	12,067	66	12,244	66	12,477
General research support	260	13,136	262	14,864	274	15,551
Reimursement agreements	16	1,319	15	1,243	15	955
Training	304[b]	3,708	345[b]	2,834	57[b]	1,183
Research career development awards	34	982	58[b]	1,361	73[b]	2,305
New, young, and academic investigator awards[c]	64	1,560	60	1,960	411[b]	3,447
Subtotal	2,323	138,608	2,355	136,571	2,442	155,488
Intramural:						
Projects	95	9,193	85	7,364	91	8,134
Training	25[b]	700	24[b]	449	47	684
Subtotal	120	9,839	109	7,813	138	8,818
NIH total nutrition research and training	2,433	148 500	2,404	144.384	2.442	164,306

[c] In fiscal year 1980 the New, Young, and Special Investigator Awards were combined under the new title, New Investigator Research Awards.

faculty members who teach or coordinate a nutrition course, there are approximately equal numbers of Ph.D.s and M.D.s, but few of them have had formal training in nutrition. Faculty members who teach nutrition spend approximately 40% of their time on research, which provides a major source of financial support.

- Schools that successfully integrate nutrition into their curriculum can be characterized as having:

—strong faculty leadership from those members who are willing to devote time to develop a nutrition education program;
—a physician who demonstrates the application of nutrition principles to clinical practice;
—an identifiable, discrete nutrition course or an identifiable block of nutrition hours within the curriculum; and
—a strong research component that is effective, creative, and related to clinical nutrition, and that contributes to the visibility and credibility of nutrition as a science.

- Medical school faculty currently believe that the restricted curricular time available is the most serious limitation to the incorporation of nutrition in U.S. medical schools. They also believe that students would be receptive to increased instruction in nutrition.
- The majority of medical students believe that instruction in nutrition is inadequate and that when nutrition is incorporated into other courses, as opposed to being a discrete course, its impact is lost.

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5

Curriculum Guideline for Incorporating Nutrition in Medical Education

To assist medical schools in incorporating nutrition into their curricula, the committee has developed an outline of core concepts, which is presented in this chapter. This outline identifies the basic nutrition knowledge that all graduating medical students should have acquired during their medical education.

The major concepts are identified and illustrated by examples of specific information that may be included. This outline is neither a comprehensive list of topics on clinical nutrition nor a detailed course outline. Rather, the suggestions are a guide both to the development of specific courses that can become part of the basic science curriculum and to the integration of nutrition into clinical clerkships, such as pediatrics, medicine, surgery, and obstetrics and gynecology, in which nutrition has an integral role in patient care. Where and how the components of the proposed curriculum should be incorporated into medical school programs are discussed in Chapter 6, Conclusions and Recommendations.

In developing this curriculum guideline, the committee gathered information in several ways. Approximately one-third of the medical schools in the United States were asked to respond to a survey regarding their nutrition curricula (see Chapter 4, Current Programs). To identify clearly those nutrition concepts most frequently taught, the committee requested a course outline or syllabus from each school. In addition, it received testimony from and conducted telephone interviews with several persons directly responsible for the curricular design of nutrition programs at selected medical schools. It also reviewed previously published curriculum guides (Frankle,

n.d., and 1976) and current nutrition course outlines from 18 schools (see Chapter 4, Current Programs).

The information obtained from these sources and the collective experience and expertise of its members formed the basis of the nutrition concepts developed by the committee. They are intended to help medical schools develop a program to inform medical students not only about nutrient requirements and metabolism but also about the role of nutrition in the prevention, etiology, and treatment of disease. Especially emphasized are aspects of nutrition that apply to clinical medicine.

Because of the diversity of instructional approaches and curricular organization in U.S. medical schools, the essential nutrition information for a core curriculum can be organized in several, perhaps equally effective, ways. Nonetheless, the approach described in this chapter should provide a useful and practical guide for the development of a nutrition program at most medical schools.

The committee identified eight main topics on which a curriculum can be based: energy balance, role of specific nutrients, nutrition in the life cycle, nutritional assessment, protein energy malnutrition, the role of nutrition in disease prevention and treatment, possible risks from poor dietary practices, and social and cultural factors that influence dietary practices. Graduating physicians who receive instruction in these subjects should acquire a background knowledge of nutrition that should equip them to deliver effective patient care and to keep abreast of new developments in the field.

ENERGY BALANCE

A discussion of energy balance should include information on control of food intake, the effect of inadequate or excessive energy intake, and metabolic determinants of energy expenditure.

Suggested Topics

- measurements of energy consumption and utilization, the components of energy needs, exercise, and the economy of energy balance

- physiological and behavioral aspects of hunger and satiety as they relate to modulation of food intake
- the prevalence of obesity, obesity as an etiological factor in other diseases, and prevention and therapy of obesity
- negative energy balance and undernutrition, including appropriate measurement and assessment techniques
- clinical significance of undernutrition as illustrated by such conditions as anorexia nervosa, bulimia, illness or malabsorption disorders, the metabolic and physiological adaptations associated with these conditions, and appropriate methods of prevention, therapy, and rehabilitation

ROLE OF SPECIFIC NUTRIENTS

Medical students should be instructed in nutrient requirements, food sources providing essential nutrients, the effects of nutrient deficiency and excess, and nutrient interactions with other factors, such as other nutrients and drugs. Instruction should emphasize the clinical applications of these topics.

Students should learn to recognize specific conditions that may predispose patients to particular nutrient deficiencies, such as increased physiological requirements due to pregnancy, older age, disease states, malabsorption, or alcoholism. Also important is an understanding that the interaction of one nutrient with another or with drugs may affect the bioavailability of a nutrient and that prolonged intake of excessive or pharmacological doses of some vitamins and minerals may pose potential hazards.

Suggested Topics

- biochemical function of specific nutrients
- general principles of the Recommended Dietary Allowances (RDAs), including the definition of the RDAs, how they differ from requirements, the methods of expression, criteria for an adequate diet, and the uses of the RDAs, especially their applicability to patient care

- macronutrients (i.e., lipids, carbohydrates, and protein), their significance to clinical medicine, normal requirements for growth and maintenance, and appropriate dietary sources

—lipids: lipid transport, cholesterol metabolism, and role of essential fatty acids
—carbohydrates: forms and sources in the diet, simple sugars, complex carbohydrates, and role of fiber in the diet
—protein: basis of protein requirements, sources in the diet, potential toxicity, protein quality, alterations in disease states (e.g., liver or renal complications), or protein-depleting enteropathies

- micronutrients, including requirements, biological function, and clinical usefulness, in the prevention of deficiency states and in the treatment of other diseases

—vitamin A: renal function, role in preventing xerophthalmia, relationship to liver disease and particular forms of cancer
—calcium, phosphorus, and vitamin D: role in metabolic bone disease and osteoporosis
—folate metabolism: intestinal function and folate absorption, interaction with alcohol, antibiotic therapy, and oral contraceptives
—vitamin B12: hematopoietic disorders
—iron: criteria for assessing iron nutrition, the bioavailability of iron, and iron requirements for various populations
—functions of such trace minerals as zinc, iodine, copper, selenium, and fluoride

NUTRITION IN THE LIFE CYCLE

Instruction regarding the influence of nutrition and nutritional factors on people at various ages should include discussion of the overall relationship between nutrition and reproduction, the physiology of pregnancy and lactation and the nutritional needs of women during this period, the nutritional merits of various formulas, cows' milk or human milk for infant feeding, and the nutritional problems and nutritional requirements during adolescence, adulthood, and aging.

