**Integrating Employee Health:  A Model Program for NASA**

Committee to Assess Worksite Preventive Health Program Needs for NASA Employees

ISBN: 0-309-54955-8, 200 pages, 6 x 9,  (2005)

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# INTEGRATING EMPLOYEE HEALTH

## A MODEL PROGRAM FOR NASA

Committee to Assess Worksite Preventive Health
Program Needs for NASA Employees

Food and Nutrition Board

INSTITUTE OF MEDICINE
*OF THE NATIONAL ACADEMIES*

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
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Willing is not enough; we must do."*
—Goethe

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by **LESTER WRIGHT,** New York Department of Correctional Services. Appointed by the National Research Council and Institute of Medicine, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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# Preface

The American workforce is changing, creating new challenges for employers to provide occupational health services to meet the needs of employees. First, a shift from manufacturing to services, knowledge-centered, and mobile work has changed the focus of occupational health from physical injury and exposure-related illness prevention and management to enhancing performance, productivity, and resilience of workers. Second, the impact of non-occupational illness on performance, productivity and health care costs now outweighs that of occupational illnesses and injuries for many employers. There is, however, an opportunity to lessen the impact of these illnesses through an integrated, total health approach.

The National Aeronautics and Space Administration (NASA) is an organization that includes 14 independent geographically diverse centers. NASA employs more than 72,000 people in its workforce; approximately 75 percent are non-federal contract employees and 25 percent are civil servants. The NASA workforce is highly skilled and competitive, and employees frequently work under intense pressure to ensure mission success. NASA also has an aging workforce that, like their colleagues in other agencies and in the private sector, is at risk for chronic diseases associated with an older population. These include heart disease, hypertension, overweight and obesity, and diabetes, which are frequently associated with sedentary lifestyle and poor eating habits such as high fat, high sodium, calorie-dense food choices.

A healthy, productive workforce is integral to the success of NASA's

technically challenging high-risk missions. Responsibility for the health and wellness of NASA employees falls under the Office of the Chief Health and Medical Officer (OCHMO). The office is responsible for policy and oversight for occupational health, aerospace medicine, medicine in extreme environments, protection of research subjects and patients, quality assurance, public health issues, and professional health education and development. The OCHMO administers a broad range of health, wellness, and environmental programs and guides occupational health program planning at the various centers. The goal of the OCHMO is to ensure that every agency employee, upon separation from NASA, is healthier than the average American worker as a result of their experience with NASA occupational and preventive health programs.

In 2003, the OCHMO requested that the Institute of Medicine at the National Academies review NASA's occupational health programs, employees' awareness of and attitudes toward those programs, and recommend specific options for future worksite preventive health programs focusing on, but not limited to nutrition, fitness, and psychological well-being, incentives or methods to encourage employees to voluntarily enlist and sustain participation in worksite preventive health programs, ways to create healthier workplace environments that are conducive to more active lifestyles, supportive nutrition options to reduce risk factors for chronic disease, and ways to evaluate the effectiveness of such programs. In response to this charge, the Committee to Assess Worksite Preventive Health Program Needs for NASA Employees reviewed current literature, held an information-gathering workshop, and made site visits to occupational health facilities and programs at six NASA centers.

The Committee's findings showed that NASA has a history of being forward-looking in designing programs aimed at improving the health and wellness of its employees. The agency was a pioneer among federal agencies in its efforts to incorporate wellness into occupational health programs. In the early 1990s the agency developed and implemented a 10-year agency-wide competitive plan to meet the Healthy People goals. Currently, occupational health programs are developed by a health and wellness committee with representation from each of the NASA centers. All occupational health programs, including health and wellness programs that are offered agency-wide are posted on the NASA occupational health website.

The Committee also found that, although NASA has a variety of health care, preventive health, and health promotion programs for its employees, the current approach to implementing occupational health follows a more traditional rather than an integrated model. Further, data-gathering at NASA does not provide for NASA-wide or center-specific health care cost, health care utilization, or health outcome data. The ab-

sence of critical, standardized health metric and program utilization data impedes efforts to provide employee-centered programs designed to improve health status and health care consumption behavior of NASA employees.

A critical requirement for integrating traditional health and safety with occupational and non-occupational disability and health benefits is integration of occupational health programs, a shift of program focus from center-specific to employee-specific, and centralized collection of uniform health metrics and program utilization data. The Committee believes that NASA's efforts could serve as a national model for both public and private employers to emulate and improve the health and performance of their workforces.

## ACKNOWLEDGMENTS

James A. Merchant, *Chair*
Committee to Assess Worksite Preventive Health
Program Needs for NASA Employees

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# INTEGRATING
# EMPLOYEE HEALTH

# Executive Summary

The National Aeronautics and Space Administration (NASA) employs a highly skilled workforce accustomed to working under high pressure, short deadlines, and limited budgets. Despite these challenges, it has turned the vision of space exploration into a reality in fewer than 50 years. This legacy of exploration and discovery is a hallmark of national pride. NASA's achievements in air and space exploration, research, and development are integrally woven into the American experience. The high profile of the agency's activities has led to public celebration of its mission successes as well as intense public scrutiny during times of tragedy.

NASA's cultural tradition of believing that its workers can overcome complex technical challenges is reflected in its stated core values: safety, people, excellence, and integrity. As a result, NASA's manned space flight and the unmanned space probe missions alike have produced many successful, leading-edge programs. In large part, the success of these programs is the result of a highly motivated and resourceful workforce that embraces highly visible challenges during intense periods of exceptionally high demand. However, the very same cultural traits and organizational practices that have fostered mission success can also affect employee well-being.

The success of NASA's missions has always relied heavily on both the health and productivity of its workforce. Today, NASA has an aging workforce that may be at risk for the same chronic diseases facing America's aging population as a whole. These chronic diseases, including heart disease, hypertension, obesity, diabetes, and cancer are frequently associated with negative lifestyle behaviors such as physical inactivity,

*1*

poor eating habits, and tobacco use. In addition, the NASA work environment is highly variable, and some workers are subjected to unusually hazardous and stressful conditions.

NASA was one of the first federal agencies to recognize the importance of occupational health and wellness programs for the well-being of its employees. NASA has invested in health promotion research and established preventive employee health programs such as nutrition education and one-on-one counseling for employees with cardiac and other chronic diseases.

Today, NASA offers a broad scope of employee health and wellness options, including programs in areas such as employee assistance, environmental health, health promotion, and occupational medicine. Individual centers within NASA incorporate these agency-wide programs into their own occupational health activities. These programs, managed by NASA's Division of Occupational Health, are described further on the agency's occupational health information web site, http://www.ohp.nasa.gov, and in Chapter 2 of this report.

NASA's Office of the Chief Health and Medical Officer (OCHMO), which administers the Division of Occupational Health, works to ensure that every NASA employee will, on leaving or retiring from the agency, be healthier than the average American worker as a result of his or her experience with NASA's occupational and preventive health program system. In support of this goal, the Institute of Medicine's Committee to Assess Worksite Preventive Health Program Needs for NASA Employees was charged to review existing preventive health programs, assess employee awareness of and attitudes toward occupational health programs, and determine whether there are any special risks unique to NASA work environments.

The committee further was asked to prepare a report that evaluates and recommends specific options for future worksite preventive health programs, focusing on, but not limited to, nutrition, fitness, chronic disease prevention, and psychological well-being; incentives or methods to encourage employees to voluntarily enlist and sustain participation in worksite preventive health programs; ways to create healthier workplace environments that are conducive to more active lifestyles; intervention options to reduce risk factors for chronic disease; and ways to evaluate the effectiveness of such programs.

## PRIMARY FINDINGS

The committee derived four primary findings from information obtained from observations made by committee members at site visits to six

NASA centers,[1] published reports about NASA, and reviews of literature. Specific recommendations for addressing these findings appear in the following sections of this summary.

*FINDING 1:* The occupational health mission statement at NASA is designed and directed to meet the health needs of NASA employees; however, there is a need to bring this mission statement into alignment with a mission-driven vision for the NASA organization.

*FINDING 2:* Most organizations, public and private, follow a traditional model for providing health care to employees in which the focus is on disease status rather than health status, treatment rather than preventive care, an individual medical model rather than population-based health model, and single- rather than multiple-risk interventions, with segregated rather than integrated management systems. NASA is similar in its current approach to occupational and preventive health care. Although there is collection of information on employee health and program use, the data collected lack uniformity and consistency within and between NASA centers. In addition, there is a need to strengthen communication lines between NASA's Headquarters and centers.

*FINDING 3:* The traditional approach to occupational health care leads to segregated rather than integrated health programs (Table ES-1). The needs of the modern knowledge-based workforce in a high-performance organization require an approach beyond those traditionally used in occupational health. As currently implemented at NASA, such an approach is not conducive to meeting the health care needs of employees in a large, decentralized organization.

*FINDING 4:* There is a need for more effective, coordinated, and data-driven health program policy development to support the agency's mission and goals.

## THE CASE FOR CHANGE

NASA serves as an excellent prototype for the twenty-first-century organization, challenged with increasing demands and a changing American workforce. Just as the agency's scientific and engineering breakthroughs have improved everyday life, so too can NASA's strategy for analyzing and improving the health and productivity of its workforce serve as a model for other U.S. employers.

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[1]Ames Research Center, Glenn Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center, and Kennedy Space Center.

**TABLE ES-1**  Current Trends in America for a Healthy and Productive Workforce

| Perspective | Current State | Desired State |
| --- | --- | --- |
| Function | Absenteeism | Performance |
| Cost Metrics | Medical Costs | Economic Outcomes |
| Care Model | Treatment Focused | Prevention and Behavior Change Focused |
| Medical Model | Individual | Population |
| Health Metrics | Disease Status | Health Status |
| Interventions | Single-Risk Focused | Multiple-Risk Focused |
| Health Framework | Employer-, Condition-, and Program-Centric | Employee-Centric |
| Management Systems | Segregated Programs | Integrated Systems |

A "healthy workforce" is characterized by four key attributes, consistent with the World Health Organization (WHO) definition of health, which can be analyzed and improved to promote personal and organizational "well-being." Specifically, for both individuals and organizations to achieve optimal performance, they must be

- **healthy**—demonstrating optimal health status as defined by positive health behaviors; minimal modifiable risk factors; and minimal illnesses, diseases, and injuries;
- **productive**—functioning to produce the maximum contribution to achievement of personal goals and the organizational mission;
- **ready**—possessing an ability to respond to changing demands given the increasing pace and unpredictable nature of work; and
- **resilient**—adjusting to setbacks, increased demands, or unusual challenges by bouncing back to optimal "well-being" and performance without incurring severe functional decrement.

The twenty-first-century American workforce is characterized by increasing demographic diversity, as workers perform a greater number of multidisciplinary jobs with higher degrees of collaborative work and reliance on technology, around-the-clock operations, an accelerated work

pace, and more flexible work patterns. In addition, workplaces in America now rely more heavily on information technology and use highly variable work arrangements, employing teams composed of members from different employers, or from the same employer but with different terms of employment; creating and dissolving work groups and employment around specific projects; and employing global work teams using technology to perform work in "virtual" environments of electronic team rooms and Web-hosted meetings. Within the workforce itself, there is greater uncertainty about employment, with people having many more employers during their working careers, being required to become continuous learners to enhance or expand skills, and experiencing the movement of work and jobs to other countries.

Previous reports addressing relevant health, health care, occupational health, and American workforce issues provide important information that can inform and guide NASA's efforts to achieve its broad goal of creating a comparatively healthier NASA workforce. Interest in worksite initiatives integrating occupational health and safety with health promotion and disease prevention efforts is on the rise among the research and business communities as well as labor groups, as evidenced by the recent National Institute for Occupational Safety and Health (NIOSH) Steps to a Healthier United States Workforce Symposium (Goetzel, 2005; Seabury et al., 2004; Sorensen and Barbeau, 2004).

Additional evidence supporting the potential impact of an integrated approach is emerging in a growing literature reporting results of studies that have systematically assessed the efficacy and effectiveness of integrated interventions (Sorensen and Barbeau, 2004). For example, Hunt et al. (2005) reported greater participation in preventive health programs by both employees and managers when an integrated approach was used.

The Steps to a Healthier U.S. Workforce Initiative (STEPS) was developed by NIOSH from an initiative in the U.S. Department of Health and Human Services (USDHHS), called Steps to a Healthier U.S. (NIOSH, 2004). Concordant with this committee's study charge to evaluate options for preventive health programs, incentives to encourage employee participation, and methodologies to longitudinally track employee health at NASA, the STEPS initiative seeks to improve the dissemination, acceptance, and effectiveness of activities directed at improving worker health through integrated approaches to health protection and health promotion.

The vision of the STEPS initiative is to integrate occupational safety and health protection with health promotion activities into a coordinated system that addresses both workplace and worker health. STEPS strongly supports the view that all illness and injury should be prevented when possible, controlled when necessary, and treated where appropriate, and

an integrated approach serves to enhance the effectiveness of programs designed to promote and protect worker health.

The STEPS initiative has created an opportunity for the occupational safety, occupational health, and health promotion communities to develop and implement a comprehensive set of programs aimed at improving integrated health and productivity in the workplace. Further, the STEPS project is pertinent to meeting the needs of public-private partnerships such as NASA, which include a mixed workforce of civil servant and private-sector employees, technically-focused products designed for specific outcomes, and major research needs.

As discussed above, employers and relevant federal agencies have demonstrated that multifactor determinants of health and productivity must be addressed using new perspectives, metrics, and models. Table ES-1 outlines current trends toward achieving a healthy and productive workforce on the basis of determinants of health and productivity.

The traditional "occupational" and "nonoccupational" dichotomy stemming from regular shifts and the 40-hour workweek is being increasingly blurred by the changing demands of the contemporary American workplace. Employers who have traditionally been responsible for safety, environmental, and occupational health concerns will, by necessity, become more involved with worklife issues, health behaviors, and social factors affecting their employees. NASA and other employers, who must support a mission-directed, healthy, and optimally productive workforce, will have to articulate a new vision, develop new strategies, and employ new tactics to meet this challenge.

**Recommendation 1:** *A New Vision*
**The committee recommends that the administrator of NASA adopt a new vision for worker health, readiness, and resilience that directly links to NASA's mission and includes health as a core NASA value that is implemented through an integrated health and systems approach.** This vision should extend and apply to the entire NASA workforce and should

•   clearly articulate a broader perspective of health and how it advances NASA's core mission;

•   be adopted and adapted by each center director to maximize the alignment with each center's mission and workforce composition;

•   be promoted and implemented vertically and horizontally within NASA, using participatory strategies to ensure sustained senior management and organizational commitment and total workforce engagement.

## ACHIEVING A NEW VISION FOR NASA WORKER HEALTH

The success and sustainability of an integrated health process must first and foremost begin with a clear understanding of the organization's mission. The organization's senior leadership must directly communicate the critical importance of policies, programs, and practices designed to optimize the health and productivity of the workforce, promoting an organizational culture that values worker well-being.

Senior leadership also must ensure that human resource activities, personnel benefit designs, occupational health and safety policies, environmental health, wellness programs and practices, and disability management are integrated and coordinated. Senior leadership must further ensure that all relevant stakeholders participate in and provide input to the planning process. Roles and responsibilities of key functional area leaders can be defined in the context of their contribution to the broader organizational mission. All individual and organizational factors contributing to the health and productivity of the workforce must be addressed, monitored, and improved over time.

The current health vision for NASA employees (i.e., achieving an improved level of health status as a consequence of employment at NASA) does not establish a clear link to the larger organizational mission. As a consequence, it does not provide NASA leadership with a compelling reason to commit resources and management attention to employee health needs beyond hygiene components such as injury prevention, exposure and occupational hazard control, regulatory compliance, and emergency response. A mission-driven vision for health should articulate why investment in health and employee-integrated health helps NASA achieve its core mission on time, under budget, and better than expected.

A management systems approach for NASA would serve as a means to establish and achieve specific integrated health priorities for its knowledge workforce. Benchmark management systems, available both in the private and public sector, could serve as useful models for design and implementation insights. Such a quality systems-based approach can be an effective mechanism for targeting increasingly scarce resources on higher-value initiatives related to the physical and psychological fitness and resilience of a high-performance workforce; fostering engagement and accountability; focusing on specific outcomes, and discipline to measure and improve employee health by integrating people, processes, and resources toward specific common goals and objectives.

Figure ES-1 shows the components of a Health and Productivity Management System (HPMS) that can be adapted by NASA. The integrated HPMS works by first ensuring that the program is tied, if possible, to the design of the federal health benefits provided to NASA employees. Not
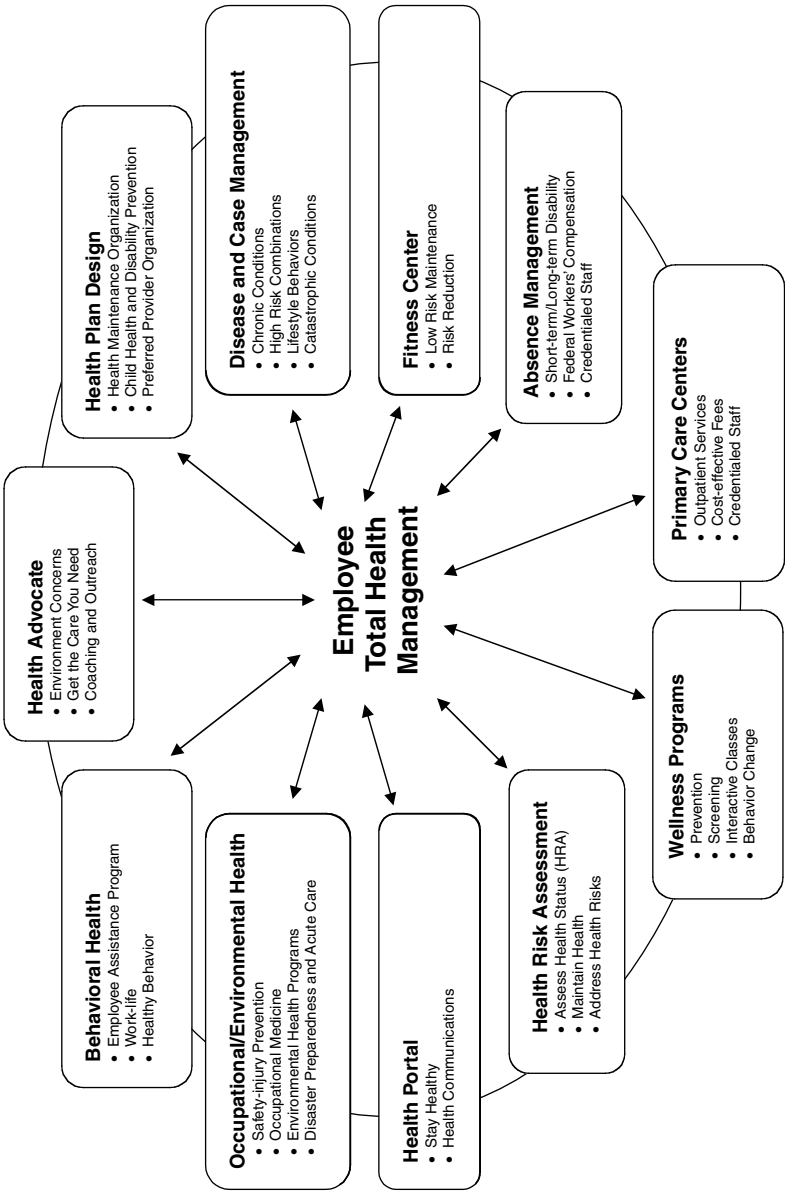
**FIGURE ES-1** An integrated and sustainable approach for Total Health Management.
SOURCE: Personal communication, D.W. Edington [Modified from Florida Power & Light], February 2005.

only must the programs be integrated and sustainable, but data must be integrated into the measurement and evaluation systems as described below, under "Data Integration and Management For Better Health."

**Recommendation 2:** *NASA's Health Vision*
**To achieve an integrated health program, grounded in a management systems approach to health and safety, NASA should (1) recast its employee health vision to improve linkage and support for NASA's core mission and goals; (2) integrate workplace safety with the occupational health function; (3) establish specific interfaces or linkages between health benefits design and administration in Human Resources and Occupational Health for analytic, intervention, and outcome assessment purposes; and (4) adopt a management systems approach to actualize, sustain, and improve NASA's commitment and performance in employee health, safety, and well-being.**

**Recommendation 3:** *Consolidation and Consistency*
**To the extent possible, NASA Headquarters should encourage consistency between core occupational health programs, health data collection, impact assessment, and program evaluation.** A management systems approach that consolidates local with NASA-wide health priorities can ensure harmonization. In addition, consistency in programs and data collection, assessment, and evaluation should be endorsed by the center directors and become a component of full-cost accounting.

**Recommendation 4:** *Program Integration*
**To achieve the integration required, NASA should incorporate those components of an integrated system most appropriate to its organizational needs, including:**

• **Develop a data-based approach to policy, planning, programming, budgeting, implementation, operations, evaluation, and management.** Such an approach will serve to ensure agency-wide deployment of an integrated health program;

• **Create a standardized "health and performance" full-cost accounting framework to define, standardize, prioritize, fund, and evaluate resource allocation for human-related mission performance and workplace safety, health, and productivity.**

• **Incorporate mission-essential elements of integrated health programs in contracting requirements.** In addition to ensuring basic health insurance coverage to all employees and access to preventive services and core fitness and health promotion programs, such ele-

ments should include management of short-term disability, Federal Workers' Compensation, family medical leave, and other applicable leave policies. Resourcing and cost sharing should be considered within the legal and regulatory practices of NASA and the federal procurement rules.

**Recommendation 5:** *Manager Education*
**NASA should provide education and training to first-line managers and supervisors that focus on the relationship between health and productivity and the linkage to NASA- and center-specific missions.** This should include evaluation of common core program elements across sites; reevaluation of current training programs for the prevention, detection, amelioration of risk factors; and integration of content related to risk reduction across program components.

### UNDERSTANDING INTEGRATED HEALTH PROGRAMS

An integrated approach to improving the health of employees involves going beyond traditional medical or occupational health to include a variety of fitness and wellness programs as integral components to a comprehensive well-being approach. Such a strategy can be targeted on multiple levels, according to a social ecological approach that provides guidelines for thinking about health decisions as being determined by multiple, including environmental and behavioral, systems. These systems are organized and combined in a variety of ways, depending on the research objectives, and have been successful in explaining and changing behavior.

The committee found variability, from center to center, in support for health programs at the level of individual work units in some settings or for some job classifications. The committee also found significant variability between civil servant and contractor access to some health programs.

A common finding among large, decentralized organizations that also appears to be true at NASA is communication gaps between the centers and Headquarters, as well as between managers and employees, resulting in a lack of integration among programs designed to optimize health, safety, and productivity. This, coupled with a segregated approach to program administration without integration across functions at large organizations such as NASA, results in a less effective health care system.

The committee also found that methods for collecting health metrics varied among NASA centers. Without uniform metrics to inform program planners of the needs of participants, it is difficult to design and implement preventive health care programs that optimize health outcomes for participants.

To establish a system in which health data are collected in a consistent and useful way that will contribute to the design and implementation of health and safety programs that meet the NASA vision for a healthy workforce, the committee makes the following recommendations.

**Recommendation 6:** *Health Care Cost and Utilization Data*
**NASA should obtain health care cost and utilization data for its civil service employees enrolled in the Federal Employee Health Benefit Program (FEHBP) to inform, target, and optimize agency benefits, policies, and workplace interventions as private-sector employers do.** Ideally, these data could be analyzed and reviewed at the directorate level to further inform and optimize local programmatic efforts.

**Recommendation 7:** *Health Risk Appraisal*
**A basic health assessment tool such as a health risk appraisal (HRA) should be selected from those available in the marketplace and offered to all NASA workers.** For contract employees, NASA occupational health leaders should identify ways to channel HRA information back to the contracting companies for their use in designing and implementing uniform health care programs, and prioritizing and monitoring longitudinal health and performance status that is consistent with the NASA vision.

The HRA can be used as a basic component to build an agency-wide database of aggregate health data that will inform the design, development, implementation, and evaluation of health programs to meet the needs of NASA employees. The subsequent recommendations flow from this vision for a uniform database.

**Recommendation 8:** *Integrated Health Policies and Programs*
**NASA should offer coordinated and integrated individual- and environmental-level health promotion policies and programs that promote worker health across content areas including diet, exercise, job stress, tobacco use, alcohol and substance abuse, and control of worksite hazardous exposures to meet the health needs of a diverse workforce.** All programs should include program promotion strategies and financial and benefit-designed incentives to foster program participation across the diverse NASA workforce.
Examples of policies and programs include:

• Developing policies for making healthy food options available throughout the workplace for all shifts through a combination

of cafeteria and vending options, and offering a variety of nutrition education programs targeting both healthy workers and those with nutrition-related diseases;

• Ensuring a physical activity–friendly atmosphere and environment that is supportive of employees' efforts to achieve physical activity guidelines for health benefits as outlined by national policy, including Healthy People 2010 and the Dietary Guidelines for Americans;

• Providing support for nonsmoking employees by uniform adoption and enforcement of tobacco control policies and through a broad spectrum of tobacco use cessation programs for tobacco users at varying stages of readiness for change; further, review the medical benefit screen for tobacco cessation counseling and pharmacological support;

• Implementing an approach to reducing stress and building resilience that focuses on increasing output through enhancing organizational health-focused productivity. Perceived stress and job control and strain should be screened as part of the Health Risk Appraisal and further assessed, if needed, through referral to appropriate follow-up programs. Individual programs should be made available to employees with stress concerns that address both resilience through integrated health promotion and reduction of individual stress reactions. At the organizational level, managerial training should be organized within NASA and for contractors and civil servants. This training should address communication and job control issues that affect both stress and productivity. Training should also include how to recognize and handle the stressed or mentally ill individual in conjunction with EAP personnel;

• Developing financial- and benefit-designed incentives to encourage employee participation in health promotion and disease management programs.

**Recommendation 9:** *Periodic Health Examinations*
**NASA should reexamine the allocation of resources at the center level for periodic health examinations, in consideration of an integrated risk factor reduction program, and evaluate the data requirements, periodicity, and effectiveness of existing occupationally related medical screening examinations.** To achieve this goal requires a clear rationale, policy, and practice that drive accomplishment and resource allocation at the center level. The committee recommends the following strategy:

- Establish appropriate databases to provide health metrics to inform the evaluation process;
- Define desired goals for periodic health examination programs and medical surveillance data requirements;
- Stratify health and safety requirements into occupationally mandated standards rather than general risk factor identification;
- Link health promotion and disease prevention examinations, if and when uniformly performed, through a standardized process, to the employee's primary health provider and the HRA.

**Recommendation 10:** *Program-Specific Evaluations*
**NASA should conduct program-specific evaluations to ensure the effectiveness and appropriate use of available resources.** Ideally, each program should include some level of evaluation integrated into the program implementation process that will inform program staff about reach, participation, acceptability, and effectiveness.

## DATA INTEGRATION AND MANAGEMENT FOR BETTER HEALTH

In an organization such as NASA, where measurement and evaluation is a cultural norm, a data-driven decision-making system is a prerequisite for success. However, observations made by the committee at site visits to selected NASA centers indicate that this type of system is not uniformly in place across the agency or in complete form at the observed centers.

Data management is a key concept in the successful implementation, conduct, and measurement of any occupational health program. Programs that experience long-term success and are consistently recognized as "best practice" are those that incorporate integrated management and evaluation efforts where program information is collected in a systematic manner that allows for data integrity and consistency.

An effective data management and measurement system can support organizational objectives such as

- decision making;
- accountability;
- improvement; and
- surveillance and longitudinal analyses and knowledge discovery.

A systematic approach, incorporating these "four faces of measurement," described in the quality improvement literature, can serve as an organizing framework for data management- and measurement-related

objectives. Such a framework adds to the realities of the business setting that demands an approach to data-driven decision-making processes. This framework also serves as a paradigm that encourages managers to explicitly recognize various approaches to data collection and use, measurement, and reporting, and subsequently provides support for the reporting needs at the various levels within the NASA organization (i.e., intracenter-, intercenter-, and headquarter-specific needs).

The data collected are used for a variety of purposes—to create reports that are presented to top management as well as to employees, ensuring that the program staff is accountable for the program's performance, and to support ongoing improvement of the program, allowing for an assessment of need at baseline that may inform program staff on necessary actions to take, identify barriers to opportunities, and quantify results following the implementation of change in programming. Finally, the program design is based on scientific theory. The reporting of the program's performance may, in fact, aid in the generation of new hypotheses that could be tested in a research setting or context and, in return, may benefit the field of worksite health promotion.

To determine the success of each health programmatic component, data systems must be able to reflect an "employee-centric" perspective rather than a program-centric focus (see Chapter 6). A comprehensive data management system vision should not deter facility-specific linkages of databases or incremental improvements in capability. The infrastructure, broadly defined as the personnel, technology, and information needed to support the integrated health programs, should be defined and appropriately supported as a critical requirement for maintaining the value of an optimally functioning workforce.

Observations of occupational health programs at NASA, findings from the literature, and comparisons with "best practice" models in the private sector indicate a need for data-driven integration and health management capabilities across NASA and within its centers, so that a truly integrated health management program can be implemented. Consistent with many organizations that follow a traditional approach, occupational health programs and initiatives at NASA tend to be program specific, and although readily available to the centers, the selection of such programs and initiatives does not appear to be based on health-related, employee-based, NASA-wide data or center-specific analyses. The health improvement data at NASA that are available for program planning, prioritization, and resource allocation tend to be fragmented and sparse. Because NASA is interested in moving forward with a world-class integrated health program, it is imperative that a robust, agency-wide, center-specific, and employee-centered data management system be implemented. With this aim in mind, the committee recommends the following.

**Recommendation 11:** *Data Management*
**NASA should implement a systems-based approach to data management that includes the following components:**
   • **data collection, management, and reporting according to agreed-on protocols and standards;**
   • **consistent data practices across all NASA centers; and**
   • **longitudinal tracking of data across all centers and the agency as a whole**.

**Recommendation 12:** *Data Access*
**NASA should adopt a framework for measurement that will allow the agency direct access to data collected for the purposes of decision making, accountability, improvement, surveillance, longitudinal analyses, and knowledge discovery.**

**Recommendation 13:** *Intra-agency Collaboration*
   • **NASA should create and initiate a data-management collaborative that includes representatives from all centers as well as Headquarters who are trained and well informed about measurement and evaluation.** At a minimum, the objectives of the collaborative would include generation and ongoing monitoring of performance data measures;
   • **Initiation of a data-driven exchange of improvement strategies and tactics for practitioners at the centers;**
   • **Provision of input and feedback to center- and agency-specific health initiatives; and**
   • **Provision of specific recommendations for data management-related resource needs, training, and integration.**

**Recommendation 14:** *Data Architecture and Technology*
**NASA should establish agency-wide data architecture and technology, that may or may not include a comprehensive electronic medical record, to support its operational goals.** Clarification of occupationally related, compared to general health, promotion and disease prevention and management data requirements is an essential first step in defining agency-wide technology solutions.

**Recommendation 15:** *Research Opportunities*
**NASA should use the opportunity of building such new programmatic endeavors to contribute to knowledge about program effectiveness, cost benefits arising from these programs, and factors that can contribute to the success of these programs.** Implementation of a standardized methodology using NASA's full cost accounting ap-

proach for a health and productivity element (see Recommendation 4 above) would greatly assist in this regard. In this way, NASA's experiences can help to inform the directions taken by other worksites.

Specifically, the Committee recommends that NASA consider research in program outcomes (including improved health outcomes for workers and overall cost savings), factors that contribute to program success (e.g., as measured by employee participation rates, or behavior change), barriers and facilitators that contribute to worker participation in programs—and how these barriers and facilitators differ by type of worker, center, and other factors—and factors that contribute to each center's ability to initiate, implement, and sustain integrated health programs.

## CONCLUSION

Well-being programs can reach large numbers of employees with information, activities, and services that enhance occupational health and encourage the adoption of healthy dietary and physical activity behaviors. Moreover, these programs may reduce health care costs, including employer costs for insurance programs, disability benefits, medical expenses, and employee sick leave. Implementation and ongoing evaluation of effective programs at all NASA worksites may provide significant improvements in the employees' physical and psychological well-being, benefiting the agency with a more productive workforce, and be more cost effective than the current, traditional program. Such measures, supported by the committee's examination of "best practice" programs and relevant published research, stand to confer similar benefits if adopted by other public- and private-sector organizations. In addition, opportunities exist for further research that will help inform future program and policy development.

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**Websites:**
www.cdc.gov/niosh/steps/
www.cdc.gov/niosh/steps/2004/whitepapers.html
www.ohp.nasa.gov

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# The NASA Worksite

The National Aeronautics and Space Administration (NASA) is the global leader in air and space exploration, research, and development. Throughout its history, NASA has demonstrated ingenuity, focus, and resilience in meeting the requirements of exacting, time-sensitive projects. NASA's cultural legacy of believing that its workers can overcome complex technical challenges is reflected in the agency's stated core values: safety, people, excellence, and integrity. As a result, both the manned space flight and the unmanned space probe missions have produced leading-edge programs. However, cultural traits and organizational practices that have fostered exceptional achievement may also affect employee health, well-being and productiveness and thus impact on mission success.

## HOW AND WHY THE COMMITTEE WAS FORMED

NASA's Director of Occupational Health requested that the Institute of Medicine's Food and Nutrition Board, in consultation with the Board on Population Health and Public Health Practice, convene an ad hoc committee to prepare a report that would make recommendations to NASA's Office of the Chief Health and Medical Officer (OCHMO) for (a) specific options for future worksite preventive health programs focusing on, but not limited to, nutrition, fitness, and psychological well-being; (b) incentives or methods to encourage employees to voluntarily enlist and sustain participation in worksite preventive health programs; (c) ways to create healthier workplace environments that are conducive to more active

*19*

lifestyles; (d) supportive nutrition options to reduce risk factors for chronic disease; and (e) ways to evaluate the effectiveness of such programs.

Worksite programs can reach large numbers of employees with information, activities, and services that encourage the adoption of healthy dietary and physical activity behaviors. For example, Irvine et al. (2004) evaluated an interactive multimedia program designed to encourage reduced consumption of dietary fat and increased consumption of fruits and vegetables at worksites. This study showed that the program had a positive impact on employee eating habits that was sustained at least 60 days following implementation. Other recent studies of worksite health promotion programs have found that both worksite and family-based interventions to increase fruit and vegetable consumption were similarly effective (Sorensen et al., 1999, 2004a). Worksite health promotion programs may reduce health care costs, including employer costs, for insurance programs, disability benefits, medical expenses, and employee sick leave (Aldana et al., 2005; Wright et al., 2004; Serxner et al., 2003).

A number of worksite health promotion activities have been instituted at NASA and are described on the NASA website (http://www. ohp.nasa.gov/). For example, at NASA Headquarters, nutrition counseling and physical activity interventions for employees with elevated serum cholesterol showed a trend of lowering serum low-density lipoproteins, a suggestive increase in high-density lipoproteins, and mild to moderate weight loss for the intervention group of employees (Angotti et al., 2000; Angotti and Levine, 1994). Uniform implementation of effective programs throughout the NASA system may provide significant improvements in employees' physical and psychological well-being, and in turn benefit the agency.

## HISTORY OF NASA AND DEVELOPMENT OF NASA CULTURE

### Historical Development of NASA

*Historical Timeline*

Before the formation of NASA, research aimed at putting a U.S. astronaut in space was conducted primarily by the National Advisory Committee for Aeronautics in cooperation with other federal organizations. NASA was formed in 1958 in response to the first successful launch and flight of *Sputnik* by the Soviet Union (http://www.history.nasa.gov/). At a time when the United States was engaged in a Cold War with the Soviet Union and was concerned about national defense, the successful launch of *Sputnik* indicated that the United States lagged behind in technological development.