Suggested Topics

- pregnancy and lactation: nutrient requirements, maternal gain, and nutritional status
- early infant feeding: nutrient requirements for the full-term and premature infant; nutritional considerations in the use of human milk, cows' milk, or infant formulas; introduction of solid foods and whole milk; and infant vitamin-mineral supplements
- adolescence: changes in body composition, growth patterns of boys and girls, changes in eating behavior patterns, and pregnancy
- aging: problems associated with drug-nutrient interaction; alterations in utilization and absorption of nutrients; calcium and osteoporosis; and states of dependency, isolation, depression, or physical disability, which may affect the acquisition of an adequate diet

NUTRITIONAL ASSESSMENT

Nutritional assessment is a valuable tool that may assist the clinician in diagnosis. Students should be informed of the various techniques for assessing patients' nutritional status, such as dietary history and physical examination, including anthropometric measurements and laboratory tests.

PROTEIN ENERGY MALNUTRITION

Protein energy malnutrition (PEM) is second only to infection as a major cause of death and morbidity for most of the world's children. Although acute protein depletion in infants is uncommon in developed countries, it has occurred under some circumstances. Through complex interactions, the depletion of energy and specific nutrients exerts profound effects on growth, development, and resistance to infection. These effects also provide striking examples of the relevance of nutrition to patients with chronic illness.

Suggested Topics

- identification, etiology, and treatment of PEM and its long-term effects on growth, development, and behavior
- relationship of surgery, trauma, and sepsis to PEM and appropriate intervention techniques

THE ROLE OF NUTRITION IN DISEASE PREVENTION AND TREATMENT

Inadequate or excessive nutrient intake, increased nutrient requirements, and decreased bioavailability of nutrients due to decreased absorption or to a high rate of either breakdown or excretion may be associated with many disease states. The relationship of nutrition and nutritional factors to the etiology, prevention, and treatment of various diseases and organ systems should be discussed with emphasis on the application of nutrition to patient care.

Suggested Topics

- atherosclerosis and cardiovascular disease: relationship of dietary cholesterol and saturated fat to cardiovascular disease; the influence of dietary modifications on plasma cholesterol and lipid concentrations; distinction between the various types of hyperlipidemias, their etiology, relationship to disease, and principles of dietary modification; relationship of obesity to cardiovascular disease and the principles and components of the prudent diet
- hypertension: risk factor in cardiovascular disease; potential influence of sodium, calcium, magnesium, and phosphorus and the dietary sources of these elements; relationship of hypertension to obesity
- diabetes: dietary factors and etiologies of type I and type II diabetes; modalities of treatment, including the principles and objectives of dietary management, insulin administration, and exercise therapy; education of diabetic patients about the objectives and methods of diet therapy and conditions with dietary implications that complicate diabetes, such as pregnancy, renal failure, congestive heart failure, and gastrointestinal complications

- cancer: dietary factors that may play a role in the etiology of cancer, especially nutritional myths and misconceptions; metabolic aspects of the cachexia that is frequently associated with cancer; strategies for dietary intervention
- renal disease: role of protein, sodium, calcium, phosphorus, and vitamin D; physiological basis of nutrition therapy; strategies to improve nutritional status in order to alleviate symptoms by the use of such techniques as parenteral nutrition therapy and defined formulas that are composed of amino acids or their ketoanalogues
- gastrointestinal disease and malabsorption: role of various segments of the gastrointestinal tract in nutrient assimilation; nutritional consequences of malabsorption and the clinical and laboratory measurements that identify them; principles of nutritional therapy for specific gastrointestinal or malabsorption disorders, such as sprue, celiac disease, ileitis, ulcerative colitis, disaccharidase deficiency, short bowel syndrome, and infantile diarrhea; the role of dietary factors in the etiology of various gastrointestinal disorders
- liver, biliary tract, pancreatic disease, and alcoholism: effects of alcohol use on health and nutritional status; synergism of alcohol and malnutrition; hypovitaminosis of the B vitamins, such as thiamin and folate; nutritional management
- immune response: role of nutrients in the development and function of the immune response and the mechanism by which infection affects nutritional status
- surgery, trauma, thermal injury, and sepsis: characteristic metabolic responses, including potential changes in metabolic rate and cardiac output; requirements for energy, protein, ascorbic acid, zinc, and other vitamins and trace elements; methods of nutritional support (see next section).
- parenteral and enteral nutrition: indications for use, suitability of a particular route of administration, the principles of formulation, potential hazards and complications that may be associated with these techniques, and the importance of monitoring electrolyte balance and nutritional status

- inborn errors of metabolism: such disorders as disaccharidase deficiency, lactose intolerance, phenyl-ketonuria, principles of dietary modification and management, including prevention of toxic accumulation of substrate and its metabolites, replacement of a deficient product or its derivative, and supplementation of the deficient enzyme or coenzyme to amplify catalytic activity
- dental caries and oral disease: conditions that interfere with the chewing or swallowing of food and practical means for providing adequate nutrients under those circumstances, etiology and prevention of oral disease, role of sucrose in plaque formation, the role of bacteria, and the role of fluoride in the prevention of dental caries

POSSIBLE RISKS FROM POOR DIETARY PRACTICES

Many persons are selecting reducing diets or diets to improve athletic performance or are taking vitamin or mineral supplements in an attempt to improve their nutritional well-being. Discussions should emphasize the health risks and benefits of these self-selected diets.

Suggested Topics

- food fads and popular diets, megavitamins and megaminerals, and weight-reduction diets
- alcoholism and other substance abuse
- toxic substances in food (e.g., mercury, lead, naturally occurring toxicants) and nutritional consequences of self-medication (e.g., antacids)
- diet and athletic performance

SOCIAL AND CULTURAL FACTORS THAT INFLUENCE DIETARY PRACTICES

Nutrition education should present some of the anthropological, sociological, and psychological factors that influence food choices and various dietary patterns and practices.

Suggested Topics

- the clinical consequences of various dietary practices, both cultural and ethnic
- vegetarianism
- public health programs and policy recommendations relating to dietary practices
- the implications of all these topics for the practicing physician

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6

Conclusions and Recommendations

In considering strategies to improve current nutrition programs in U.S. medical schools, the committee was mindful of the enormous body of knowledge and continuous accretion of scientific information that must be conveyed to medical students in a relatively short time. It concluded, however, that the core curriculum outlined in Chapter 5 can be readily incorporated into the curricular design of a medical school currently without such a program.

After reviewing all the data collected through interviews and surveys and considering a number of various alternatives, the committee made the conclusions and recommendations summarized in this chapter.

- The teaching of nutrition in most U.S. medical schools is inadequate. The committee recommends that U.S. medical schools examine the nutrition component of their curriculum and, as explained below, take steps to remedy the deficiencies identified.
- Nutrition is not taught as a separate subject in the majority of schools surveyed by the committee. Although some nutritional concepts are taught in conjunction with other courses, they are frequently not identified as such and their impact and importance are accordingly diminished.

All students should be given a course or its equivalent in the fundamentals of nutrition during the same years in which other basic sciences are offered. These concepts should be reinforced during later clinical clerkships as students see and experience the application of nutrition to patient care.

- There is considerable variation among schools in the scope of subject matter and the thoroughness with which it is taught. In the committee's judgment, based on its review of existing courses and the experience of its members, the nutrition curriculum should include at least the following topics: energy balance; role of specific nutrients and dietary components; nutrition in the life cycle; nutritional assessment; protein energy malnutrition; the role of nutrition in disease prevention and treatment; and risks from poor dietary practices stemming from individual, social, and cultural diversity.
- More than half the medical schools surveyed by the committee teach less than 20 hours of nutrition, and 20% of them teach less than 10 hours. The committee finds this amount of time inadequate for the effective teaching of the most basic nutrition principles. It therefore recommends that a minimum of 25 to 30 classroom hours in nutrition be required of all students during the preclinical years. In the committee's judgment, this is the minimum amount of time required to teach the core concepts described in Chapter 5. Of equal importance, additional clinical teaching of nutrition must be reinforced throughout clerkships, electives, and postgraduate training.
- The committee's survey and consultation with selected faculty members indicate that the success of a nutrition program depends heavily upon the willingness of faculty to commit time to initiate and develop a program. Moreover, there must be a faculty member with ability to demonstrate the application of nutrition principles to clinical practice. On the basis of its surveys and interviews, however, the committee found that faculty responsibility for nutrition varies widely, thus undermining chances for success. Therefore, the committee recommends that a faculty member with a scholarly commitment to nutrition and its application to clinical medicine be designated to lead and develop a nutrition program at each medical school. A clinically active physician who can serve as a prominent role model for the students should be considered for this position.

- Research programs foster the discovery of new knowledge, secure the position of the faculty, enhance their credibility, and provide the scientific rationale for the inclusion of nutrition in medical practice. Strong research programs should therefore be established to complement the teaching of nutrition. The committee recognizes, however, that research alone does not ensure that nutrition will be taught.
- The committee observed a distinct lack of organizational structure and administrative support for nutrition programs in the schools they surveyed. This environment was found to be counter-productive in efforts to foster the long-term survival of a program. To ensure permanence, the committee recommends that the responsibility for the nutrition program be vested in a separate department or a distinct division of the medical school. In addition, each medical institution should allocate specific funds for the support of at least one faculty position in nutrition. To assist in relieving the financial burden attendant on meeting these goals, medical schools might explore the feasibility of generating nutrition-related income from clinical support services within the hospital.
- The committee's review of the National Board examinations indicates that there is an inequity in the distribution of nutrition topics among questions relating both to the basic sciences and to various medical specialties. Certain aspects of nutrition were strongly emphasized, whereas others were ignored. The committee also observed that there is no mechanism in place to ensure that the quantity or degree of challenge associated with nutrition-related questions is satisfactory.

  It therefore recommends that the scope of the nutrition-related questions on the National Board examinations be broadened to reflect more accurately current knowledge in nutrition. To improve the coverage, the National Board of Medical Examiners should consider the recruitment of a scholar in nutrition to join its roster of consultants. It should also consider appointing an advisor to review the examinations for balance of nutrition-related questions and to propose questions for committee consideration.
- The resources available for teaching nutrition in medical schools are insufficient. Faculty members who

teach nutrition concur that nutrition textbooks, although plentiful, are inadequate to meet their instructional needs. Thus, they must prepare their own syllabi. In addition, those schools that lack an appropriate faculty member teach only a minimum amount of nutrition.

The committee recommends that the federal government and private foundations provide assistance for the development of appropriate teaching materials. In addition, there is a need for an adequately trained cohort of nutritional scientists with skill in the clinical application of nutrition. The committee acknowledges the federal government's support for the training of faculty in nutrition and recommends that such funding be continued and increased. For example, the committee recommends that NIH consider increasing the funding for such programs as the Clinical Nutrition Research Units, which focus on training, research, and nutrition education activities. To meet intermediate needs, the committee encourages short-term institutional sharing of faculty and other resources; however, long-term survival of nutrition programs is dependent an increase in funds from federal and private sources.

- The committee concludes that there is no reliable mechanism for monitoring the changes that may occur in nutrition research and education over the next several years. It therefore recommends that the annual questionnaire prepared by the Association of American Medical Colleges' (AAMC) for the Liaison Committee on Medical Education (LCME) include more exploratory and relevant questions concerning the nutrition curriculum. To obtain a more valid assessment of current nutrition programs and to assist in future program needs, these questions should be directed to those faculty who can characterize the nutrition program. Since accreditation is one important way to encourage nutrition teaching, the LCME should consider placing stronger emphasis on nutrition in its periodic accreditation procedures.

The committee further recommends that each medical school assess the changes that may occur within its own institution and that in 5 years the Food and Nutrition Board of the National Research Council or another authoritative body reexamine the status of nutrition in medical schools.

Appendixes

Appendix A

U.S. Medical Schools Surveyed by the Committee and Their Characteristics

The following 46 schools were sent survey questionnaires by the committee:

Albert Einstein College of Medicine of Yeshiva University
Baylor College of Medicine
Bowman Gray School of Medicine
Creighton University School of Medicine
East Carolina University School of Medicine
East Tennessee State University Quillen-Dishner College of Medicine
Georgetown University School of Medicine
Hahnemann University School of Medicine
Harvard Medical School
Louisiana State University School of Medicine in Shreveport
Medical College of Georgia School of Medicine
Medical College of Pennsylvania
Meharry Medical College School of Medicine
Mount Sinai School of Medicine of the City University of New York
New York Medical College
Northeastern Ohio Universities College of Medicine
Northwestern University Medical School
Rush Medical College of Rush University
Southern Illinois University School of Medicine
State University of New York at Buffalo School of Medicine
Texas Tech University Health Sciences Center School of Medicine
Tufts University School of Medicine
Uniformed Services University of the Health Sciences
University of Alabama at Birmingham School of Medicine
University of California at Irvine, College of Medicine
University of Colorado School of Medicine
University of Florida College of Medicine
University of Health Sciences/Chicago Medical School
University of Iowa College of Medicine
University of Kentucky College of Medicine
University of Maryland School of Medicine
University of Medicine and Dentistry of New Jersey
University of Michigan Medical School
University of Mississippi School of Medicine

University of North Carolina at Chapel Hill School of Medicine
University of Oklahoma College of Medicine
University of Pittsburgh School of Medicine
University of Rochester School of Medicine and Dentistry
University of South Carolina School of Medicine
University of Southern California School of Medicine
University of Vermont College of Medicine
Virginia Commonwealth University Medical College of Virginia
Washington University School of Medicine
West Virginia University School of Medicine
Wright State University School of Medicine
Yale University School of Medicine

Characteristics Of The 45 Schools That Responded

Of the 46 schools sent questionnaires (listed above), 45 responded. Not all the respondents provided answers to all the questions, however. The committee identified four basic categories of schools among the respondents: private (17), state (25), federal (1), and not stated (2). The curriculum structure and responsibility were also identified (see Table A-1).