The mission of the first NASA project, Mercury, was to learn whether humans could survive in space. Subsequent mission projects included Gemini during the 1960s, then Apollo, which ultimately landed the first astronauts on the moon in 1969. The Skylab and Apollo-Soyuz Test Projects were initiated in the 1970s. The Space Shuttle Program and the *International Space Station* developed from these initiatives during the 1980s and 1990s. NASA has launched several unmanned probes, such as *Pioneer*, *Voyager*, and the *Hubble Space Telescope*, in addition to its manned missions, and space science programs have been carried out to Earth's moon and all planets in our solar system except Pluto. Together, these projects have yielded NASA many successes with few tragic failures (Table 1-1) (http://www.history.nasa.gov/).

**TABLE 1-1** Draft Timeline of NASA History

| Chronology | Policy Events | Mission Events |
|---|---|---|
| 1958 | NASA began operation | *Pioneer 1*: NASA's first launch |
| 1960 | | *Mercury 1*: Mercury-Redstone Capsule-launch vehicle combination.  Unoccupied test flight |
| 1961 | President Kennedy announced that he was committed to landing a man on the moon | Mercury Astronaut program: human space flight initiatives to see if humans could survive in space, 1961-1963 *Mercury 2*: Chimpanzee Ham was sent into suborbital space for 16.5 minutes Alan Shepard became the first American to fly in space: Mercury spacecraft *Freedom 7* |
| 1962 | | John Glenn becomes first American to orbit the Earth: Mercury spacecraft *Friendship 7* |
| 1965 | Project Gemini is implemented: Flights, 1965-1966 | Gus Grissom and John Young: first operational mission of Project Gemini with *Gemini 3* Ed White became the first American to complete a spacewalk: *Gemini 4* |
| 1967 | Project Apollo is implemented: Flights, 1967-1972 | Apollo-Saturn (AS) 204 (*Apollo 1*): First death directly attributable to U.S. Space program. Gus Grissom, Ed White, and Roger Chaffee died as a result of a fire on the launch pad |

*continued*

**TABLE 1-1** Continued

| Chronology | Policy Events | Mission Events |
|---|---|---|
| 1969 | | *Apollo 11*: Neil Armstrong walked on the moon |
| 1970 | | *Apollo 13*: An oxygen tank burst halfway through the journey to the moon. The crew improvised to end the mission safely |
| 1975 | | Apollo-Soyuz Test Project: first international human space flight |
| 1981 | Space Shuttle Program is implemented | *Columbia* 1st launch |
| 1983 | | *Challenger* 1st launch |
| 1984 | | *Discovery* 1st launch |
| 1986 | Office of Safety, Reliability, Maintainability and Quality Assurance was created in response to the *Challenger* investigation<br>Report of the Presidential Commission on the Space Shuttle *Challenger* Accident and Implementation of the Recommendations | Space Shuttle *Challenger* was lost during launch killing all 7 astronauts on board |
| 1988 | | *Discovery* launch, first flight after *Challenger* disaster |
| 1990 | Future of U.S. Space Program Advisory Committee issued a report outlining chief objectives of the agency and recommendations of key actions relating to a need to create a balanced program of human space flight, robotics probes and space science within a tightly constrained budget | Launch of the *Hubble Space Telescope* |
| 1992 | | First flight of Space Shuttle *Endeavor* |
| 1995 | | *Atlantis* docked with *Mir Space Station* (Russian space lab) |
| 1996 | "NASA announced that scientists had uncovered evidence, however not conclusive proof, that microscopic life may have existed on Mars" | *Atlantis* docked with *Mir*, Shannon Lucid was left aboard for 5 months |
| 1997 | | *Mars Pathfinder* landed on Mars *Cassini* Space Probe was launched to Saturn |

**TABLE 1-1** Continued

| Chronology | Policy Events | Mission Events |
|---|---|---|
| 1998 | International Space Station agreement signed by 15 countries | |
| 1999 | | *Mars Polar Lander* reached Mars but was lost during the landing sequence; "not known whether the probe followed the descent path or was lost in some other manner" *Mars Climate Orbiter*: Contact with spacecraft was lost after it passed behind Mars due to some commands being sent in English units instead of being converted to metric. The spacecraft missed its intended altitude above Mars. Atmospheric stresses and friction at a lower altitude would have destroyed the spacecraft |
| 2000 | | *Expedition One* International Space Station: First permanent crew was sent to the ISS |
| 2003 | The Columbia Accident Investigation Board released its final report | The Space Shuttle *Columbia* was lost just before landing killing all seven astronauts on board |
| 2004 | The President's Commission on | *Cassini* Space Probe arrived at Saturn |
| | Moon, Mars and Beyond delivered its report entitled "A Journey to Inspire, Innovate and Discover" to the White House. | *Genesis Capsule* returns to earth with particles of the Sun |

SOURCE: http://www.hq.nasa.gov/office/pao/History/40thann/define.htm.

## Historical Development of the NASA Culture

The challenge posed by President John F. Kennedy in 1961 to put a man on the moon before the end of the decade, and the subsequent "space race" with the Soviet Union fostered a "can-do" and insular culture at NASA, which was further solidified in the era of the Apollo missions. Faced with a series of seemingly impossible tasks, the agency's workforce and leadership were required to achieve high goals and expectations in full view of the American people. Also required was the recognition that there were many risks in the frontier of space and that there would be failure on occasion, as an inevitable consequence of working in the unknown environment of space beyond the Earth's atmosphere (CAIB, 2003).

During the Apollo missions between 1967 and 1975, political and financial support were stronger than has been the case in recent years, which have been characterized by budgetary constraints and downsizing. The Nixon administration directed that the NASA budget be reduced as much as was politically feasible. When the Space Shuttle Program was proposed in 1971 with an estimated cost of $5.15 billion, funding was approved, with a subsequent cost ceiling of $5.5 billion imposed by the President's Office of Management and Budget. Because the original cost estimate was overly optimistic, the cost ceiling placed NASA in the position of making a number of trade-offs to achieve a savings on the project, even though future operational costs would increase.

The engineering expertise, dedication, and "can-do" culture of NASA's engineers, however, overcame these obstacles and successfully produced a reusable shuttlecraft on a constrained budget. Unfortunately, the image of the space shuttle as a safe vehicle that could be operated routinely with little risk was shattered in 1986 when the agency experienced the tragic loss of the space shuttle *Challenger*.

In response to the *Challenger* accident, an independent commission determined that the shuttle program's constrained, decentralized budget resulted in inadequate resources and personnel limited in independence and authority, which contributed to risks in mission safety (NASA, 1986).

The Columbia Accident Investigation Board (CAIB) identified similar issues that led to failures in communication and weakening of the safety system, culminating in the loss of *Columbia* in 2003 (CAIB, 2003).

*Policy Reports to NASA*

The CAIB conducted an independent investigation of the loss of the space shuttle *Columbia* in 2003. The CAIB determined that the accident was not likely an anomalous, random event—rather, it was more likely rooted in the history and culture of NASA (CAIB, 2003). The report clearly identified attributes of NASA that contribute positively to the safety climate, including a robust and independent program technical authority that has control over specifications and requirements, as well as over waivers to them; an independent safety assurance organization with line authority over all levels of safety oversight; and an organizational culture that reflects the best characteristics of a learning organization (CAIB, 2003). It also identified organizational weaknesses that contributed to the accident, including compromises that were required to gain approval for the shuttle, years of resource constraints, fluctuating priorities, schedule pressures, mischaracterization of the shuttle as operational rather than developmental, and lack of an agreed national vision for human space flight (CAIB, 2003).

## Effect of NASA Culture on Organizational Goals

The culture of an institution or organization encompasses its basic values, norms, beliefs, and practices. The culture that characterizes the NASA organization has its origins in the Cold War environment of the late 1950s and early 1960s (CAIB, 2003) and in its military background and engineering focus. This culture emphasizes a top-down approach to organizational management, in which decisions are made by upper-level managers and administrators and carried out by the workforce.

In large part, the success of NASA's programs is the result of clear and forward-thinking goals set by NASA scientists, engineers, and administrators and carried out by a highly motivated and resourceful workforce that embraces challenge and periods of exceptionally high demand. The successes enjoyed by NASA may be attributable to its cultural traits and organizational practices; however, this same culture that contributed to achievement of exceptional mission success may also have affected employee safety, health, and productivity.

## Assessment and Plan for Organizational Culture Change at NASA

Following the loss of the shuttle *Columbia*, NASA asked Behavioral Science Technology, Inc. (BST), to assist in the development and implementation of a plan for changing the safety climate and culture within the agency. An important observation noted in this 2004 study was NASA's approach to defining and executing projects. Although NASA's emphasis on addressing tasks with a discrete beginning and ending point allows the agency to accomplish challenging technical missions, it may also hinder the agency in addressing cultural issues that underlie the need for safety climate change within the organization.

The BST study also surveyed NASA personnel on their perceptions of the safety climate and culture within the agency. The results indicate that, in relation to other organizations, NASA scores well in areas such as approaching others, work-group relations, reporting, social efficacy, teamwork, and leader/member exchange. Two areas in which NASA scored lowest were perceived organizational support and upward communication. The lower scores in these areas indicate the need for focus to effect a successful culture change. Notably, the study points out that perceived organizational support and upward communication are factors that strongly influence the way that culture relates to mission safety.

Overall, the BST study concluded that an organization's strong task orientation at the expense of relationship orientation can lead to inhibition of upward communication and weak perceived organizational support. A successful culture change initiative in NASA should build from its

strengths, but it should also move toward integrating the values of safety and people into the fabric of the organization by helping management to effectively balance task orientation and relationship orientation, thus creating a culture that will more effectively support NASA's mission.

## ORGANIZATION OF NASA

NASA includes 14 worksites in 10 states across the United States plus the District of Columbia (Figure 1-1). Within the NASA organizational structure (Figure 1-2), there are more than 72,000 employees working at these sites. Approximately 25 percent of the total workers are federal employees, and 75 percent are on-site contractors, although the workforce composition varies at each site (Probst, 2004). A breakdown of the NASA workforce by center is shown in Table 1-2.

### The NASA Work Environment

The NASA work environment is highly variable, comprising deep space, near space, land, and sea. For example, NASA aquanauts in the
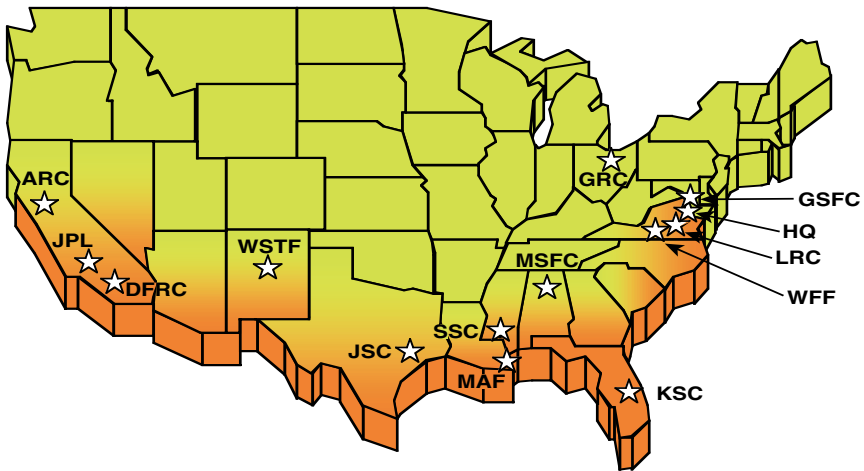


**FIGURE 1-1** NASA centers and facilities.
SOURCE: Probst, 2004.

**FIGURE 1-1** NASA centers and facilities

| Abbreviation | Full Name | Description of Activities |
|---|---|---|
| ARC | Ames Research Center | ARC specializes in research geared toward creating new knowledge and new technologies that span the spectrum of NASA interests. |
| DFRC | Dryden Flight Research Center | DFRC specializes in innovation in aeronautics and space technology. |
| GRC | Glenn Research Center | GRC develops and transfers critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications. |
| GSFC | Goddard Space Flight Center | GSFC focuses efforts on expanding knowledge of the Earth and its environment, the solar system, and the universe through observations in space. |
| JPL | Jet Propulsion Laboratory | JPL, managed by the California Institute of Technology, is NASA's lead center for robotic exploration of the solar system. |
| JSC | Johnson Space Center | JSC developed the Gemini, Apollo, and Skylab projects as well as the *Space Shuttle* and *International Space Station*. It is NASA's lead effort in human space exploration. |
| KSC | Kennedy Space Center | KSC is America's gateway to the universe, leading the world in preparing and launching missions around the Earth and beyond. |
| LRC | Langley Research Center | LRC forges new frontiers in aviation and space research for aerospace, atmospheric sciences, and technology commercialization to improve the way the world lives. |

**FIGURE 1-1** NASA centers and facilities (continued)

| Abbreviation | Full Name | Description of Activities |
|---|---|---|
| **MAF** | Michoud Assembly Facility | MAF is a government-owned, contractor-operated component of the Marshall Space Flight Center, with a mission to support the continuing development and operations of the NASA space shuttle program. It provides the design and assembly of the external tank for the space shuttle. |
| **MSFC** | Marshall Space Flight Center | MSFC is responsible for bringing people to space and space to people. It is the world leader in the access to space and use of space for research and development to benefit humanity. |
| **HQ** | NASA Headquarters | HQ, located in Washington, DC, exercises management over the space flight centers, research centers, and other installations that constitute NASA. |
| **SSC** | Stennis Space Center | SSC is responsible for NASA's rocket propulsion testing and for partnering with industry to develop and implement remote sensing technology. |
| **WFF** | Wallops Flight Facility | WFF is NASA's principal facility for management and implementation of suborbital research programs. |
| **WSTF** | White Sands Test Facility | WSTF is a preeminent resource for testing and evaluating potentially hazardous materials, space flight components, and rocket propulsion systems to NASA, the Department of Defense, other federal agencies, universities, and commercial industry. |
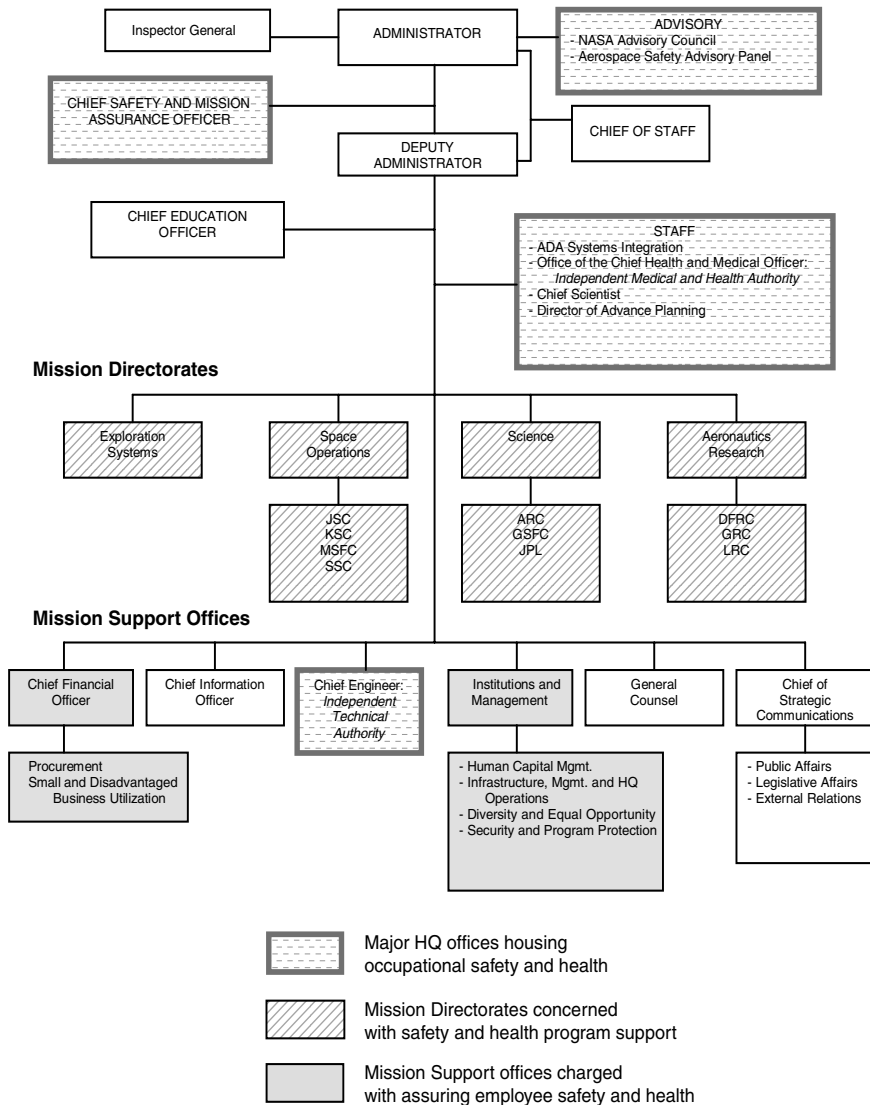
**FIGURE 1-2** NASA ORGANIZATIONAL CHART (as of May 2005). The Mission Directorates support both Directorate-level and NASA-wide visions and goals. The office of the Chief Financial Officer is responsible for contracting specifications, procurement services, financial-related health metrics, and total cost accounting. The Office of Institutions and Management directly impacts the health and well-being of employees and the workplace environment.

**TABLE 1-2** Approximate Size of NASA Workforce by Site

| NASA Site | Federal Employees | | Contractors | | Total |
|---|---|---|---|---|---|
| Ames (ARC) | 1,456 | (26 percent) | 4,180 | (74 percent) | 5,636 |
| Dryden (DFRC) | 621 | (24 percent) | 1,981 | (76 percent) | 2,602 |
| Glenn (GRC) | 1,937 | (56 percent) | 1,500 | (44 percent) | 3,437 |
| Goddard (GSFC) | 3,100 | (41 percent) | 4,500 | (59 percent) | 7,600 |
| Headquarters (HQ) | 1,100 | (81 percent) | 250 | (19 percent) | 1,350 |
| Jet Propulsion Laboratory (JPL) | 58 | (1 percent) | 9,118 | (98 percent) | 9,176 |
| Johnson (JSC) | 3,112 | (30 percent) | 7,251 | (70 percent) | 10,363 |
| Kennedy (KSC) | 1,831 | (14 percent) | 11,057 | (86 percent) | 12,888 |
| Langley (LRC) | 2,348 | (62 percent) | 1,420 | (38 percent) | 3,768 |
| Marshall (MSFC) | 2,731 | (38 percent) | 4,527 | (62 percent) | 7,258 |
| Michoud (MAF) | 14 | (1 percent) | 2,307 | (99 percent) | 2,321 |
| Stennis (SSC) | 291 | (6 percent) | 4,390 | (94 percent) | 4,681 |
| Wallops (WFF) | 250 | (22 percent) | 876 | (78 percent) | 1,126 |
| White Sands (WSTF) | 60 | (9 percent) | 615 | (91 percent) | 675 |
| TOTALS | 18,909 | (26 percent) | 53,972 | (74 percent) | 72,881 |

SOURCE: Probst, 2004.