TABLE A-1. Curriculum Structure and Responsibility in the Responding Schools

Characteristic	Year 1	Year 2	Year 3	Year 4
Curriculum Structure				
Basic science (normal)	39	20		
Clinical science(disease)	3	27	11	7
Clerkships (required)			35	18
Clinical electives			5	32
Other		4	2	
Curriculum Responsibility				
Departmental	34	32	36	36
Interdepartmental	7	12	2	3

Appendix B

Survey of Medical School Deans and Associate Deans

NUTRITION CURRICULUM QUESTIONNAIRE PART I

GENERAL OVERVIEW OF NUTRITION IN THE MEDICAL SCHOOL CURRICULUM

National Research Council

Food and Nutrition Board

Committee on Nutrition in Medical Education

PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS YOU CAN. YOUR ASSISTANCE WILL BE GREATLY APPRECIATED. PLEASE RETURN BY JUNE 5, 1984.

1. School: _____ Address: _____

2. Type of School:
   Private university____ State university____ Other____
   Number of students per class____

3. Name of Administrator:
   Telephone:

4. Titles/Rank:

5. What is the general structure of the curriculum?

	Year I	Year II	Year III	Year IV
Major Emphasis				
Basic science (normal)	_____	_____	_____	_____
Clinical science (disease)	_____	_____	_____	_____
Clerkships (required)	_____	_____	_____	_____
Clinical electives	_____	_____	_____	_____
Other: _____	_____	_____	_____	_____
Year Responsibility Predominant?				
Departmental	_____	_____	_____	_____
Interdepartmental	_____	_____	_____	_____

6. Are there identifiable sections of the curriculum that are primarily concerned with nutrition?
   Yes_____ No_____ Don't know_____

   If you are not sure, is there another member of the faculty who might know about this area?
   Name: Department:

7. Who on the faculty has the primary responsibility for the nutrition curriculum?
   Name:
   Title:
   Location:
   Phone:

8. Who else on the faculty has major responsibilities (limit to two)?

Name:	Name:
Title:	Title:
Location:	Location:
Phone:	Phone:

9. How many total hours in the required curriculum can be identified as primarily concerned with nutrition? _____

10. Is nutrition taught as a separate course? _____ Or is nutrition taught in combination with other subjects? ___

11. During which year is most of the nutrition curriculum taught?
    First ____ Second ____ Third ____ Fourth ____

12. If available, will you please include a current nutrition course outline?

13. Are electives offered in nutrition? Yes____ No____
    If so, please provide:
    Titles:
    Faculty directors:
    Year offered:
    Length of course:
    Number of students participating (average per year):

14. Have there been any major changes in the nutrition curriculum within the past 10 years? If so, please describe.

15. Approximately what percentage of the medical school operating budget is from:

Tuition	_____%
Endowment and gifts	_____%
State funds	_____%
Federal grants	_____%
Other (_____)	_____%

Appendix C

Survey of Medical School Nutrition Course Coordinators

NUTRITION CURRICULUM QUESTIONNAIRE PART III
COURSE STRUCTURE AND CORE CURRICULUM
National Research Council
Food and Nutrition Board
Committee on Nutrition in Medical Education

PLEASE ANSWER THE FOLLOWING QUESTIONS AS ACCURATELY AS YOU CAN. YOUR ASSISTANCE WILL BE GREATLY APPRECIATED. PLEASE RETURN BY AUGUST 10, 1984.

NAME:
TITLE:
SCHOOL:
ADDRESS:

WAS PART I OF THE QUESTIONNAIRE FORWARDED TO YOU FOR COMPLETION? Yes_____ No_____

I. COURSE INFORMATION

1. Are there identifiable sections of the curriculum that are primarily concerned with nutrition?Yes_____ No_____
2. How many total hours in the required curriculum can be identified as primarily concerned with nutrition? _____
3. Is nutrition taught as a separate course? _____ Or is nutrition taught in combination with other subjects?
4. During which year is most of the nutrition curriculum taught?

First_____ Second_____ Third_____ Fourth_____

5. Are electives offered in nutrition? Yes_____ No_____ If so, please provide:

a. Title:

Faculty director:

In which year is this course offered:

Number of hours:

Average number of students enrolled in class:

b. Title:

Faculty director:

In which year is this course offered:

Number of hours:

Average number of students enrolled in class:

II. Nutrition Core Curriculum

Please answer the following questions relating to curriculum and, if available, please provide a course outline.

	TAUGHT? (yes/no)	WHERE? (year/ section)	NUMBER OF HOURS
A. Energy Balance			
General concepts	_____	_____	_____
Excess: obesity	_____	_____	_____
Deficiency: undernutrition	_____	_____	_____
B. Specific Nutritional Factors (requirements, sources, deficiency, excess, interaction)			
General Principles of Recommended Dietary Allowances (RDAs)			
Protein	_____	_____	_____
Carbohydrate	_____	_____	_____
Lipids—essential fatty acids	_____	_____	_____
Vitamins and minerals, including:			
Vitamin D	_____	_____	_____
Calcium, phosphorus	_____	_____	_____
Iron	_____	_____	_____

	TAUGHT? (yes/no)	WHERE? (year/section)	NUMBER OF HOURS
Specific Nutritional Factors (cont.)			
Vitamin B_{12}, folate			
Vitamin A			
Trace minerals			
Nutrient interaction with other factors (genetic, other nutrients, drugs, etc.)			
C. Nutrition in the Life Cycle			
Pregnancy and lactation			
Early infant feeding			
Adolescence			
Aging			
D. Nutritional Assessment			
E. Protein-Energy Malnutrition			
F. The Role of Nutrition in Disease Prevention and Treatment			
Atherosclerosis and cardiovascular disease			
Hypertension/sodium			
Renal disease			
G.I. disease/malabsorption			
Liver disease/alcoholism			
Food intolerance: allergy			
Cancer			
Diabetes			
Surgery, stress, burns			
Dental caries			
Parenteral and enteral nutrition			
Immune response			
Nutrition and central nervous system			

	TAUGHT? (yes/no)	WHERE? (year/section)	NUMBER OF HOURS
G. Dietary Practices			
Variation in dietary practices:			
Cultural, ethnic			
Prudent diet			
Vegetarianism			
Food faddism: popular diets			
Megavitamins			
H. Others (list)			

APPENDIX D

Personal Interview Survey of Nutrition Course Coordinators

NUTRITION CURRICULUM QUESTIONNAIRE PART II
DETAILED EXAMINATION OF NUTRITION CURRICULUM
National Research Council
Food and Nutrition Board
Committee on Nutrition in Medical Education

PLEASE FILL OUT THE FOLLOWING QUESTIONS AS COMPLETELY AS POSSIBLE. YOUR ASSISTANCE IN RETURNING THE FORM BY AUGUST 15, 1985 WILL BE GREATLY APPRECIATED.