Extreme Environment Mission Operations project conduct both human and environmental research on the NEEMO, an underwater laboratory off the coast of Florida. In contrast, other employees at the Jet Propulsion Laboratory spend their day in an environmentally-controlled, artificially-lit laboratory. Some employees work in an office environment, while others spend their days outside or in assembly buildings. Employees in some NASA environments are subjected to hazardous conditions and materials such as jet and rocket fuels, radiation, and hazardous chemicals, or to psychologically stressful conditions such as may exist when mission deadlines are approaching.

### The NASA Workforce

As a world-class science and engineering agency, NASA requires a world-class workforce to carry out its objective for "One NASA," with integrated capabilities to support its missions (see http://www.nasa.gov/). This workforce is, by necessity, variable in its skills and educational levels and is very diverse, comprising not only professional scientists and engineers, but also technicians, service staff, and a range of highly specialized personnel. As previously stated, the majority of the workforce is made up of contracted employees. Only about 25 percent of the NASA workforce

are civil servants (Probst, 2004). Within both of these groups, a range of work skills, both blue-collar and white-collar, is represented. These differences increase the difficulty of supporting worker health in ways that meet employee needs (e.g., smoking cessation, physical fitness training) while avoiding disparities in the provision of health care and other preventive services (Sorensen et al., 2002, 2004b).

A number of impediments to maintaining a diverse and competitive workforce also have been identified by NASA. These include, at the nationwide level, a shrinking science and engineering resource pool, increased competition with the private sector for technical skills, and a lack of diversity within the applicant pool; and at the agency level, an imbalance in skills and lack of depth in critical competencies, significant loss of knowledge resulting from projected retirements, and increased recruitment and retention problems.

The goal of NASA's recruitment efforts is to bring in the "best and brightest" scientists and engineers, as well as highly competent support staff, to maintain the agency's technical programs and address its financial, acquisition, and business management challenges (see http://www.hq.nasa.gov/office/codee/index.html). Essential to this effort is providing, through its occupational health services, the tools and competencies needed to support a workforce that is healthy, productive, ready, and resilient.

## THE CHARGE TO THE COMMITTEE

The Institute of Medicine's Committee on Assessing Worksite Preventive Health Program Needs of NASA Employees was charged to assess existing worksite preventive health programs and assess employee awareness and attitudes concerning these existing programs. Using previously gathered data and other research sources, the committee was asked to determine whether there are chronic disease issues unique to the NASA work environment. The committee further was asked to prepare a report that evaluates and recommends (a) specific options for future worksite preventive health programs focusing on, but not limited to, nutrition, fitness, and psychological well-being; (b) incentives or methods to encourage employees to voluntarily enlist and sustain participation in worksite preventive health programs; (c) ways to create healthier workplace environments that are conducive to more active lifestyles; (d) supportive nutrition options to reduce risk factors for chronic disease; and (e) ways to evaluate the effectiveness of such programs.

## Approach to the Task

The committee approached its charge by gathering information from existing literature and from workshop presentations by recognized experts (see Appendix B for the workshop agenda), commissioning an analysis of NASA worksite preventive health programs, deliberating on issues relevant to the task, and formulating an approach to address the scope of work. Reports and other data releases, such as the analysis by the Health Enhancement Research Organization (HERO), the CAIB's report, and *Healthy People 2010*, were included in the committee's research (Kennedy et al., 1998; CAIB, 2003; USDHHS, 2000). In addition, the committee conducted site visits to six NASA centers. These visits included observations of occupational health-related programs and activities; interviews with leadership, including where possible the center director or associate director; and focus group interviews with employees (see Chapter 2 for site visit summary).

The committee's recommendations, following the analysis of gathered data and commissioned work, include those interventions that the committee determined would be both feasible and effective in meeting the goal of NASA's Chief Health and Medical Officer to ensure that employees who join NASA should end their careers healthier than employees in other organizations as a result of their experience with NASA's occupational and preventive health programs.

## Organization of the Report

The report is organized into six chapters that describe NASA as an organization and discuss the role of Occupational Health in NASA and in other organizations, both public and private. The report presents examples of successful preventive health programs "best practices," as well as strategies for optimizing the preventive health options offered to the NASA workforce. Chapter 2 describes Occupational Health at NASA, including the range of programs and a summary of committee observations from visits to selected centers. Chapter 3 presents a healthy workforce paradigm and makes the case for change based on current best practices at NASA and in other organizations. Chapter 4 describes the elements required for organizing and managing effective workplace wellness programs. Chapter 5 describes the integration of health and wellness in worksite health promotion. Finally, Chapter 6 reviews integrated health data management systems.

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www.nasa.gov/

2

# Occupational and Preventive Health at NASA

This chapter provides an overview of occupational and preventive health programs at NASA, beginning with a historical perspective. The administrative structure of Occupational Health is described, including the departmental locations of various occupational health-related programs. The chapter closes with a summary of committee member site visits to observe occupational health programs and activities at selected NASA centers.

## DEVELOPMENT OF PREVENTIVE HEALTH PROGRAMS

NASA was one of the first federal agencies to recognize the importance of occupational and preventive health programs to the overall health and productivity of its employees. In addition, safety was early on instituted as a core value among the NASA workforce—vital to the success of NASA missions. In 1972, NASA commissioned the Durbeck study, which showed a relationship between worksite exercise programs and improved health, particularly cardiac health (Durbeck et al., 1972). In 1976, NASA established and implemented a standardized set of criteria for Employee Assistance Programs (EAP). By 1977, preventive health programs based on nutrition education and counseling had been established within the agency. In the subsequent three decades, NASA took additional steps to institute preventive health programs agency-wide. Between 1977 and 1997, NASA initiated several nutrition programs, including one-on-one counseling about cardiac and other chronic diseases. In 1989, the agency commissioned a study on implementation of the Healthy People 2000

*34*

goals, and from 1990 to 2000 it developed and implemented a 10-year, agency-wide competitive plan to meet the Healthy People goals. It was the first federal agency to achieve Voluntary Protection Program (VPP) Star Status, and was recognized by the American Productivity and Quality Center (APQC) for its programs in 1999. Today, NASA offers a broad scope of health and wellness support options to employees. In addition, a NASA Health Promotion and Wellness Team (HPWT) was established in 2000 to standardize the delivery of health promotion across the agency. The HPWT, comprising Occupational Health Program professionals from each NASA center and facility, meets quarterly (Probst, 2004).

All of the occupational health-related programs and activities offered by NASA are linked to the NASA Occupational Health website (http://www.ohp.nasa.gov/). This website can be accessed by all NASA employees, as well as by viewers outside the agency. The site informs employees of relevant events such as the Healthier Feds campaign (http://www.healthierfeds.gov/) and topics such as flu vaccines, and it serves as a vehicle to facilitate employee participation in personal health care by offering health information, links to outside health sites, and notification to employees of health screening, physical exams, and other health programs offered by NASA (NASA, 2004).

## THE OFFICE OF THE CHIEF HEALTH AND MEDICAL OFFICER

The Office of the Chief Health and Medical Officer (OCHMO) was created to undertake responsibility for the health of the NASA workforce in areas such as policy, medical guidelines, best medical practices, professional development and training, and medical quality assurance. (Refer to Chapter 1, Figure 1-2 for the NASA organizational chart, including the OCHMO.) Specifically, the office is responsible for policy and oversight for occupational health, aerospace medicine, medicine in extreme environments, protection of research subjects and patients, quality assurance, public health issues, and professional health education and development. The OCHMO administers a broad range of health, wellness, and environmental programs and is headed by the Chief Health and Medical Officer (CHMO). Figure 2-1 shows the organizational chart for the OCHMO.

### Program Administration at NASA Centers

Occupational Health at NASA is decentralized (see Figure 2-1), with each center administering its own programs. The total FY 2002 budget dedicated to occupational health across all centers was $45,042,553 (Probst, 2004). A breakdown of the Occupational and Environmental Health budget for this year by center is shown in Table 2-1. Each center is unique, and

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                    │ Chief Health and Medical Officer │
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  │ Director of          │        │ Special Assistant for│
  │ Occupational Health  │        │ Quality Assurance    │
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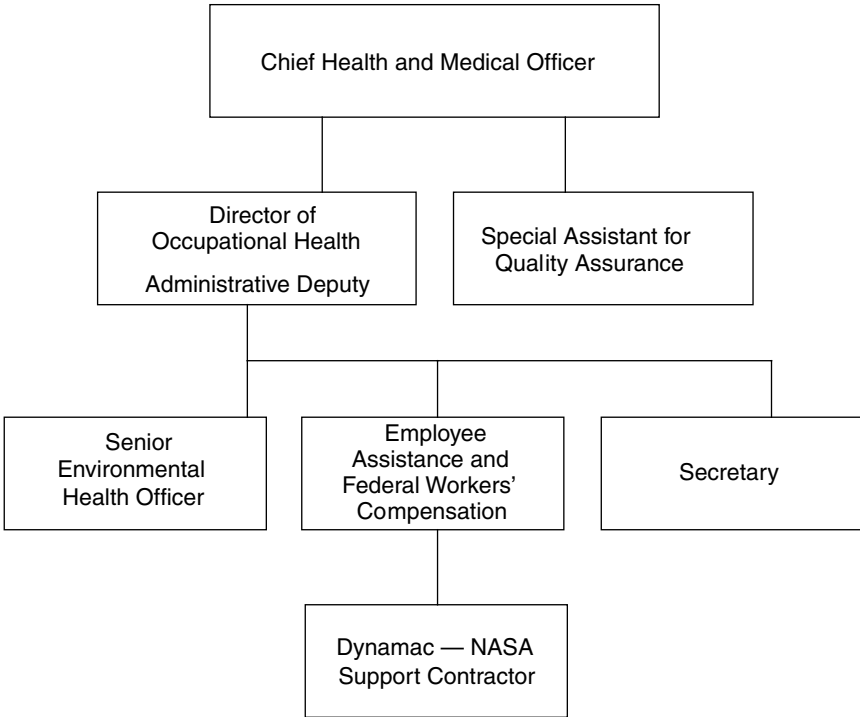
FIGURE 2-1  Occupational Health Organizational Chart, NASA Headquarters.

although the offices are separate, they are mutually supported and cooperative. The centers are encouraged to communicate with Headquarters, and feedback mechanisms include biannual outbrief/inbrief surveys, news sheets disseminated via e-mail from Headquarters to the centers, an annual occupational health conference, the annual health and safety meeting, biweekly continuing professional education videoconferences, for centers, and an OH website (see above).

The range of occupational health services offered to civil servants and contract employees varies between centers, depending on the proportion of contract and civil servant employees at the site, as well as on contract specifications. Every site offers some level of preventive health including fitness centers, stress management, diet/nutrition, and so on, as well as Employee Assistance Programs (EAPs).

*Occupational Medicine Strategic Planning*

Strategic planning within NASA gave rise to the development of specific outcome metrics for the OCHMO that focused on the objective that

**TABLE 2-1** Occupational Health Budgets for Selected Sites in Millions of Dollars (2002)

|  | Occupational Medicine | Environmental Health | Total |
|---|---|---|---|
| Ames | $1.2 | $1.2 | $2.4 |
| Dryden | $.9 | $.5 | $1.4 |
| Glenn | $.9 | $2.0 | $2.9 |
| Goddard | $1.4 | $1.1 | $2.5 |
| Headquarters | $.8 | – | $.8 |
| JPL | $2.4 | $2.8 | $5.2 |
| Johnson | $5.5 | $2.5 | $8.0 |
| Kennedy | $7.4 | $8.8 | $16.2[a] |
| Langley | $1.2 | $.6 | $1.8 |
| Marshall | $1.8 | $1.0 | $2.8 |
| Stennis | $.6 | $.6 | $1.2 |
| **Total** | $24.1 | $21.1 | $45.2 |

[a]Includes support of the Cape Canaveral Air Force Station through the Joint Base Operations Support Contract.
SOURCE: Probst, 2004.

employees who join NASA should end their careers healthier than the average American worker. There were several documents that helped transform this outcome objective into a vision for the OCHMO. These included the Institute of Medicine (IOM) report, *Safe Passage* (IOM, 2001), which helped develop a focus on prevention, and the Healthy People 2010 report, which served as a model for an occupational health approach to preventive health and provided benchmarks for programs (USDHHS, 2000).

There are impediments, however, to the implementation of the OCHMO's vision. First, safety is historically a core element of most engineering cultures, whereas health is not; and second, occupational health and safety are each managed in separate NASA offices. Both of these factors affect development and implementation of programs offered through the OCHMO.

## ORGANIZATION OF OCCUPATIONAL AND PREVENTIVE HEALTH PROGRAMS

Occupational and preventive health programs at NASA are carried out by over 400 health professionals across the 14 centers (Probst, 2004). They provide comprehensive support to NASA's diverse and highly technical workforce, which includes both federal employees and contractors.

The primary program elements making up NASA Occupational Health and administered through the Office of the Chief Health and Medical Officer (OCHMO) are:

- Occupational Medicine
  - Medical Clinics
  - Health Education and Wellness Programs
- EAP
- Environmental Health
  - Health Physics (HP)
  - Industrial Hygiene (IH)
  - Sanitation
- Federal Workers' Compensation
- Physical Fitness

### Occupational and Preventive Health Programs

*Occupational Medicine*

Figure 2-1 shows the organizational chart for Occupational Medicine at NASA Headquarters, and Table 2-2 depicts the office's developmental timeline. The primary objectives of the Occupational Medicine program are to improve health through prevention, ensure fitness for duty, and minimize absenteeism and reduced productivity resulting from injury, illness, short- or long-term disability, or premature death (http://www.ohp.nasa.gov/index.html/). The program components offered through OCHMO include:

- Acute Medical Care
- Certification Examinations
- Clinical Care
- Electronic Health Record System (EHRS)
- EAPs
- Health Maintenance Examinations
- Medical Monitoring Examinations
- Nutrition Services
- Physical Fitness Programs
- Traveler Health
- Federal Workers' Compensation Services

*Environmental Health*

The Environmental Health program at NASA is dedicated to the identification, evaluation, and control of occupational and environmental haz-

**TABLE 2-2** Developmental Timeline for Occupational Medicine at NASA

| | |
|---|---|
| **1972** | U.S. Public Health Service Health Evaluation and Enhancement Program at NASA (Durbeck Study) linked a worksite exercise program with improved cardiovascular health. |
| **1976** | Standardized criteria for Employee Assistance Programs was established at NASA. |
| **1977** | Preventive health programs on nutrition education and counseling were developed and implemented. |
| **1989–1999** | NASA conducted a Cardiovascular Risk Reduction Program. |
| **1989** | NASA commissioned a study to examine which Healthy People 2000 goals could be implemented in the worksite. From 1990-2000 NASA implemented a plan to meet the Healthy People 2000 goals. |
| **mid-1990s** | Agency-wide downsizing reduced the occupational health function from eleven FTE civil servants to three FTE civil servants. |
| **1996** | Two of three remaining billets and existing budget were transferred to the Kennedy Space Center. Two existing civil service positions were filled, one additional civil service position was hired, and a contractor workforce was hired. |
| **1997** | NASA funded a study by the Health Enhancement Research Organization (HERO) examining the modifiable health risk factors of coronary artery disease, and related expenditures and hospitalizations. |
| **1998** | LifeSkills, Inc. conducted focus groups to determine sources of stress at NASA. |
| **2000** | Office of the Chief Medical Officer (OCHMO) was established. Separate divisions for Occupational Health, Medicine of Extreme Environments, and Bioethics and Transition to Practice were created. |
| **2002** | Responsibility of four civil service FTEs was transferred to NASA Headquarters following an independent review of effectiveness of the lead center concept for occupational health. |
| **2003** | OCHMO moved from the Administrator's Office and was reorganized as the independent Office of Health and Medical Systems. |
| **2004** | OCHMO was returned to the Administrator's Office as a result of the President's Commission for the Exploration Vision. |

ards or stresses that may adversely affect the well-being, work environment, or performance of the workforce. The program components offered through Environmental Health at NASA include:

- Health Physics
- Industrial Hygiene

- Environmental Sanitation
  — Pesticides
  — Food sanitation
- OSHA Compliance.

### Components of NASA Occupational Medicine

The NASA Occupational Health website (http://www.ohp.
nasa.gov/) provides employees with information on environmental
health programs and weekly health topics.

### Acute Medical Care

Occupational Health clinics provide emergency first aid and medical
care to employees who experience a medical emergency while at work.

### Occupational and Health Maintenance Examinations

*Clinical Care*. NASA Occupational Medicine's policy is to minimize sick
absences and reduced productivity resulting from partial physical dis-
ability, permanent disability, or premature death. NASA centers provide
acute medical care for first-aid care and other services to maintain health,
improve morale, control costs, and reduce lost time resulting from inju-
ries and illness.

*Electronic Health Record System*. In an effort to improve the longitudinal
understanding of the health status of the workforce, NASA Occupational
Health has planned to implement an EHRS. This system would replace
the traditional paper medical record and afford NASA clinics the oppor-
tunity to facilitate identification of critical health issues in real time, re-
duce the chance of medical errors and improve reporting, assess the effec-
tiveness of health improvement programs, and advance collaboration
between centers to provide an overall employee health status. In addition
to enhancing the day-to-day delivery of occupational health services, the
EHRS would allow the measurement of health outcomes compared to ca-
reer-long exposures and employee-focused health care.