SCHOOL: ADDRESS:

I. FACULTY PARTICIPATING IN THE NUTRITION CURRICULUM

A. Do you have the primary responsibility for the nutrition curriculum? Yes_____ No_____

If no, please indicate the faculty person who has the overall responsibility.

Name:
Academic Title:
Department (primary):
Other Titles:
Professional Training—Degrees: Postgraduate:
Clinical Responsibilities—Type: % Effort:
Research Activity—Major interests:
% Effort: Grant support?
Nutrition Teaching Activity—Role: % Effort:

B. Which other faculty play a major role in the nutrition curriculum?

1. Name:	
Academic Title:	
Department (primary):	
Other Titles:	
Professional Training—Degrees:	Postgraduate:
Clinical Responsibilities—Type:	% Effort:
Research Activity—Major interests:	
% Effort: Grant support?	
Nutrition Teaching Activity—Role:	% Effort:
2. Name:	
Academic Title:	
Department (primary):	
Other Titles:	
Professional Training—Degrees:	Postgraduate:
Clinical Responsibilities—Type:	% Effort:
Research Activity—Major interests:	
% Effort: Grant support?	
Nutrition Teaching Activity—Role:	% Effort:

C. List other faculty who participate in nutrition teaching:

1. Name:
Title:
Department:
Teaching Responsibilities:
2. Name:
Title:
Department:
Teaching Responsibilities:
3. Name:
Title:
Department:
Teaching Responsibilities:
4. Name:
Title:
Department:
Teaching Responsibilities:

II. NUTRITION CORE CURRICULUM

(Please enclose a course outline if available.)

Subject	Equivalent Topic (other title)	Taught (yes/no)	Where (year/ session)	Faculty (names)	Type of Session (lecture/ group/etc.)
A. Energy Balance					
General concepts					
Obesity					
Starvation					
Protein/energy malnutrition					
B. Specific Nutritional Factors (requirements, sources, deficiency, excess)					
General principles					
Protein					
Carbohydrates					
Fat					
Calcium, phosphorus					
Vitamin D					
Iron					
Vitamin B_{12}, folate, Vitamin A					
C. Nutrition in the Life Cycle					
Pregnancy					
Lactation					
Early infant feeding					
Adolescence					
Aging					
D. Nutritional Assessment					

Subject	Equivalent Topic (other title)	Taught (yes/no)	Where (year/ session)	Faculty (names)	Type of Session (lecture/ group/etc.)
E. The Role of Nutrition in Disease Prevention and Treatment					
Atherosclerosis					
Cardiovascular disease					
Hypertension/ sodium					
Renal disease					
G.I. disease/ malabsorption					
Liver disease/ alcoholism					
Food intolerance/ allergy					
Cancer					
Diabetes					
Surgery, stress, burns					
Dental caries					
Therapuetic diets					
Enteral nutrition					
Parenteral nutrition					
Drug-nutrient interaction					
F. Alternative Dietary Practices					
Vegetarianism					
Food faddism: popular diets					
Megavitamins					

	Subject	Equivalent Topic (other title)	Taught (yes/no)	Where (year/ session)	Faculty (names)	Type of Session (lecture/ group/etc.)
G.	Nutrition and Societal Needs					
	Prudent diet/ recommendations					
	Food supply/ economics					
	Community nutrition resources					
H.	Others (list)					

III. WHAT TEACHING MATERIALS AND RESOURCES ARE BEING USED EXTENSIVELY IN THE REQUIRED CORE NUTRITION CURRICULUM?

Type of Material (text, syllabus, video-tapes)	Title	Author(s) (primary)	Source (publisher)	Cost	How used? (subjects)	Required? (yes/no)	Useful-ness

A. How are the students evaluated with regard to their knowledge of the nutrition curriculum?

1. No specific evaluation ____
2. Pass/fail/etc. ____
3. Scaled grade ____

B. Is the initial evaluation:

1. Separate for the nutrition curriculum? _____

2. Combined with performance on other parts of the curriculum?_____

Comments: _____

IV. ORGANIZATION AND IMPLEMENTATION OF THE NUTRITION CURRICULUM

A. How many years has the current nutrition curriculum been in effect?_____

B. Describe major changes in the curriculum during the past 10 years:

C. What significant problems were encountered in organizing and implementing major changes in the curriculum? (Mark in order of severity.)

	SEVERITY				
PROBLEM	None	Slight	Moderate	Severe	Very Severe
Faculty training	___	_____	_____	_____	_____
Faculty time	___	_____	_____	_____	_____
Selection of content	___	_____	_____	_____	_____
Time in curriculum	___	_____	_____	_____	_____
Faculty acceptance	___	_____	_____	_____	_____
Student acceptance	___	_____	_____	_____	_____

Comments: _____

D. What factors have been most helpful in implementation of the current nutrition curriculum? (Describe)

Comments: _____

E. Have proposals for major changes in the current nutrition curriculum been considered and rejected? (Explain)

Comments: _____

F. Are plans under consideration now for major changes? (Explain)

Comments: _____

_____

G. In your opinion, is the current required core nutrition curriculum for medical students at your school

1. severely inadequate? ____
2. moderately inadequate? ____
3. just adequate? ____
4. optimal? ____
5. extensive? ____

Comments: _____

_____

This questionnaire was sent to the following nine schools:

Medical College of Georgia School of Medicine
Mount Sinai School of Medicine of the City University of New York
Tufts University School of Medicine
Virginia Commonwealth University Medical College of Virginia
University of Medicine and Dentistry of New Jersey--New Jersey School of Medicine
University of Oklahoma College of Medicine
University of Rochester School of Medicine and Dentistry
University of Southern California School of Medicine
University of Vermont College of Medicine

Appendix E

Speakers at Various Committee Meetings

A.Harold Lubin, M.D., Director, Personal Health Program, Food and Nutrition Unit, American Medical Association, Chicago, Illinois

Maurice Shils, M.D., Sc.D., Principal Investigator, The New York-New Jersey Regional Center for Clinical Nutrition Education, The New York Academy of Medicine; Director of Clinical Nutrition, Memorial Sloan-Kettering Cancer Center; and Professor of Medicine, Cornell University Medical College, New York, New York