The EHRS project is a major initiative of the OCHMO. An Agency
Task Force, comprising individuals from each of NASA's 14 centers and
facilities, and crosscutting many professional disciplines, is currently fo-
cusing on the generation of technical and functional requirements neces-
sary for such a system to operate successfully in NASA's environment.
The results of this endeavor will drive the development of an agency-

wide system capable of standardizing an improved level of health care for all employees.

*Health Maintenance Examinations.* NASA centers offer physical exams to civil servant employees on an age-based schedule. Additional testing is offered on the basis of age and risk criteria. Employees in positions with potential toxic exposure are required to undergo occupational physical exams. The requirements for such testing are determined by state and federal regulations. All examination protocols include a health risk counseling component.

In addition, numerous preventive medicine services are available to employees, including physical exams, health education, screening programs (e.g., mammography and screening for skin cancer, prostate, and colon cancers) and cardiovascular risk reduction programs.

### Employee Assistance Programs

The NASA EAP is one of the constituent Occupational Medicine programs within the agency. All NASA centers offer an EAP that provides employees with short-term counseling or referrals to community resources. Features of the EAP include employee stress management; Web-based training services for employees experiencing emotional stress, mental health disorders, family or relationship difficulties, financial or legal concerns; and alcohol or drug abuse problems. Participation is voluntary, though services may be initiated by supervisor, medical, or other referral. The training programs include a stress-level questionnaire with immediate feedback and after-hours EAP coverage.

### Nutrition Services

It is NASA Occupational Medicine policy to promote healthy behaviors by creating a work environment supportive of healthy choices, advanced by providing to the employees sound and safe nutrition services to assist with proper diet, meal planning, and weight and disease management.

### Physical Fitness Programs

NASA provides employees with fitness facilities at all centers, staffed to offer counseling and individualized training and offering a variety of exercise classes and equipment. Some centers also provide orthopedic and cardiac rehabilitation services, directed by qualified professionals. Be-

tween 1990 and 2000, in collaboration with the President's Council on Physical Fitness and Sports, NASA engaged employees in an intercenter competition called "Exercise for the Health of It" to raise awareness of the benefits of regular exercise, based on the fitness objectives of Healthy People 2000.

### Traveler Health

It is NASA's policy to offer a comprehensive health services program for international travelers to safeguard the health and productivity of its employees on international travel and duty assignments. NASA Occupational Health clinics follow the guidelines set by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) when providing health evaluations, immunizations, and information on diseases, food and water, and personal safety in foreign countries. In addition, any employee, including contractors, traveling to a medically underserved area is provided with contract arrangements for emergency evacuation.

### Federal Workers' Compensation Programs

NASA's goal is the prevention of occupationally related injury and illness. However, it is agency policy, as directed by the Federal Employees' Compensation Act, to provide compensation benefits to civilian employees of the U.S. government (civil servants) who are injured, become ill, or die while in the performance of duty.

### Occupational Health Website

The Occupational Health Website, http://www.ohp.nasa.gov/, provides employees with information on occupational medicine and environmental health programs and provides a single point of access to all programs, and a large inventory of resources and tools.

## Environmental Health Programs

### Health Physics

Licensed radiation protection programs are in place at every center where radiation hazards are present. These programs comply with the regulations established by the Nuclear Regulatory Commission, and qualified staff provides training and evaluation to employees. Laser Safety

and Ground Nuclear Safety training programs are available on the SOLAR Website.

### Industrial Hygiene

*Hazardous Material Exposure.* Every NASA center has a Hazardous Material Program designed to identify, evaluate, and control potentially hazardous materials to which employees may be exposed (NASA, 2004). A Material Safety Data Sheet (MSDS) inventory is maintained on all potentially toxic substances and hazardous physical agents. Employees participate in special programs to manage unique hazardous materials and processes and receive special training in handling such materials.

Annual inspections are conducted at each center, and personal exposures are monitored. NASA industrial hygienists are available to respond to all spills and accidents involving hazardous materials, conduct on-site evaluations, and answer employee questions (NASA, 2004).

Proactive reviews are made of all engineering drawings of new and renovated buildings and of all contract and purchase requests before the initiation of new research and development programs. These reviews serve to identify and control potential exposures to hazardous materials and processes to prevent such occurrences (NASA, 2004).

Employees are trained in hazard recognition, proper use and care of personal protective equipment, and proper handling of harmful substances. Training is conducted through a multimedia approach called the Site for On-line Learning and Resources (SOLAR). Web-based training is also available on Bloodborne Pathogens and Hearing Conservation.

The NASA Safety Training Center (NSTC), near Johnson Space Center, Houston, offers course development and deployment through a catalog of safety and health courses which are updated annually and offered agency-wide.

*Ergonomics.* The NASA Ergonomics Program uses a multidisciplinary approach to evaluating workers and the workplace to prevent work-related musculoskeletal disorders (MSD). At least one center has an on-site physical therapy and rehabilitation group; however, ergonomic hazard awareness and training programs have been instituted and engineering controls used to abate ergonomic hazards wherever they are encountered. Agency-wide, a compendium of informational materials and links to ergonomic information is made available through the Occupational Health Website.

*Indoor Air Quality.* The Indoor Air Quality (IAQ) Program focuses on the four basic causes of "sick building syndrome": inadequate ventilation, inside contamination, biological contamination, and outside source con-

tamination (NASA, 2004). Investigations into air quality problems are made on a case-by-case basis by Occupational Health personnel. IAQ takes a proactive approach, including a review process to evaluate any new construction for air intake and exhaust locations, ventilation rates based on occupancy, and a review of operations to determine the need for local exhaust ventilation to control emissions of potential contaminants. IAQ courses, an in-house training video, and IAQ-related websites are available to employees.

### Food and Sanitation

All centers operate a Food Sanitation Program that addresses issues of food safety. Food sanitation and inspection programs are in place to prevent foodborne illness, poisoning, and contamination of food. Food handlers are trained in proper food handling procedures, use of equipment, and personal hygiene.

## OBSERVATIONS OF OCCUPATIONAL HEALTH PROGRAMS AT SELECTED NASA CENTERS

The Office of the Chief Health and Medical Officer is staffed at NASA Headquarters in Washington, DC, and at a tenant office at Kennedy Space Center (KSC) in Florida. NASA Occupational Health consists of approximately 400 occupational health professionals distributed across 14 NASA centers and facilities. These professionals provide comprehensive support to NASA's diverse, highly technological workforce.

Headquarters maintains oversight of the Occupational Health program and is responsible for ensuring compliance with programmatic, statutory, and regulatory guidelines and policy implementation. NASA center directors and the Assistant Administrator for Institutional and Corporate Management have the responsibility to ensure that the NASA Occupational Health program is effectively implemented and operated at their respective center and component facilities (refer to Chapter 1, Figure 1-2).

### Site Visits to Review Health Programs, Employee Attitudes and Awareness, and the NASA Work Environment

A component of the charge to the study committee was to gather data to assess employees' awareness of and attitudes toward preventive health care programs and the support facilities offered in their worksite. Limitations in time and budget precluded the conduct of a formal research survey of the NASA workforce; however, the committee did conduct infor-

mal voluntary interviews and focus groups with employees and managers at selected NASA worksites.

Six NASA centers were selected for site visits by the study committee during the summer of 2004. These sites (Kennedy Space Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Ames Research Center, Glenn Research Center, and Johnson Space Center) were visited by three to five committee members and project staff. The sites visited were selected on the basis of the following criteria to ensure as representative a sampling of sites as possible:

- Site mission and function,
- Geographic location,
- Workforce size, and
- Mix of civil servant and contract employees.

Typical activities on each itinerary included (a) tours of the site, including the fitness facility and health unit; (b) interviews with one or more upper-level administrators (usually a deputy center director), the division chief for Occupational Health, union representatives, and a representative from human resources; and (c) focus groups composed of male and female employees and supervisors. Although there are differences among the sites visited, committee members noted recurring themes at all sites. These major themes are described below.

The site visits allowed committee members to make observations and interact directly with employees at all levels from administrative to nonsupervisory workers. Major categories of NASA-identified concerns and program areas were specifically reviewed by the committee, using the best available data, site visits, and interviews. Focus groups of 6-10 individuals were arranged to include either all male or all female employees and either all supervisory or all nonsupervisory employees whenever possible at each center. Though the content of the focus group discussions varied between sites, the following topics were included to the extent possible:

1. Use of fitness facilities,
2. Attendance and valuing of other programs,
3. Health/Nutrition environment,
4. Overall health of employees and value of health,
5. Stress environment, and
6. Group interactions.

On the basis of the information provided and collected, the committee formed its assessments, findings, and recommendations.

*Employee Training Programs*

The committee site visit teams did not obtain specific information on these programs, although some observations by committee members indicated that the skills taught by outside contractors were typically too generic and failed to adequately address the actual problems present at NASA. Employees expressed concerns that supervisory training did not include the identification of stress in the workplace and that inadequate management education may have exacerbated or created unnecessary stress among employees. In at least some cases, such training seemed available only to civil service employees. Further observation by committee members indicated that training was not appropriately integrated into management career paths and did not reach those that needed it most.

*Preventive Health Programs*

All NASA centers offer preventive health programs to employees; however, the range of options varies by site. The following observations describe the variability in range and depth of preventive health care across centers.

1. For most centers, safety and health do not appear to be integrated:
   • Safety and health are often located in different divisions, if not different directorates, which can inhibit effective coordination of programs, and
   • There appears to be relatively little attempt to integrate the variety of preventive health programs that are offered at the various centers. These programs are often driven by perceived employee desires rather than a strategic analysis of employee health needs.
2. There are inconsistencies across the centers with respect to contractor access to preventive health programs.
   • There appears to be consensus that contractors and civil servants are "on the same team," and that both groups need to function optimally for a project to succeed. However, many centers do not allow contractors access to health services, preventive health programs, or fitness facilities. This can lead to feelings of resentment and inequity, which may be exacerbated by the knowledge that some centers do allow contractor access.

*Evaluation of Stress at NASA*

NASA can be compared to a large corporation that faces unique and competitive challenges and attempts to adjust its management and work-

force to meet these challenges. As a federal agency, NASA experiences significant stress because of the high visibility of its major programs, and a number of NASA operations are not error tolerant—seemingly minor mistakes can have major negative consequences.

The committee's evaluation of chronic and acute stress was limited to observations at site visits and site-specific, small data sets. Its conclusions about stress at NASA, however, were similar to those observed in prior surveys such as those described above. An exact assessment of chronic stress would require appropriate sampling of stress measures and risk factor measurements that were not available at NASA. The committee did not seek out high-stress occupations or attempt to assess peak levels of stress.

Stress resulting from the public visibility of NASA and its often hazardous missions appeared to be most evident among the upper levels of management. Discussion with employees did not elicit any voiced concern about public exposure, mission events, or long-term psychological reactions to mission events. Importantly, the response from upper-level management to stressful exposures did appear to frequently translate into reorganization or policy changes that then posed significant daily challenges to employees.

In general, the committee observations of the NASA work environment, along with findings from the previously described reports, indicate that deficits in managerial training and the design of work/communication flow at NASA create acute stresses, which may affect both employee health and employee productivity. Specific observations on the NASA work environment are that:

1. Job stress levels were reported as comparable to those in private industry.

Although employee stress is clearly an issue among NASA employees, it did not appear to the committee that the absolute level of stress was significantly different than that experienced by employees in the private sector. The major sources of and trends related to job stress consistently noted by employees and management are:

- The recent initiation of a "full-cost accounting" approach has caused considerable stress among civil servant and contract employees.
- There are peak and valley times of stress and increased workload. However, the most stressful times are also the most exciting times.
- Employees who had worked in both sectors believed there were no significant differences, whereas NASA civil servants generally perceived more workplace stress.

2. Employees appreciate the campus-like atmosphere and academic freedom.

- Employees recognize the benefits of working for NASA and appreciate the campus-like atmosphere. However, employees also exhibited a sense of entitlement to these benefits and desired additional "perks".

3. There are pervasive concerns regarding the *Report of the President's Commission on Implementation of United States Space Exploration Policy* (Aldridge Report).

- There are significant concerns regarding job security. This was more apparent at some sites than others but was mentioned at all of them.
- Employees are concerned about the effects of potentially becoming a Federally Funded Research and Development Center (FFRDC), like the Jet Propulsion Laboratory.

4. Relations between civil servant and contract employees are positive, but somewhat strained because of perceived inequities.

- For a variety of reasons, civil servants and contractors were not able to access all of the same health and wellness services (e.g., fitness center, health clinic, EAP) at all of the sites. Some sites allowed more equitable access than others.
- Some employees reported that contractors are treated like "second-class citizens".
- Contractors noted the difficulties involved in reporting to two supervisors: the contractor supervisor and the project supervisor.

Despite these issues, the overwhelming committee consensus was that stress did not interfere with productive and collegial working relationships. The stress concerns the committee observed closely echo those reported earlier in *Stress at NASA* (Williams and Williams, 1998). The Williams Report was commissioned to evaluate the employees' level of concern associated with federal-wide downsizing so that NASA's employee assistance programs would be better positioned to assist employees. Both report stressors at NASA that could have been observed in other large corporations; for example, effects of downsizing (Landsbergis et al., 1999), poor "people skills," inadequate vertical communication, and problems with a mixed contractor/civil servant workforce. The 2004 survey of NASA by Behavioral Science Technology (BST) provides further confirmation of problems with communication and management style. A pilot program has been initiated with contractors hired by NASA to train managers in stress and communication management (BST, 2004).

Although the committee site visit teams did not obtain specific information on this program, its initiation seemed to be viewed positively by employees. Observations during the site visits, however, raised concerns about the implementation of this (and prior) programs. NASA staff discussions of programs indicated that the skills taught by outside contractors were typically rather generic and failed to engage successfully the actual problems present at NASA. In at least some cases, such training seemed available only to civil service employees. Further observation by committee members indicated that training was not appropriately integrated into management career paths and did not reach those that needed it most.

The positive features present at NASA are echoed in committee observation as well as previous reports (CAIB, 2003; President's Commission on Implementation of United States Space Exploration Policy, 2004; BST, 2004) that emphasize the strength of the NASA workforce in terms of skills, dedication, and in most cases, positive morale. An important function of EAP personnel that is well executed at NASA is crisis intervention. Acute stressors, such as occur in mission mishaps, affect large segments of the NASA community. In such situations, and in equally severe, but more local, crises, it is important for the community to recognize the effect of such stressors, provide social support, and enhance referral for those suffering severe symptoms.

Overall, the committee impressions and these reports indicate (but cannot definitively prove) that deficits in managerial training and the design of work/communication flow at NASA create acute stresses, which may affect both employee health and productivity. The committee impressions further indicate that chronic stress at NASA was comparable to that at similar large workplaces. Such stress remains important to long-term health and productivity despite the possibility that NASA does not have a unique or remarkably greater level of stress relative to other worksites.

### Employee Utilization and Awareness of Occupational Health Programs

In general, the committee observed employee appreciation for the variety of programs offered. As noted earlier, employees realize that working at NASA provides a lot of "perks," and that they have a wide array of health and wellness programs offered to them. They appreciate the availability of services such as the fitness center and health unit, even if they do not necessarily use them. The following factors, however, affect the utilization and effectiveness of programs:

- Communication regarding available health and wellness programs varies;
- Many employees noted that information regarding wellness programs is often lost in the volume of daily notices that employees receive. Flyers and e-mail notices are sometimes received after the fact or are buried in center-wide emails;
- There appears to be some dissatisfaction with the trend toward population-based health assessments;
- At some of the sites, the medical clinics have started to eliminate annual physicals and routine blood work in favor of population- and risk-based assessments. Employees were not generally aware of the rationale behind these changes and were not happy with the perceived reduction in services; and
- Attitudes toward the fitness center and health units are very personality dependent and center specific.

In general, there were high levels of employee awareness regarding the medical clinics and fitness centers. However, attitudes appeared to vary depending on the contractor managing the facility. In addition, employees often cited barriers to participation in these programs (e.g., too much work, programs only offered for the already healthy, etc.).

*Metrics*

The committee reviewed health metric collection and management systems at the centers visited. They found that large amounts of data are collected; however,

- Metrics are collected and maintained by individual centers and are not consistently or uniformly coordinated between centers; and
- Utilization data generally tend to be collected, rather than health outcomes data.

Another important observation made by the committee was that data are generally not used to inform decisions. It appears that data are often collected to verify that contractual requirements are being met, but these data do not appear to be used to influence future strategic planning, to assess the health effect of the programs that are being offered, or to assess the actual health needs of employees.

As noted above, there is inconsistency from site to site regarding what is collected and how it is used. Specifically, there is a lack of consistently reported utilization data across centers. As an example of inconsistency, fitness center utilization may be tracked by "number of monthly visits,"

"number of active members," "daily average visits," or "number of em-
ployees with medical clearances." Therefore, it is difficult to make com-
parisons across the different centers.

## FINDINGS

The committee found that, overall, Occupational Health at NASA has
established many of the elements of an integrated health program and has
taken an important step toward incorporating its programs into an inte-
grated system through its Occupational Health Website. Observations of
committee members indicate that a stronger emphasis and greater visibil-
ity was given to safety over health, although that observation varied be-
tween centers. The committee believes, however, that safety and health
should both be viewed as elemental components of an integrated health
program.

The committee further found, based on its observations and review of
existing programs, that the current organizational status of Occupational
Health programs is segregated and fragmented between and within cen-
ters. The lack of uniformity in these programs is largely a consequence of
a decentralized system that results in variability and lack of consistency in
the collection and reporting of health data and program use at the center
level.

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**Websites:**
www.healthierfeds.gov/
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# 3

# Workforce Health, Performance, Readiness, Resilience: The Case for Change

This chapter outlines the evolution of and evidence for a new vision and approach to optimizing employee health and performance.

## INTRODUCTION AND BACKGROUND

### Definition and Significance of "Healthy Workforce"

Like other large U.S. agencies and corporations, NASA is challenged with both increasing productivity demands and a changing American workforce. Just as the agency's scientific and engineering breakthroughs have improved everyday life for Americans, so too can NASA's pioneering effort in other aspects of its mission be harnessed as an opportunity to improve the health and performance of its own workforce and serve as a model for other "knowledge worker" employers whose workers are highly educated and whose work products are complex problem solving and solutions rather than service delivery or product manufacture.

The twenty-first-century American workforce is characterized by increasing demographic diversity, a greater number of multidisciplinary jobs, higher degrees of collaborative work and reliance on technology, "knowledge workers," and highly skilled technicians, as well as around-the-clock or so-called "24/7" operations, an accelerated workpace, and more flexible work patterns (IOM, 2003a). In addition, significant changes are occurring in the organization of work.

U.S. workplaces now rely more heavily on information technology, have more distributed work arrangements, and engage teams composed

*53*

of members from different employers or from the same employer but with different terms of employment. They also create and dissolve work groups and employment around specific projects and employ global work teams using technology to perform work in "virtual" environments of electronic team rooms and web-hosted meetings. Within the workforce itself, there is greater uncertainty about employment, as evinced by people having many more employers over their working careers, being required to become continuous learners to enhance or expand their skills, and experiencing the movement of work and jobs to other countries (IOM, 2003a).

These changes within the workforce and at the workplace create greater psychological demands on workers as well as demands for higher levels of productivity. To succeed in a work environment of rapid change requires workers to be mentally and physically prepared, adaptable, and resilient—in a word, healthy.

A "healthy worker" can be characterized as one who is physically fit and demonstrates positive health-related behaviors such as not using tobacco, alcohol to excess, or illicit drugs, maintaining body weight in the ideal range, regularly performing appropriate levels of physical activity, and complying with recommended preventive health practices; who has psychological skills that enable success in work environments of high demand, collaborative work, and short cycle times; and who works within a safe and healthy work environment. An integrated occupational health and safety program can help improve worker health through worksite strategies aimed at strengthening psychological skills, changing health behaviors, and reinforcing social norms supportive of these health goals (Sorensen and Barbeau, 2004).

Integrated worksite health and safety programs have both individual and organizational applications that can be developed to promote personal and organizational health-related productivity. A "healthy workforce" is characterized by four key attributes, consistent with the World Health Organization (WHO) definition of health, that can be analyzed and improved to promote personal and organizational "well-being." Specifically, for both individuals and organizations to achieve optimal performance, they must be

• **healthy**—demonstrating optimal health status as defined by positive health behaviors; minimal modifiable risk factors; and minimal preventable illnesses, diseases, and injuries;
• **productive**—functioning to produce the maximum contribution to achievement of personal goals and the organizational mission;
• **ready**—possessing an ability to respond to changing demands given the increasing pace and unpredictable nature of work; and

- **resilient**—adjusting to setbacks, increased demands, or unusual challenges by bouncing back to optimal "well-being" and performance without incurring severe functional decrement.

The traditional "occupational" and "nonoccupational" dichotomy that has been defined by predictable shifts and the 40-hour workweek is increasingly blurred by the changing demands of the contemporary American workplace (IOM, 2003a). Employers that have traditionally been responsible for safety, environmental, and occupational health concerns will, of necessity, become more involved with worklife issues, health behaviors, and social interactions. Adverse effects on employers of high health care costs and tight labor markets, particularly in engineering, create employer imperatives for engaging health beyond traditional occupational health and safety. Employers, including NASA, who must support a mission-directed, healthy, and optimally productive workforce will have to articulate a new vision, develop new strategies, and employ new tactics.

## Effectiveness of Health and Health Care

The health and safety of NASA's diverse and geographically widespread employees are the concern of the Office of the Chief Health and Medical Officer (OCHMO). The goal of this office, in collaboration with the NASA vision, is to ensure that employees who join NASA should end their careers healthier than employees in other organizations as a result of their experience with NASA occupational and preventive health programs. NASA draws its workforce from the general population, and thus the American working population serves as a point of comparison.

Understanding important occupationally related health issues and trends among Americans is critical to understanding the health needs of NASA employees. Previous federal and Institute of Medicine (IOM) reports addressing relevant health, health care, occupational health, and American workforce issues provide important information that can illuminate and guide NASA's efforts to achieve its broad goal of creating a comparatively healthier NASA workforce.

### Healthy People 2010

The Healthy People series, begun in 1979, was developed to address disparities in health status and outcomes between diverse population groups, and to improve the overall health of the nation (U.S. Public Health Service, 1979; USDHHS, 2000; www.healthypeople.gov/Publications).

The goals put forward in the original document and its subsequent editions embrace the concept of quality of life and protective, proactive health behaviors, rather than just disease prevention. The two overarching goals identified in Healthy People 2010 are to increase quality and years of healthy life and to eliminate health disparities.

The health goals that were established for the nation in the Healthy People series serve as a framework for NASA's Occupational Health programs; however, as the focus of occupational health at NASA is its workforce, the agency's focuses for action and the benchmarks are necessarily somewhat different from those established for the entire American population. Specific application of these goals to an integrated preventive health care program is discussed further in Chapter 5.

In the implementation of Healthy People 2010, health goals are monitored through a set of 467 objectives in 28 focus areas (USDHHS, 2000). The objectives are linked to targets for health improvement to be achieved by the year 2010 and are intended to facilitate the two overarching health goals described above.

An array of factors including individual (biology, behavior, and physical and social environment), policies and interventions, and access to quality health care directly influence morbidity and mortality in the United States. Understanding these determinants of health is a key component in the effort to achieve the Healthy People goals. Further, monitoring and measuring health determinants are necessary activities to understand and improve the population's health status. This approach—understanding and monitoring health behaviors, environmental factors, and community health systems—has been applied to the development of Leading Health Indicators for Healthy People 2010 (USDHHS, 2000; www.healthypeople.gov/LHI).

*Leading Health Indicators for Healthy People 2010*

The Leading Health Indicators for Healthy People 2010 developed out of a collaborative effort led by an interagency working group within the Department of Health and Human Services (USDHHS). In addition, the report from the Institute of Medicine (IOM), *Leading Health Indicators for Healthy People 2010* (IOM, 1999), provided models to support the indicator sets. The indicators represent major concerns in public health that stem from individual behaviors, physical and social environmental factors, and important health system issues affecting both individuals and communities.

The leading health indicators—physical activity, overweight and obesity, tobacco use, substance abuse, responsible sexual behavior, mental health, injury and violence, environmental quality, immunization, and

access to health care—are linked to specific objectives from Healthy People 2010 that are used to track progress. They are also linked to the 467 objectives in Healthy People 2010 in that they can serve as a starting point for community health initiatives. These indicators are anticipated to facilitate health promotion and disease prevention, encourage participation in health improvement efforts, and increase the effect of Healthy People on improving quality and length of life and eliminating health disparities (USDHHS, 2000).

### The Future of the Public's Health

The primary objective of the report on *The Future of the Public's Health* (IOM, 2003b) was to develop a framework for action to assure the public's health in the new century. The guiding vision for this framework is based on the goals of Healthy People 2010. The action areas reviewed in this report and its findings are consistent with Healthy People 2010 and support the case for change by addressing occupational health and productivity issues in federal agencies such as NASA, as well as the private sector. The *Future of the Public's Health* study committee envisioned six areas of action and change to accomplish the objectives of the framework:

1. Adopt a population health approach that builds on evidence of the multiple determinants of health;
2. Strengthen the governmental public health infrastructure—the backbone of any public health system;
3. Create a new generation of partnerships to build consensus on health priorities and to support community and individual health actions;
4. Develop appropriate systems of accountability at all levels to ensure that population health goals are met;
5. Ensure that action is based on evidence; and
6. Acknowledge communication as the key to forging partnerships, ensuring accountability, and using evidence for decision making and action.

The findings of the report emphasize the challenge of achieving these goals at the community level and the need for action at the societal level that is broadly supported by the community and its agencies. The recommendations of the committee support the need for commitment to the action areas on the part of government, including national, state, and local levels, and engagement of citizens, nongovernmental organizations, health-care providers, businesses, academia, the media, and others to achieve the goal of a healthier U.S. population.

*Safe Work in the 21st Century*

The IOM report *Safe Work in the 21st Century* reviewed numerous programs for training and education of workers and identified needs in worker and employer training for workplace safety and health (IOM, 2003a). The report identified a need for more emphasis on workplace injury prevention as well as easier access for Occupational Safety and Health (OSH) workers to more comprehensive and alternative learning experiences. Another important finding of this report was that worker training and education in workplace safety and health was not considered a prime responsibility of most OSH professionals. Thus, recommendations from the report focus on OSH workforces and training programs, including urging that federal agencies such as the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the National Institute of Environmental Health and Safety (NIEHS) work together with employers, unions, and industry representatives to evaluate the effectiveness of worker training programs and better define minimum training requirements (IOM, 2003a).

Although training efforts are now in place at NASA, this report may serve as a useful guide to inform future training and education efforts. It may also serve as a guide to integration of training and education for worksite health professionals into agency-wide occupational health and safety programs.

*Guide to Community Preventive Services*

Employers can exercise many environmental and population-based interventions to improve the health and productivity of employees and their families. Evidence- and population-based strategies and programs to improve health and prevent disease, whether in states, communities, local organizations, health care organizations, worksites, or schools, have been analyzed and recommended by the Task Force on Community Preventive Services.

The *Guide to Community Preventive Services* (http://www.thecommunityguide.org/) is a federally sponsored initiative that is a component of a larger group of federal public health initiatives that includes documents such as Healthy People 2010. It was developed by the nonfederal Task Force on Community Preventive Services, which was appointed by the director of the Centers for Disease Control and Prevention (CDC). The Task Force was convened in 1996 by the USDHHS as an independent decision-making body that would provide leadership in the evaluation of community, population, and health care system strategies to address a variety of public health and health promotion topics (see

below). Support is provided by staff from CDC as well as various public and private partners.

The guide was developed for employers who controlled many population-targeted programs and environmental factors that have been demonstrated to be effective in improving or supporting health behaviors that reduce morbidity, mortality, and loss of productivity. The guide provides communities and health care systems with recommendations for population-based interventions to promote health and prevent disease, injury, disability, and premature death. The recommendations are provided through systematic reviews of three general topic areas: changing risk behaviors; reducing diseases, injuries, and impairments; and addressing environmental and ecosystem challenges. Specific topics covered in the recommendations are:

- Alcohol
- Cancer
- Diabetes
- Mental Health
- Motor Vehicle Safety
- Nutrition
- Oral Health
- Physical Activity
- Pregnancy
- Sexual Behavior
- Social Environment
- Substance Abuse
- Tobacco
- Vaccines
- Violence

The various topics are covered in an ongoing series of publications (CDC, 2004; Zaza et al., 2005) and are also published in supplements to the *American Journal of Preventive Medicine*.

*Quality Chasm*

NASA is both a purchaser of health care insurance and a provider of health care services for its employees and their families. NASA, as other major U.S. employers, has an important role in promoting and ensuring effective and efficient health care systems and delivery. The IOM report from the Committee on the Quality of Health Care in America (IOM, 2001) addressed issues of quality care in the American health care system and

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**BOX 3-1**
**The Six Aims for Improvement That Can**
**Raise the Quality of Care**

*safe* – avoiding injury from intended therapy;

*effective* – providing evidence-based service to all who can benefit and not
     to those  for whom no benefit can be derived;

*patient-centered* – providing respectful and responsive care guided by the
     preferences, needs, and values of the recipient;

*timely* – reducing waiting time and other delays to both recipients and
     providers;

*efficient* – avoiding waste of equipment, supplies, ideas, and energy; and

e*quitable* – providing care of consistent quality to all recipients

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   SOURCE: Committee on the Quality of Health Care in America (IOM, 2001).

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made recommendations for a wide variety of key stakeholders to improve
the effectiveness and efficiency of health care.

The study panel proposed a broad agenda for improving and rede-
signing the current health care system in the United States, which included
the following: all health-care constituencies, including policy makers, pur-
chasers, regulators, health professionals, health-care trustees and man-
agement, and consumers, should commit to a national statement of pur-
pose for the health care system as a whole and to a shared agenda of six
aims (see Box 3-1) for improvement that can raise the quality of care to
unprecedented levels; clinicians and patients, and the health care organi-
zations that support care delivery, adopt a new set of principles to guide
the redesign of care processes; the USDHHS identifies a set of priority
conditions on which to focus initial efforts, provides resources to stimu-
late innovation, and initiates the change process; health care organiza-
tions design and implement more effective organizational support pro-
cesses to make change in the delivery of care possible; and purchasers,
regulators, health professionals, educational institutions, and the
USDHHS creates an environment that fosters and rewards improvement
by creating an infrastructure to support evidence-based practice, facilitat-
ing the use of information technology, aligning payment incentives, and
preparing the workforce to better serve patients in a world of expanding
knowledge and rapid change.

Although this report is focused on acute and critical care systems, the
principles proposed apply as well to preventive health care. Preventive
and health promotion programs and activities should provide services

that are evidence-based, patient- or participant-centered, and systems-oriented, and thus are applicable to improving the quality of care provided to employees of organizations such as NASA.

### NIOSH Steps to a Healthier U.S. Workforce

Interest in worksite initiatives integrating occupational health and safety with health promotion and disease prevention efforts is on the rise among the business community, labor groups, and the research community, as evidenced by the recent NIOSH Steps to a Healthier United States Workforce Symposium (Goetzel, 2004; Seabury et al., 2004; Sorensen and Barbeau, 2004 [http://www.cdc.gov/niosh/steps/2004/whitepapers.html]). Additional evidence supporting the potential effect of an integrated approach is emerging in a growing literature reporting results of studies that have systematically assessed the efficacy of integrated interventions (Sorensen and Barbeau, 2004). For example, one randomized controlled study asked the question, "Does the addition of worksite occupational health and safety increase the effectiveness of worksite health promotion only?" (Sorensen et al., 2002). From a survey of 15 manufacturing worksites, randomly assigned to receive either worksite health promotion only or worksite health promotion plus occupational safety and health, the study found that among blue-collar workers who were more likely to be exposed to hazards on the job, smoking cessation rates for those in the integrated intervention were double those in the traditional health promotion-only program. This study also found that worksites receiving the integrated intervention made significantly greater improvements in their health and safety programs than the health program-only sites.

The Steps to a Healthier U.S. Workforce Initiative (STEPS) was developed by NIOSH from an initiative in the USDHHS called Steps to a Healthier U.S. (NIOSH, 2004; www.healthierus.gov/steps/). Concordant with this committee's study charge to evaluate options for preventive health programs, incentives to encourage employee participation, and methodologies to longitudinally track employee health at NASA, the STEPS initiative seeks to improve the dissemination, effectiveness, and acceptance of activities directed at improving worker health through integrated approaches to health protection and health promotion.

The vision of the STEPS initiative is to combine occupational safety and health protection with health promotion activities into integrated health management programs that address both workplace and worker health. STEPS strongly supports the view that all illness and injury should be prevented when possible, controlled when necessary, and treated

where appropriate, and an integrated approach serves to enhance the effectiveness of programs designed to promote and protect worker health.

The STEPS initiative has created an opportunity for the occupational safety, occupational health, and health promotion communities to develop and implement a comprehensive set of programs aimed at improving integrated health and productivity in the workplace. Further, the STEPS project is pertinent to meeting the needs of public–private partnerships such as NASA, which include a mixed workforce of civil servant and private-sector employees, highly directed products with specific outcomes, and major research needs.

## ENVISIONING THE FUTURE

### Current Trends in the United States to Create a Healthy, Productive Workforce

Health and productivity of the U.S. workforce are affected and predicted by many and various factors, including individual health status (e.g., disease incidence and prevalence), health care access and quality, occupational health and safety efforts, employer-specific culture and organizational factors, and community-wide (demographic or geographic) influences (Evans and Stoddart, 1994). Figure 3-1 illustrates the Evans and
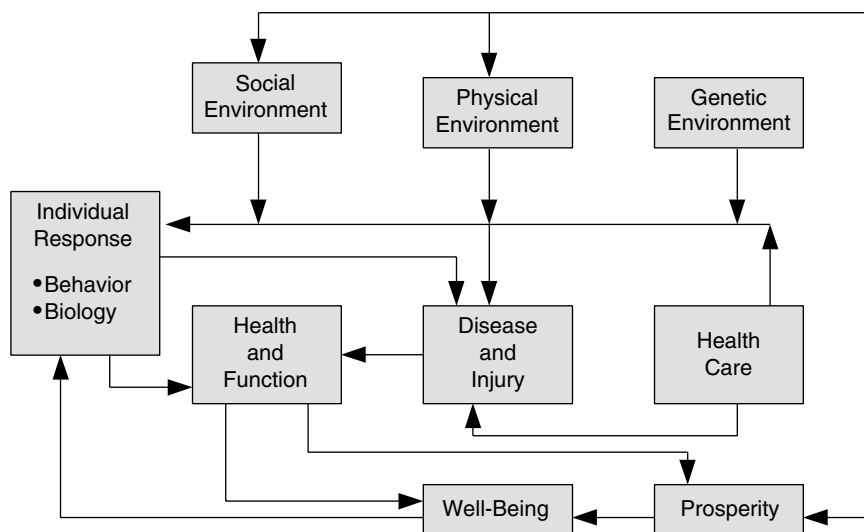


**FIGURE 3-1** Determinants of health; Evans and Stoddart Model.
SOURCE: IOM, 2003b. Adapted from Evans and Stoddart, 1994.

Stoddart (1994) model of health, the determinants of health, and the health care system. Employers, through their policies, benefits, culture, and community influences, can affect numerous health determinants that have an effect on employees and their families.

The ability of health promotion programs to affect employee health has been the subject of hundreds of published research manuscripts and reviews (Wilson et al., 1996; Chapman and Pelletier et al., 2004). Health promotion programs are designed to promote health by maintaining healthy behaviors and by reducing health risks and actively preventing the onset of disease. The risk-reduction programs typically include interventions and programs designed to reduce stress; increase physical activity and fitness; reduce high blood pressure and cholesterol; reduce excess body weight; improve nutrition; reduce tobacco, alcohol, and substance abuse; and even increase seatbelt use. Some programs offer cancer screening, health risk appraisals, cooking classes, and a variety of health education activities. Reviews of the effectiveness of many of these interventions have shown promising results (Sorensen et al., 1998; Aldana and Pronk, 2001). The low-risk-maintenance programs are a more recent strategy and are designed to help maintain already healthy behaviors. It has been estimated that this strategy may be the most effective in influencing the health of a workplace population (Edington, 2001).