Willard J. Visek, M.D., Ph.D., Professor of Clinical Science, University of Illinois College of Medicine, Urbana, Illinois

Roland Weinsier, M.D., Dr.P.H., Professor and Director, Clinical Division, Department of Nutritional Science, University of Alabama at Birmingham, Birmingham, Alabama

Eleanor Young, Ph.D., Associate Professor, Department of Medicine, Division of Gastroenterology and Nutrition, University of Texas Health Science Center, San Antonio, Texas

Appendix F

Testimony of the American Medical Student Association: Nutrition Education in the Undergraduate Medical Curriculum

Prepared for the National Research Council's Food and Nutrition Board by William J. Kassler, AMSA National President January 14, 1985

Medical education has traditionally focused on the principles of acute episodic health-care delivery, overlooking the concepts and application of nutrition and preventive medicine. Nutrition is not well taught, if taught at all, in most medical schools. Students tend to place little value on nutrition courses, which are often incorporated into other courses, receive lesser emphasis, and have to compete for study time with subjects that carry more weight in overall student evaluations and grades. Because of this deficiency, most physicians-in-training in the United States enter their professional life not equipped with the skills or attitudes to apply nutritional concepts in their practice of medicine.

Generally, patients should be able to expect physicians to have at least a minimum level of knowledge and skill in the area of nutrition. Pregnancy, breast feeding, child rearing, and aging are all "healthy" times in the life cycle when nutrition counseling is needed. Patients seeking care related to a chronic illness, such as diabetes, stroke, or heart disease, also have an urgent need for nutrition education and to understand the relationship of diet to their health. In addition, the current proliferation of special diets, such as vegetarianism and weight reduction and a host of fad diets, all point to a need for the physician to be able to apply basic nutritional knowledge to a variety of situations in health and disease.

Ideally, all physicians would have the knowledge described above and the clinical skills to assess and

intervene appropriately. Unfortunately, very few physicians have this level of expertise, and if they do, it has been generally acquired outside the traditional medical school curriculum. This situation neglects a potentially valuable preventive and therapeutic tool and contributes to inadequate health care.

The American Medical Student Association (AMSA) is committed to increasing the effectiveness of teaching nutrition to medical students and strongly supports the need for quality curricula in this area. AMSA believes that future gains in the health status of Americans will be maximized if an effective preventive health care program can be established. One key element to this is the training of future physicians in nutrition.

AMSA is the largest independent organization of physicians-in-training, representing over 30,000 medical students at 140 allopathic and osteopathic schools across the country. Since its inception in 1950, AMSA has had a long-standing commitment to, and experience in attempting to bring about change in, medical education .through curriculum reform.

One of AMSA's strengths is our experience with community-based programs designed to provide medical students with quality learning experiences, using the delivery of a needed community service by students as the primary vehicle to promote student learning. Currently, AMSA, under contract with the Bureau of Health Care Delivery and Assistance, is placing students in Community and Migrant Health Centers, thereby assisting their efforts in health promotion and disease prevention. Students participating in this program will help the physicians and other providers introduce nutrition counseling and education into their clinic setting.

AMSA's task forces represent a programmatic arm of the organization. Composed and directed by medical students, they publish quarterly newsletters, conduct workshops, and organize special projects on specific issues of importance. The Nutrition and Preventive Medicine Task Force represents over 2,000 students and is one of AMSA's

most active task forces. The task force provides an organizing and communication mechanism that can stimulate interest in, and bring together students who want to participate in, the programs. In addition, AMSA has provided funds and encouragement to local chapters for student-organized educational programs in nutrition, several of which have become incorporated into the formal curriculum.

Nutrition in the formal curriculum consists of required nutrition courses, elective nutrition courses, nutrition incorporated into another course, clinical clerkships in nutrition, and opportunities for nutrition research. Several observations can be made concerning this curricular emphasis.

Required nutrition courses are usually taught in the basic science years. Topics vary widely in each course. Whereas AMSA supports the idea that a separate course on nutrition is desirable in order that the subject receive proper emphasis, this support is not enough. The emphasis must be reinforced by continual attention to nutrition throughout all phases of medical training. The materials learned in the basic sciences are often forgotten unless followed by reinforcement during the clinical years.

Preclinical electives (or selectives) are often good, but they are still inadequate. It has been suggested that only a very low percentage of students at these schools take advantage of this opportunity. This is frequently because nutrition is forced to compete against other attractive electives, such as bioethics, medical Spanish, geriatrics, and occupational health, for the students limited, preclinical elective time. This approach alone demonstrates a lack of emphasis by the school on nutrition.

Most nutrition in the formal curriculum is incorporated into other courses. Biochemistry, physiology, and pharmacology are the courses most often alleged to contain some nutrition instruction. Too often in such courses, nutrition is touched on briefly, with the primary emphasis on the major discipline. It is quite possible to finish such

a course and not even realize that nutrition was covered. Nutrition taught by those whose interest and expertise lie elsewhere simply doesn't work.

Preclinical nutrition courses are often unsuccessful and irrelevant, because the courses fail to identify practical applications. Nutrition courses are too often courses in metabolism. The role of food must be emphasized in addition to nutrients. The nutritional component of today's major public health problems must be elucidated. Cancer, hypertension, diabetes, heart disease, obesity, and anorexia nervosa are at least as important to today's physicians-in-training as are the classical nutritional deficiency disorders.

Clerkships in clinical nutrition are one of the best places to learn the basics of applied nutrition. Such clerkships should encompass all of the basic concepts of nutrition and should not be limited to just pediatrics, surgery, oncology, or some other specialty area, as is often the case. Nor should they be limited to specialized in-patient techniques like total parenteral nutrition, but should include practical applications of nutrition in everyday practice. Whereas a clerkship in clinical nutrition is quite valuable, these clerkships are almost always elective and consequently impact on a small percentage of students. Medical students have, on the average, between 40 and 60 clinical electives, and clinical nutrition must compete with many other more traditional electives for student time.

Research opportunities in nutrition are usually available and are a necessary component in stimulating interest among future researchers. This opportunity is not useful, however, to the average medical student.

AMSA believes that the following components are essential for the development of an effective nutrition education program:

1. the collaboration of disciplines in developing course content;

2. the development of a series of nutrition courses, which incorporate basic sciences, nutrition theory, and clinical application;
3. the integration of such classes throughout the student's required course work;
4. giving emphasis to nutrition courses equal to that of the more traditional science and clinical requirements;
5. providing course work that fosters knowledge and skills that will enable future physicians to: evaluate a patient's nutritional status, understand the nutritional needs of a healthy individual, assess and intervene when patients are at high-risk states of the normal life cycle, at risk for chronic and acute diseases with nutritional implications, and in a disease state where nutrition therapy is indicated; and
6. the opportunity to practice emerging skills in ambulatory and community-based health care settings.