*Improving Productivity and Reducing Labor Cost for Employers*

Employers are increasingly concerned about the effect of poor health on the cost of health benefits as well as the cost of lost productivity. Interventions to improve employee health have been shown to improve financial outcomes for employers. Aldana and Pronk (2001) found a strong correlation between high levels of stress, excessive body weight, and multiple risk factors, and increased health care costs and illness-related absenteeism. Lower physical fitness and activity levels were also found to be associated with increased health care costs, although not with absenteeism.

Edington et al. (2001) showed that reductions in health risk factors including stress resulted in decreased medical care costs. Analyses of health risk and medical claims over a period of years indicated a correlation between decreased health risks and declines in cost of care. Additional evidence from Ozminkowski et al. (2002) demonstrated that after a period of 4 years, following introduction of programs to reduce health risk factors; a savings of $244.66 per employee was realized, compared to a traditional medical plan.

Workplace health strategies and programs today are progressing beyond the traditional health promotion approach toward integrating all

**TABLE 3-1** Current Trends in America for a Healthy and Productive Workforce

| Perspective | Current State | Desired State |
| --- | --- | --- |
| Function | Absenteeism | Performance |
| Cost Metrics | Medical Costs | Economic Outcomes |
| Care Model | Treatment Focused | Prevention and Behavior Change Focused |
| Medical Model | Individual | Population |
| Health Metrics | Disease Status | Health Status |
| Interventions | Single-Risk Focused | Multiple-Risk Focused |
| Health Framework | Employer-, Condition-, and Program-Centric | Employee-Centric |
| Management Systems | Segregated Programs | Integrated Systems |

aspects of health to look fully at health-related productivity. Employers are finding that not only is it important to affect the overall health of a population to manage health care costs and sustain productivity (e.g., by minimizing the effect of absenteeism) but that advancing health also reduces presenteeism (the effect of diminished health on an employee's ability to engage and function to full capacity while at work), reflecting the realization that not all employees present are fully engaged and optimally productive. Isolating the components of absenteeism, disability, workers' compensation, and presenteeism has enabled employers to more closely examine the effect of health risks on overall productivity (Edington, 2001).

In recent years, employers and relevant federal agencies have demonstrated that multifactor determinants of health and productivity must be addressed using new perspectives, metrics, and models. Table 3-1 outlines current trends toward achieving a healthy and productive workforce based on determinants of health and productivity.

*Function: From "Absenteeism" to "Performance"*

Global competition and systems analyses of productivity of the workforce has led to more holistic thinking about productivity at the workplace. Whereas absenteeism was the metric of choice for many years, the current metric has been expanded and evolved into the measurement of performance or presenteeism. Productivity at the workplace now includes two components: time away from work (absenteeism and disability) and presenteeism (job performance).

Presenteeism, a term first mentioned in the literature by Smith (1970), has been defined as being the exact opposite of absenteeism: being at work when you should be at home, either because you are ill or because you are too tired to be effective. Presenteeism recognizes that work was done, but at a level of performance below optimal (see Chapter 5 for further discussion).

The more recent application of this concept was first published by Burton et al. (1999), when actual work performance of call center operators was measured in relation to health risks and disease states. Because most jobs do not have an easily accessed metric for performance, a series of self-reported work effectiveness scales has been developed and incorporated into the more general Health Risk Appraisal (HRA). The establishment of a relationship between health risk indicators and disease incidence using self-reported performance skills while on the job has been recently described (Boles et al., 2004; Mayne et al., 2004).

A healthy work ecosystem is an enabler for improving and maintaining performance-based measures of productivity. Although "time away from work" measurements are relatively standard, presenteeism is very job- and organization-specific and must be defined within the context of each center. It may not be captured by civil service or contractor classifications and could be manager defined, in the case of NASA, either by organizational leaders or by NASA contractors who are familiar with the capabilities of a healthy worker.

If presenteeism cannot be defined and measured by job classifications, then more general self-report questionnaires may be used. A serious limitation to the measurement of presenteeism, however, is the absence of a gauge of quality of work. That is, an employee may be present each day and may be productive, but if that employee makes numerous mistakes, the total productivity is diminished.

*Cost Metrics: From "Medical Costs" to "Economic Outcomes"*

Employers' health-related concerns are dominated by rapidly increasing medical costs, but in general, there is little appreciation for the underlying and mitigable factors that drive medical care expenditures. NASA, like all federal agencies, obtains civil service employee health care through the Federal Health Employee Benefits Program (FEHBP), centrally administered through the Office of Personnel Management (OPM). Unlike private and non federal government sector employers, however, NASA does not receive information on health care expenditures to monitor for quality and health improvement purposes. Such data typically include utilization costs and data for hospitalizations, outpatient care, surgical procedures, medications, diseases, and nonoccupationally related injuries. This lack

of information on health care costs as a "starting point" to detect the risk factor- and disease-related costs is a significant disadvantage for NASA, compared to non federal employers, in trying to understand and improve the health and productivity of its workforce.

Employers have traditionally viewed "medical costs" as largely separate from productivity or "indirect costs" such as absenteeism, disability, and presenteeism. However, there is little question that non-occupational illness and injury has a significantly greater impact on productivity, morbidity, mortality, and health-related costs than occupational injury and illness. For example, in 2002, death from all occupational causes was 4.0 per 100,000 employed workers overall (BLS, 2003), a reflection of the "healthy worker" effect. In contrast, mortality per 100,000 population was 240.8 for heart disease, 193.5 for cancer, 25.4 for diabetes, and 36.9 for unintentional injuries. Even death from suicide and homicide exceeded all occupational cause mortality (NCHS, 2004). Cost data specific to employed populations was reported by Goetzel et al. (2001) in their analysis of health and productivity impacts for forty-three employers in 1998. Categories of cost and utilization examined included non-occupational health benefits and disability, workers' compensation, absenteeism and worker turnover rates.

The employers studied were from eight different industry sectors: communications (n=5), government and education (n=10), finance and insurance (n=4), manufacturing (n=8), and employed nearly a million workers. Data for 1998 showed the impact of non-occupational sources of morbidity and cost far exceeded that of occupational causes as reflected in workers' compensation costs. Goetzel et al. (2001) reported the range of per capita costs for these corporations related to non-occupational health benefits as $3,127 to $6,421; for non-occupational disability, $225 to $1084; and for workers' compensation, $93 to $863. While it is unclear from these data whether the non-occupational health benefits data are for the employee only or the employee plus dependents, even at one third the cost reported, assuming the reported costs reflect a conservative allocation of cost at one third employee/one third spouse/one third children, the conclusion is unchanged.

*Care Model: From "Treatment-Focused" to "Prevention and Behavior Change-Focused"*

The leading causes of premature morbidity and mortality in the United States have consistently been shown to be modifiable health behaviors (McGinnis et al., 2002; McGinnis and Foege, 1993). Recent large cohort studies of Asian and Mediterranean populations have further supported the finding of an unnecessary U.S. burden of risk factor-related disease. It is estimated that 65-85 percent of heart disease, 60 percent of

cancers, and 91 percent of diabetes among Americans are caused by modifiable personal health behaviors that, if adapted, would result in a likely 50 percent reduction in all-cause mortality (Knoops et al., 2004; Rimm and Stampfer, 2004). Both the U.S. Preventive Services Task Force and the U.S. Community Preventive Services Task Force provide evidence-based recommendations for the prevention of risk factors, illnesses, and injuries (see above).

The medical and short-term disability costs of preventable medical conditions are substantial (Edington and Musich, 2004). In at least two studies, excess risks were clearly related to excess costs in workers' compensation and short-term disability costs (Musich et al., 2001; Wright et al., 2002). Thus, the outcome of controlling costs through the process of controlling risks becomes obvious, and risk-reduction and low-risk maintenance programs should become a major business strategy in moderating disability costs.

### Medical Model: From "Individual" to "Population"

The traditional medical model focuses on treating individuals after a series of symptoms are identified and associated with a known disease. It has been useful for the diagnosis and treatment of disease in individuals; however, a population-based public health framework ("agent-host environment" causation of diseases or conditions) is more suitable to address both the health of the general population and workforce health issues (Rose, 1985; McKinlay, 1995; Berkman and Kawachi, 2000; Wilkinson and Marmot, 2003; Goetzel, 2004). Occupational health and safety models, closely aligned with a public health perspective, emphasize a systems-based approach to preventing illnesses and injuries and sustaining good health. A similar population health-based approach to effectively alter individual health behaviors is needed to address large preventable burdens such as disease and lost productivity. Employers are more likely to improve their employees' health and productivity using multiple strategies and tactics at the population level than by focusing on individual medical or clinical programs to address risk factors, disease, and injuries as they occur.

Most employers continue to focus on postevent medical claims, although heart disease, cancer, diabetes, and musculoskeletal disorders are major threats to performance and mission accomplishment (Wang et al., 2003; BLS, 2002). However, as discussed in Chapter 2, health care costs, costs resulting from the centralization of occupational preventive medicine, and data on prevalence of conditions are not visible at NASA, and are thus not seen as a mission threat or as a predictor of disease, injury, or death.

*Health Metrics: From "Disease Status" to "Health Status"*

Employers have monitored health care costs that reflect medical expenditures for existing diseases or conditions but have not been able to track either the actual prevalence of disease or the prevalence of important health risk factors. Numerous studies have shown that risk factor identification and early disease detection have beneficial effects on associated health care and productivity costs (Edington et al., 1997; Edington and Musich, 2004; Martinson et al., 2003). Some employers, therefore, are attempting to monitor both individual and population "health status," as expressed by the presence or absence of risk factors and other indicators shown to be associated with workplace performance such as cardiorespiratory endurance (VO-2 max) (Pronk et al., 2004a).

Although disease status is often the metric of choice as the "driver" of health care and lost productivity costs, the more important factor is actually health status (Yen et al., 1991; Edington, 2001). Overall health status might be thought of as the sum, among others, of risk factors and disease state, and it is influenced by lifestyle choices, genetics, and workplace environmental factors. Monitoring of health status for a population of employees is the preferred metric to document improved health and productivity (Edington, 2001).

*Interventions: From "Single-Risk Focused" to "Multiple-Risk Focused"*

Tobacco use, unhealthy diet, physical inactivity, overweight, and obesity remain the leading causes of morbidity and mortality in the U.S. today, and some factors are continuing to increase in prevalence (McGinnis and Foege, 1993; Mokdad et al., 2001; Orleans, 2004). Effective interventions have been described for many specific health behaviors, and the U.S. Preventive Services Task Force supports the assertion that implementing these is among the most effective approaches to reduce the incidence as well as the frequency and severity of the leading causes of morbidity and mortality (Nigg et al., 2002; Orleans et al., 1999; http://www.ahrq.gov/clinic/gcpspu.htm). Unfortunately, rates of screening and implementation of brief interventions to address these risk factors remain low in a variety of settings, including primary care (Pronk et al., 2004b; Whitlock et al., 2002).

Many of these health risk factors tend to cluster within individuals (Coups et al., 2004; Fine et al., 2004; Pronk et al., 2004c). Using 2001 National Health Interview Survey data, Fine and colleagues (2004) examined the prevalence and clustering of four risk factors—smoking, alcohol consumption, low levels of physical activity, and overweight—among adults in the United States. They provided point prevalence estimates for each

risk factor singly and in combination with others (see Chapter 5 discussion of Prevention Programs for examples). On the basis of their estimates, only 10 percent of the adult population had none of the four risk factors, whereas one, two, three, and four risk factors were noted among 33 percent, 41 percent, 14 percent, and 3 percent of the population respectively. Hence, multiple risk factors (two or more of these four) occurred in the majority of the U.S. population. Other studies by Coups and colleagues (2004) and Pronk et al. (2004c) have confirmed these results.

A small proportion of working-age adults and seniors meet recommended guidelines for multiple behavioral risk factors that are associated with health benefits (Pronk et al., 2004c). In fact, the majority of the U.S. population has two or more risk factors at the same time (Coups et al., 2004; Fine et al., 2004; Pronk et al., 2004c). Because multiple behavioral risks are present simultaneously among most people, addressing these risk factors in combination rather than singly is warranted, but requires more effective models, tools, strategies, and systemic support for integrated health behavior change efforts (Orleans, 2004).

To be more specific about what could be done to translate current scientific knowledge into practical applications, Glasgow et al. (2004) enumerated five principles and fifteen hypotheses for consideration and testing in the context of addressing multiple risk factors in the primary care setting. Three of the five principles of program design related to the patient–clinician interaction and included greater use of the "5As" model of self-management—assess, advise, agree, assist, and arrange (Goldstein et al., 2004)—collaborative goal-setting and shared decision-making, and recognition that the primary care setting is only a component of the patients' larger social framework. The other two principles included the notion that individual-level behavior change should also apply to practice and health system levels, and that redesign of the practice office environment through inclusion of more proactive and planned actions will produce better outcomes. These principles can easily be applied to the employer/worksite setting. In addition, the associated fifteen hypotheses can be used for guidance in creating testable and manageable processes that apply to NASA specifically.

*Health Framework: From "Employer-, Condition-, and Program-Centric" to "Employee-Centric"*

A condition- or program-centric framework inadequately addresses determinants of poor health, increased costs, and decreased economic outcomes. Condition- and program-centric approaches artificially segment human populations, ignore interactions, suboptimize worker en-

counters, and can become static and unresponsive to changes in an employee's dynamic ecology.

Golaszewski et al. (1998) showed that environmental (employer) interventions can be effective in supporting employee efforts to maintain and improve health. Just as the medical care system is "provider-centric," a change to an employee-centric focus can ease employee engagement and improve their personal health and medical care outcomes. A parallel argument can also be made to all employer policies and programs.

The transition away from a model that measured "indicators of health" as a consequence of mortality and disease rates began in the mid-twentieth century with the World Health Organization's broader view of health as complete physical, mental, and social well-being rather than the absence of disease (WHO, 1948). Subsequent work contributed to the evolution in thinking about health and the effect of a variety of biological and social determinants on physical, mental, and social well-being. (See Figure 3-1 for illustration of the Evans and Stoddart model of health, the determinants of health, and the health care system.)

The effect of the social and physical environments on health and health-related quality of life was further developed in a model proposed in the IOM report *The Future of the Public's Health in the 21st Century* (IOM, 2003b). This model, shown in Figure 3-2, illustrates how the characteristics of these environmental factors affect physical, mental, and social well-being.

*Management Systems: From "Segregated Programs" to "Integrated Systems"*

As discussed previously and in Chapter 2, the current state of occupational health at NASA reflects a traditional work organization and division of responsibility with centralization of policy, compliance and audit, and decentralized program planning, funding, resource management, and service delivery (see Figures 1-2 and 2-1). Further, at the local level, NASA occupational health activities are managed on a program-by-program basis. This method of service delivery is highly vulnerable to program segregation, and it tends to diminish opportunities for cross-program synergy and reinforcement of health objectives which occur at each encounter, irrespective of the specific program triggering the encounter. Outsourced occupational health programs under very large site-wide contracts, for which the occupational health team at NASA has little direct oversight, create obstacles to vendor collaboration and efficient integration of interventions.

To pursue additional individual and organizational benefits associated with a more holistic view of health and work, Occupational Health at NASA requires a service construct oriented toward human performance;

Living and working conditions may include:
• Psychosocial factors
• Employment status and occupational factors
• Socioeconomic status (income, education, occupation)
• The natural and built[c] environments
• Public health services
• Health care services
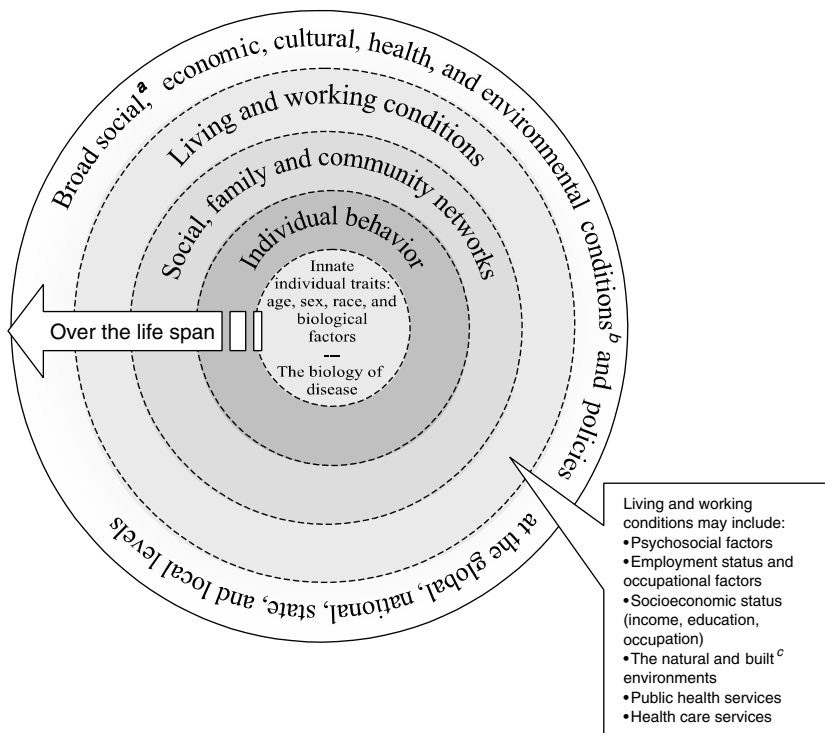
**FIGURE 3-2** A guide to thinking about the determinants of population health.

[a]Social conditions include, but are not limited to: economic inequality, urbanization, mobility, cultural values, attitudes and policies related to discrimination and intolerance on the basis of race, gender, and other differences.

[b]Other conditions at the national level might include major sociopolitical shifts, such as recession, war, or governmental collapse.

[c]The built environment includes transportation, water and sanitation, housing, and other dimensions of urban planning.