We recognize that the reality of the medical school environment is such that these elements in a nutrition education program are unlikely to be widely enacted by curriculum committees and an academic hierarchy that represents traditional disciplines. For this reason, AMSA has been committed to stimulating the development of student-initiated nutrition education programs. Progress in achieving meaningful change in this area can be achieved with the commitment and mutual cooperation of students, faculty, and administrations, as well as health policy-makers. AMSA offers its support and assistance.

Addeneum

Notes on the preparation of AMSA's testimony, "Nutrition Education in the Undergraduate Medical Curriculum," to the National Research Council's Food and Nutrition Board.

AMSA's testimony was based on several sources. AMSA's Principles of Medical Education, as enacted by its House of Delegates, states that:

> "The American Medical Student Association supports a medical school curriculum that provides in the core curriculum a structured practical nutrition course, including diet counseling centered around the patient/ student educational aspect of nutrition in health and disease."

Furthermore, many of the recommendations follow AMSA's principles regarding curriculum design and content, specifically with respect to the interdisciplinary approach, and emphasis on community and ambulatory settings.

AMSA is currently conducting a nationwide survey of U.S. medical school curricula to identify excellence in medical education. One component of this survey is being performed by the Nutrition and Preventive Medicine Task Force, which is examining nutrition curricula. Much of AMSA's testimony is derived from anecdotal material relating to this survey. Presently, raw data exist for over 25% of AMSA's 127 local chapters.

Finally, AMSA's leadership consists of several medical students who have prior graduate training in the field of nutrition, at the master's and Ph.D. levels, and who have shared their own personal experiences. The testimony was prepared by AMSA's national president, William Kassler, who received a master's degree in nutrition from Case Western Reserve University.

Appendix G

Nutrition Science Content of National Board Examinations

The National Board of Medical Examiners (NBME), an independent nonprofit enterprise based in Philadelphia, develops and administers qualifying examinations "of such high quality that legal agencies governing the practice of medicine within each state may at their discretion grant a license without further examination to those who have completed successfully the examinations of the National Board and have met such other requirements as the National Board may establish for certification of its Diplomates" (NBME, 1985). These examinations, offered for more than half a century by the National Board, represent the more traveled of the two major avenues leading to medical licensure. Indeed, during the past few decades, more than three-fourths of the students graduating from the U.S. medical schools used the National Board certification as their pathway to professional licensure.

National Board certification is now accepted as qualification by the medical licensing authorities of all states and territories other than Louisiana, Texas, and the Virgin Islands. The Canadian provinces of Alberta and Ontario also accept the National Board examinations in lieu of local licensing mechanisms. The National Board examinations are also used by some of the U.S. medical schools "as an external evaluation of the progress of their students" (NBME, 1985).

National Board Test Content

Part I of the National Board examination contains multiple choice questions in seven major disciplines:

- anatomy (gross anatomy, cell biology, histology, human development, central nervous system, special senses)

- behavioral sciences (behavioral biology, individual behavior, interpersonal and social behavior, culture and society)
- biochemistry (energy metabolism, metabolic pathways, properties and function of major cell constituents, integrated and correlative biochemistry, biochemical aspects of genetics and molecular biology)
- microbiology (microbial structure, cell metabolism, microbial and molecular genetics, immunology, bacterial pathogens, virology, medical mycology, medical parasitology)
- pathology (general pathology, systemic pathology, clinical pathology)
- pharmacology (general principles; central, peripheral, and autonomic nervous systems; autacoids; cardiovascular and respiratory systems; fluids and electrolytes; vitamins; chemotherapeutic agents; intoxicants)
- physiology (organ physiology, neurophysiology, cellular physiology)

Part II of the examinations is devoted to the clinical sciences. It contains multiple choice questions in

- medicine
- obstetrics and gynecology
- pediatrics
- preventive medicine and public health
- psychiatry
- surgery

The National Board examinations, therefore, represent a comprehensive and diligently selected set of questions

designed to reflect the measurable content of undergraduate medical education in U.S. medical schools. The scores obtained in all subjects or disciplines accordingly provide a means by which faculties may, in their discretion, judge the effectiveness of the teaching of the subject under consideration.

Members of the committee assessed approximately 6,000 questions from Parts I and II of examinations given in 1980, 1982, and 1984. The nutrition-related questions were identified and then assigned to one or another of the core curriculum categories previously proposed by the committee (Chapter 5). Analyses of student performance on each of these questions (for 1980 and 1982) were also made available to committee representatives. In the tables that follow, P is used to designate the percentage of correct responses to a particular question and R is used to designate the discrimination value--an index that represents how well high-scoring examinees perform on a particular question when compared with low-scoring examinees. The higher the R value, the more discriminating the question.

Findings

Table G-1 summarizes the distribution of and the examinees' performance on the nutrition-related questions identified in Part I of the 1980, 1982, and 1984 examinations. There was a small drop (from 4% to 3%) in the number of items that test knowledge in nutrition. The number of such questions diminished from 42 in 1980 to 25 in 1984. Questions concerning nutrition were found in all disciplines except microbiology. The average percentage of correct responses to these nutrition items for all disciplines combined ranged from 61.5% to 63.8%--in approximately the same range found for the entire examination for those years (i.e., 63% to 67%).

Table G-2 summarizes the distribution of and the examinees' performance on nutrition-related questions from Part II of the 1980, 1982, and 1984 examinations. The percentage of the total number of questions identified as

TABLE G-1. Nutrition-Related Questions on Part I of the 1980, 1982, and 1984 National Board Examinations: Distribution and Performance

	1980				1982				1984	
Discipline	N[a]	%[b]	p[c]	R[d]	N	%	P	R	N	%
Anatomy	6	4	46.2 ±10.3[e]	23 ±4.2	3	3	70.8 ±6.9	22.8 ±5.2	2	1
Behavioral science	6	4	74.8 ±10.1	26 ±5.4	3	2	57.7 ±14	25.3 ±5.8	1	1
Biochemistry	16	12	53 ±5.5	29.8 ±3.5	10	7	59.1 ±9.1	25.9 ±2.0	6	4
Pathology	4	3	73.5 ±15.1	29.5 ±5.5	5	3	72.8 ±7.2	27.4 ±5.6	4	3
Pharmacology	6	4	59.5 ±12.9	26.5 ±7.5	6	4	59.8 ±10.2	24.3 ±6.2	3	2
Physiology	4	3	75.3 ±15.0	29.3 ±7.0	4	3	67.3 ±2.4	35.0 ±2.5	9	6
Microbiology	0	0	-	-	0	0	-	-	0	0
Average for all disciplines combined		4	61.5 ±4.0	28.0 ±2.1		3	63.8 ±3.8	26.5 ±1.6		3

[a] Number of nutrition-related questions.
[b] percentage of nutrition-related questions among total questions for discipline.
[c] Average percentage of correct responses to all the nutrition-related questions in each discipline.
[d] Discrimination value: An index that represents how well high-scoring examinees perform on the particular question compared with low-scoring examinees.
[e] ±Standard error of the mean.

TABLE G-2. Nutrition-Related Questions on Part II of the 1980, 1982, and 1984 National Board Examinations: Distribution and Performance

	1980				1982				1984	
Discipline	N[a]	%[b]	P[c]	R[d]	N	%	P	R	N	%
Preventive medicine, public health (PMPH)	8	5	73.9 ±10.1[e]	35.8 ±4.5	5	3	62.9 ±9.5	9.4 ±6.6	1	1
Pediatrics	14	9	58.5 ±6.3	22.4 ±2.4	18	12	51.9 ±5.8	22.3 ±2.3	13	9
Psychiatry	3	2	74.3 ±9.7	17.7 ±14	3	2	74.0 ±20.6	26.0 ±8.5	6	4
Medicine	4	3	83.0 ±5.7	31.3 ±3.8	2	1	63.	31.5	4	3
Surgery	4	3	80.8 ±6.0	30.0 ±5.9	4	3	74.0 ±14.7	20.5 ±6.5	0	
Obstetrics and gynecology	2	7	65.5	10.0	2	1	74.5	30.0	1	1
Average for all disciplines combined		4	68.8 ±3.8	29.4 ±2.5		4	59.1 ±4.1	23.0 ±4.7		3

[a] Number of nutrition-related questions.
[b] percentage of nutrition-related questions among total questions for discipline.
[c] Average percentage of correct responses to all the nutrition-related questions in each discipline.
[d] Discrimination value: An index that represents how well high-scoring examinees perform on the particular question compared with low-scoring examinees.
[e] ±Standard error of the mean.

containing a nutrition component dropped again slightly, from 4% to 3%. The total number of nutrition-related questions varied from 22 to 29 per year.

Table G-3 summarizes the average percentage of correct responses to all questions and the discrimination values by year and scientific discipline for Parts I and Part II of the three examinations reviewed. No significant percentage trends are apparent for the years studied nor were there substantive departures from these indices in the values representing performance in nutrition-related questions.

Ninety-eight nutrition-related questions were identified in Part I, and 94 in Part II of the three examinations that were reviewed by the committee. In Table G-4 these 192 nutrition-related questions are assigned to the core curriculum categories. The percentages of the total questions assigned to each topic are given.

Summary Of Findings

Approximately 3% to 4% of all questions in Parts I and II of the 1980, 1982, and 1984 National Board examinations test the students' knowledge in the nutrition sciences. The greatest concentration of nutrition-related questions in Part I of the examinations is in the biochemistry section (varying from 7% to 12% of all questions) and in the physiology section (6%). In Part II the greatest concentration is invariably found in pediatrics.

The average percentage of correct responses indicate that there is no difference in performance on nutrition-related test items when compared to all test questions on the examinations reviewed by the committee. The R values indicate that questions on nutrition reflect about the same level of discrimination as all test items in both Parts I and II of the examinations reviewed.

Approximately 12% of the 1982 nutrition-related questions address obesity and undernutrition or starvation. The following core concepts are also well represented: lipids and essential fatty acids, vitamins and minerals,

TABLE G-3. Average Percentage of Correct Responses and Discrimination Values by Discipline for Parts I and II of the 1980, 1982, and 1984 National Board Examinations

	PART I					
Discipline	1980		1982		1984	
	P[a]	R[b]	P	R	P	R
Anatomy	63	30	65	31	68	33
Behavioral science	66	23	69	26	65	26
Biochemistry	59	33	64	35	70	35
Pathology	64	27	63	28	63	29
Pharmacology	62	29	64	31	68	32
Physiology	65	31	67	30	73	29
Microbiology	63	30	62	28	67	31
Average	63	29	65	30	67	31
	PART II					
Discipline	1980		1982		1984	
	P	R	P	R	P	R
Anatomy	63	30	65	31	68	33
Preventive medicine, public health	66	31	65	28	68	30
Pediatrics	67	28	63	26	64	26
Psychiatry	67	25	66	26	65	26
Medicine	65	32	67	30	65	28
Surgery	65	28	63	25	66	27
Obstetrics and gynecology	64	28	66	26	63	24
Average	66	28	65	27	65	27

[a] Average percentage of correct responses to all questions in each discipline.
[b] Discrimination value: An index that represents how well high-scoring examinees perform on the particular question compared with low-scoring examinees.

TABLE G-4. Questions on 1980, 1982, and 1984 National Board Examinations Related to Nutrition Core Curriculuma

Core Curriculum Topic	N[b]	%[c]
Energy balance		
General concepts	5	2.6
Excess: obesity	22	11.5
Deficiency: undernutrition and starvation	23	12.0
Specific nutritional factors (requirements, sources, deficiency, excess interaction)		
General principles of recommended dietary allowance s (RDAs)	1	0.5
Protein	7	3.6
Carbohydrate	5	2.6
Lipids - Essential Fatty Acids	16	8.3
Vitamins and minerals, including:	15	7.8
Vitamin D	7	3.6
Calcium, phosphorus	7	3.6
Iron	11	5.7
Vitamin B12, folate	4	2.1
Vitamin A	0	
Trace minerals	1	0.5
Nutrient interaction with other factors (e.g., genetic, other nutrients, drugs)	7	3.6
Nutrition in the life cycle		
Pregnancy and lactation	13	6.7
Early infant feeding	18	9.4
Adolescence	2	1.0
Aging	0	
Nutritional assessment	0	
Protein/energy malnutrition	0	

Core Curriculum Topic	N[b]	%[c]
The role of nutrition in disease prevention and treatment		
Atherosclerosis and cardiovascular disease	8	4.2
Hypertension/sodium	0	
Renal disease	2	1.0
G.I. disease/malabsorption	5	2.6
Liver disease/alcoholism	6	3.0
Food intolerance: allergy	0	
Cancer	0	
Diabetes/hypoglycemia	5	2.6
Surgery, stress, burns	1	0.5
Dental caries	3	1.6
Parenteral and enteral nutrition	0	
Immune response	0	
Nutrition and central nervous system	1	0.5
Osteoporosis	0	
Dietary practices		
Cultural and ethnic variation	2	1.0
Prudent diet	2	1.0
Vegetarianism	0	
Food faddism: popular diets	0	
Megavitamins	1	0.5
Others		
Anatomy and embryology	2	1.0

[a] Core curriculum concepts as defined by the Committee on Nutrition in Medical Education (see Chapter 5).
[b] The number of nutrition-related questions identified by core concept in both Parts I and II of the 1980, 1982, and 1984 examinations. (Total number identified = 192.)
[c] Percentage of all 192 questions related to this core concept.

iron, nutrition in pregnancy and lactation, and early infant feeding.

No test questions were found on the following subjects recommended as core concepts by the committee: vitamin A metabolism, nutrition in the aged, food intolerances and allergies, nutrition in cancer patients, parenteral and enteral nutrition, the role of nutrition in the immune response, osteoporosis, and food fads and popular diets.

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