SOURCE: *The Future of the Public's Health in the 21st Century*, IOM, 2003b. Adapted from Dahlgren and Whitehead, 1991. The dotted lines between levels of the model denote interaction effects between and among the various levels of health determinants (Worthman, 1999).

a health model focused on population, rather than individual goals and objectives; and a measurement system oriented toward health status and outcomes (Table 3-1). A systems approach rather than a programs approach better supports this paradigm because systems are constructed of linkages and seek synergy. Systems operations require thinking, work processes, and resource utilization which emphasize integration, collaboration, and optimizing overall performance rather than stand-alone components or programs.

### Integration Across Program Components

Goetzel et al. (2001) have made the case for an integrated health approach. In their report, data from 43 employers with an annual median total health and productivity management cost per employee of $9,992, included costs in five core areas: group health, turnover, unscheduled absence, nonoccupational disability, and workers' compensation. When other program areas were considered, the figure increased to $10,365 per employee per year. A savings of 26 percent per employee per year was shown to be possible by using an integrated approach in the five core areas.

### FINDINGS

Occupational health, safety, and wellness programs at NASA, as at the majority of U.S. employers, are currently organized as a program-centric model with a focus on disease status rather than health status; treatment and traditional physical health risk factor modification, with relatively less emphasis on mental health and behavior change; an individual- rather than population-based medical model; and a program-by-program approach to risk factor remediation rather than an integrated multiple-risk approach (see Table 3-1). These traditional approaches to occupational health and health promotion are not well adapted to the needs of the modern knowledge workforce and represent a significant opportunity for reengineering and improvement.

### RECOMMENDATION

**The committee recommends that the administrator of NASA adopt a new vision for worker health, readiness, and resilience that directly links to NASA's mission and includes health as a core NASA value that is implemented through an integrated health and systems approach.** This vision should extend and apply to the entire NASA workforce and should:

- clearly articulate a broader perspective of health and how it advances NASA's core mission;
- be adopted and adapted by each center's director to maximize the alignment with each center's mission and workforce composition; and
- be promoted and implemented vertically and horizontally within NASA, using participatory strategies to ensure sustained senior management and organizational commitment and total workforce engagement.

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4

# Organizing and Managing Employee–Integrated Health Programs and Policies

This chapter describes the best principles and practices of organizational and management activities needed by any organization to implement a new paradigm for integrated health and performance.

## IMPLEMENTING AN EMPLOYEE-INTEGRATED HEALTH PROCESS

The success and sustainability of an integrated health process must begin with a clear understanding of the organization's mission. The organizational culture similarly is set by senior leadership, which includes the company chief executive officer or organizational administrator and others with high-level management responsibility. Leadership behavior directly communicates the critical importance of policies, programs, and practices designed to optimize the health and productivity of the workforce.

Senior leadership must ensure that human resource activities, personnel benefit designs, occupational health and safety policies, environmental health, wellness programs and practices, and disability management are integrated and coordinated. These company or organizational leaders must further ensure that all relevant stakeholders participate in the planning process to provide input. Roles and responsibilities of key functional middle management and first-line supervisors can then be defined in the context of their contribution to the broader organizational mission. All individual and organizational factors contributing to the

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health and productivity of the workforce must be addressed, monitored, and improved over time.

To determine the success of each integrated health programmatic component, data systems must be able to reflect an "employee-centric" perspective rather than a program-centric focus (see Chapter 6). A comprehensive data management system vision should not deter organization-specific linkages of databases or incremental improvements in capability.

The infrastructure, broadly defined as the personnel, technology, and information needed to support the integrated health effort, should be defined and appropriately supported as a "mission-critical" requirement. Defining the integrated health process through defining the value of an optimally functioning workforce to the achievement of the organizational mission ensures that this linkage has already occurred. Allocating sufficient resources to the integrated health effort consequently becomes a "*must have*" rather than a "*nice to have.*"

Creating incentives and defining accountability at the employee, unit, and organizational levels reinforces the organizational mission and culture. Whereas public sector organizations may have different processes or means to recognize achievement, they are equally as critical, if not more than, financial awards more commonly used in the private sector.

## CHARACTERISTICS OF WORLD-CLASS PROGRAMS

Programs that experience long-term success and are consistently recognized as "best practice" programs share a set of common characteristics. Goetzel (2005) described these characteristics in detail. Importantly, they include relying on understandable mission and vision statements "that enable health, safety and productivity management-related functions to operationalize their goals and objectives." Further, safety metrics can help to link the organizational mission to health, safety, and productivity management metrics (Goetzel, 2005).

These characteristics were also presented in a workshop to the committee (see Appendix B) and are based on a formal analysis of a benchmark study conducted by the American Productivity and Quality Center (APQC, 1999). Supported by several sponsoring companies, this study used a cross-sectional survey that included site visits to the six highest-ranking programs. The survey was constructed and sent to 70 excellent, visible programs across the United States, achieving a response rate of 37 percent. Criteria considered in selecting the best practice programs included theory-based behavior change programs, financial impact, effective use of incentives, communication, comprehensiveness, integration

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**BOX 4-1**
**Characteristics of Best Practice Programs**

The Committee included descriptive analyses of surveys conducted in the study and a subjective review of interview data, along with information from its own expertise to derive the following characteristics that may be considered as "best practice":

- Program plans are linked to organizational business objectives;
- Top management supports the program;
- Effective communication programs are implemented;
- Effective incentive programs are used;
- Evaluation is an integral part of the program and is
  — Systematic;
  — Shared with top management;
  — Shared with employees;
  — Valued by top management;
- The creation of a supportive environment is strongly pursued;
- The program is appropriately resourced, with a sufficient budget;
- The program design is based on best practice management and behavioral theory (APQC, 1999; also see Chapter 5):
  — Goal setting;
  — Stages of readiness to change, the central construct of the Transtheoretical Model of Behavior Change; Define theories (Prochaska et al., 1997);
  — Self-efficacy as a recognized predictor for successful behavior change among employees;
  — Incentives to optimize program participation;
  — Social norms and social support features;
  — Programs tailored to the needs of individuals;
  — Multi-level program design that addresses awareness, behavior change, and supportive environments.

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with strategic planning of the organization, and uniqueness and innovation.

The list of characteristics in Box 4-1 clearly outlines the need for integrated data management and evaluation efforts. It also reinforces the need for data to be collected in a systematic manner, an approach that allows for data integrity and consistency. Furthermore, the data collected are used for a variety of purposes: to create reports that are presented to top management and all employees, ensuring that the program staff is accountable for the program's performance; for ongoing improvement of

the program, allowing for an assessment of need at baseline that may inform program staff of necessary actions to take and of barriers to opportunities; and it allows for the quantification of results following the implementation of change in programming. Finally, the program design is based on scientific theory. The reporting of the program's performance may, in fact, aid in the generation of new hypotheses that could be tested by others in a research setting or context and, in return, may benefit the field of worksite health promotion.

## Examples of Best Practices in the Private and Public Sector

Public as well as private organizations are searching for strategies to improve workforce health both on the job and at home. The integration of traditional occupational health, safety, and medicine programs with health promotion and disease prevention initiatives has produced successful programs. The best practice programs in both the public and private sector have been recognized for their achievement—for example, the American College of Occupational and Environmental Medicine (ACOEM) recognizes organizations with exemplary employee health and occupational and environmental medicine practices with its Corporate Health Achievement Award (CHAA) (ACOEM, 2004). Recipients of the CHAA may serve as model programs that demonstrate successful integration of health, safety, and employee well-being to improve productivity and accomplish organizational goals. Their program experiences can be usefully applied not only to NASA but also to any large organization trying to move forward into integrated occupational health programs.

## BankOne

BankOne, the sixth-largest U.S. bank holding company and employer of over 70,000 people, is a recipient of the C. Everett Koop National Health Award (1993) and the American College of Occupational and Environmental Medicine Health Achievement Award (1998) (Burton, 2004). Like NASA, BankOne is a large organization with a diverse and geographically widespread workforce. This organization is structured to integrate health management both strategically and operationally. Health management includes an integrated health data management system, a health risk appraisal program, and women's health wellness programs (Burton, 2001). Components of the integrated health system at BankOne that contribute to its success include:

- A comprehensive data warehouse;
- Programs that address specific health needs of workers;

- Ongoing evaluation of existing programs and exploring innovative new programs;
- A holistic, integrated view for health care; and
- Management acceptance and promotion of the concept of integrated health management.

Each of the components of this management systems approach to employee health have contributed to establishing and maintaining a successful integrated health system that builds on this organization's strategy to advance its organizational goals and objectives.

The benefits of an integrated approach to disease management were reviewed by Musich et al. (2004). The results of this review point to the importance of the benefits of an integrated approach to the total health care delivery system, and the association of reduced costs and increased savings derived from this approach with economic benefits to employers.

### Johnson & Johnson

Johnson & Johnson began its Live for Life Program in 1979. The concept of encouraging positive lifestyle choices was introduced to the company through its group chairman, Jim Burke (Isaac and Flynn, 2001). The program showed successful results for many of its intervention programs. For example, a 2-year follow-up on application of the smoking cessation initiative offered in the Live for Life program to four other companies indicated that 22.6 percent of smokers who participated in the program quit smoking, compared to 17.4 percent at companies offering a health screening only. Among high-risk smokers, 32 percent of those participating in Live for Life quit, compared to 12.9 percent at nonparticipating companies (Shipley et al., 1988).

Live for Life then evolved into its current configuration, Health and Wellness, a program that integrates health promotion activities with disability management, occupational health, employee assistance, and worklife programs. Health and Wellness provides employees with programs consistent with the credo of integrity, work–home balance, and commitment to employee health and safety, thus placing greater emphasis on reducing behavioral and psychosocial risk factors before they are transformed into disease and disability (Goetzel, 2002; Isaac and Flynn, 2001). The basis of the program is a Health Risk Appraisal (HRA) with follow-up risk reduction and health improvement interventions. As of 2001, Health and Wellness had a 90 percent participation rate among employees. A financial impact study on Health and Wellness showed that the cost savings on employee health care costs combined with administrative savings amounted to approximately $8.6 million per year for Johnson

& Johnson (Ozminkowski et al., 2002; www.24hourfitness.com/html/ corp_well/savings/study). An examination of the long-term financial impact of the Health and Wellness program estimated an average savings of $224.66 per employee per year for a 4-year period following implementation of the program (Ozminkowski et al., 2002). These cost savings also reflect an increase in the health and productivity of employees.

### Hughes Electronics

Hughes Electronics began its WorkWell program in 1995, expanding the program over the next eight years into a comprehensive integrated health and productivity program. Senior leadership at Hughes, as at BankOne, recognized the value of helping employees maintain and improve their health status, and committed themselves to offering programs aimed at helping employees achieve their health goals.

The program at Hughes was integrated into existing medical and disability plans, thus ensuring its value as a benefit to employees. It offered employees a $200–$300 discount on health care premiums as an incentive to participate in a health risk appraisal and, if needed, lifestyle risk-reduction program. This program was considered part of its health plan and was aligned with the disease management programs offered in the Preferred Provider plan. Coordination with the disability management vendor, when appropriate, led to integration across programs for the company. Hughes's wellness program was aimed at improving the health of employees, as well as reducing health plan claims costs and employee absence.

A study of Hughes's WorkWell participants between 1995 and 1998 showed a savings of $374 per eligible employee in the medical claims expense for all employees in the medical plan and $567 per WorkWell participants (Hymel, 2002, 2003; presented to Washington Business Group on Health). A study in 2000 demonstrated improved health of the participants in WorkWell, as evidenced by 12 percent fewer instances of cardiovascular conditions and an 8 percent reduction in back conditions in participants versus nonparticipants. A later study of continuously enrolled participants from 1999 to 2002 showed a savings of $402 per employee in the medical plan and $163 per employee in the disability plan (Hymel, 2002, 2003; presented to Washington Business Group on Health). Studies also demonstrated a shorter average length of disability among WorkWell participants, and savings of over $2000 per disability claim among WorkWell participants. In 2002, the return on investment for the program, after program costs were subtracted, was 2.7:1 (Hymel, 2002, 2003; presented to Washington Business Group on Health).

The program at Hughes illustrates how appropriate incentives can improve employee participation in an integrated health and wellness program. It also demonstrates direct cost benefits for the company.

## MANAGEMENT SYSTEMS FOR INTEGRATED SAFETY AND HEALTH

The preceding discussions review the basis for and the components of a strategy for advancing employee integrated health (see Chapter 3 and Table 3-1), and the importance of building that strategy to advance key organizational objectives. The following discussion centers on the challenge of implementation—specifically, how can the organization's initial support and engagement around integrated health goals be sustained for the needed long-term commitment? Further, how can the necessary organizational behaviors be integrated into the way the management and work force function, and into the processes the organization uses to get things done?

Public-sector enterprises, like their private-sector counterparts, will continue to experience major perturbations from sources such as government policies, catastrophic events, or transformational innovations, and these create powerful tendencies toward disengagement, loss of focus, and failure related to integrated health program commitments. In addition, even where disruptive forces are successfully negotiated, strategies can fail because of weak vertical or horizontal intraorganizational linkages or an erosion of senior management involvement and accountability.

### Evolution of Management Systems

Successful occupational health and safety functions (Fronstin and Werntz, 2004) have transitioned from their hierarchical "command and control" past to a systems approach to occupational safety and health. Systems approaches focus less on disconnected programs and more on
- Engagement of stakeholders;
- Identification and integration of inputs;
- Management of interfaces between components;
- Making trade-offs that emphasize the end goals, not the component parts, and have a disciplined process for measurement; and
- Assessment and change.

As shown in Table 4-1, occupational health and safety management systems (OHSMS) are outgrowths of the quality discipline best reflected in the total quality management approach of W. Edward Deming (Mahoney and Thor, 1994). Deming, General Electric (Six Sigma Program),

**TABLE 4-1** Evolution of Occupational Health and Safety Management Systems

| Evolutionary Timeline | Developmental Outcome |
| --- | --- |
| 1960s Deming's Plan Do Check Act Approach | Total Quality Management approach using teams, processes, statistics and continuous improvements |
| 1980 Six Sigma | Metric/data-driven decision making to TQM and customer satisfaction |
| 1982 OSHA VPP | OSHA Voluntary Protection Program for performance-based health and safety management |
| 1987 Baldrige Quality Improvement Act | Quality award recognition as a marketplace advantage |
| 1994 ISO 9000 | First certifiable international standard on Quality |
| 1996 ISO 14001 | Global Environmental Management System standard using quality processes |
| 1996 OHSMS Standards & 2001 Guidelines | Concurrent release of Occupational Heath & Safety Management Systems in ISO 9000/14000 like format: <br>• British: BSI 8800 (1996) & 18001 OHSAS (1999) <br>• Spain: UNE 81900 (1996) <br>• Japan: JISHA OHSMS (1997) <br>• Australia/New Zealand: AS/NZS 4801 (2001) |
| 2001 ILO/OSH Guidelines on OSHMS | International guidelines for developing national Occupational H&S Management Systems |
| 2004 ANSI Z10 OHSMS | ASC Z10 Committee approval of an American OHSMS standard (draft) |

NOTE: Deming, General Electric (Six Sigma Program), the Malcolm Baldrige quality construct and various ISO and national standards firmly established that building a quality culture to deliver sustained reductions in undesirable variability (defects) requires major behavioral and organizational change.

SOURCE: AIHA, 1996; BSI, 1996a,b; ILO, 2001; ISO, 1996, 2000; OSHA, 1991.

the Malcolm Baldrige quality construct and various ISO, and national standards (Table 4-2) firmly established that building a quality culture to deliver sustained reductions in undesirable variability (defects) requires major behavioral and organizational change. Changes include a clear client focus and quality vision, top-to-bottom organizational accountability, integration of processes, data-driven decision making, and leveraging all available resources, including customers, suppliers and partners.

A management systems approach is the basis of an integrated health

**TABLE 4-2** Requisite OHSMS Elements

- Management Commitment
- Employee Participation
- Occupational Health and Safety Policy
- System Planning with Goals and Objectives
- Programming Resources
- Education and Training
- System Implementation and Operations
- Evaluation and Assessment
- Preventive and Corrective Action
- Documentation and Record Keeping
- Emergency Response
- Management Review

and management system. Such an approach requires accountability throughout the organization, resource leveraging, evidence-based decision-making, and integration of segregated processes.

Systems approaches to achieve critical enterprise objectives, or "management systems," have been deployed during the last decade—first in the environmental affairs arena (ISO, 1996), and more recently in the health and safety arena (OSHA, 1991; AIHA, 1996; BSI, 1996a,b; ILO, 2001). These approaches are being used as a mechanism for achieving safety and health enhancement goals in complex organizations, and in some instances as procurement requirements in contract bids. While the Voluntary Protection Program (VPP) established in 1982 by the Occupational Safety and Health Administration (OSHA, 1991) could be viewed as an early management system approach, the British Standards Institute (BSI) created one of the first management system standards for occupational health and safety (BSI, 1996a).

A meeting of the International Organization for Standardization (ISO) twice failed to produce a similar standard (1996, 2000); however, when the question was put before membership, increasing interest was shown from member countries in the results of the second vote: 29 in favor versus 20 opposed (Levine, 2005). Parallel efforts have produced local and international specifications or guidelines, including BSI 18001 *Occupational Health and Safety Management Systems—Specification* (BSI, 1996b), the American Industrial Hygiene Association's *Occupational Health and Safety Management System: An AIHA Guidance Document* (AIHA, 1996), and *Guidelines on Occupational Safety and Health Management Systems* from the International Labour Offices (ILO, 2001).

### Defining an Employee-Integrated Health and Well-Being Management System

To have an effective employee-integrated health/well-being management system (IH/WBMS) requires a recognized structure to support the achievement of specific organizational goals for the physical and psychological fitness and resilience of an employed population. Box 4-2 illustrates such integration at Johnson Space Center. It manages processes within an organization through defined roles and responsibilities, resource allocation, objectives and targets, controls, measurements and evaluations, and feedback and review. The system is driven by the organization's integrated health policy, and the policy is realized through systematic planning, implementation and operation, checking and corrective action, and management review in a continuous feedback loop (Figure 4-1).

Using the management systems approach, companies such as IBM have shown consistent improvements in their work-related injury/illness rates and compensable injury experience, and have met customers' procurement requirements for health and safety performance and manage-
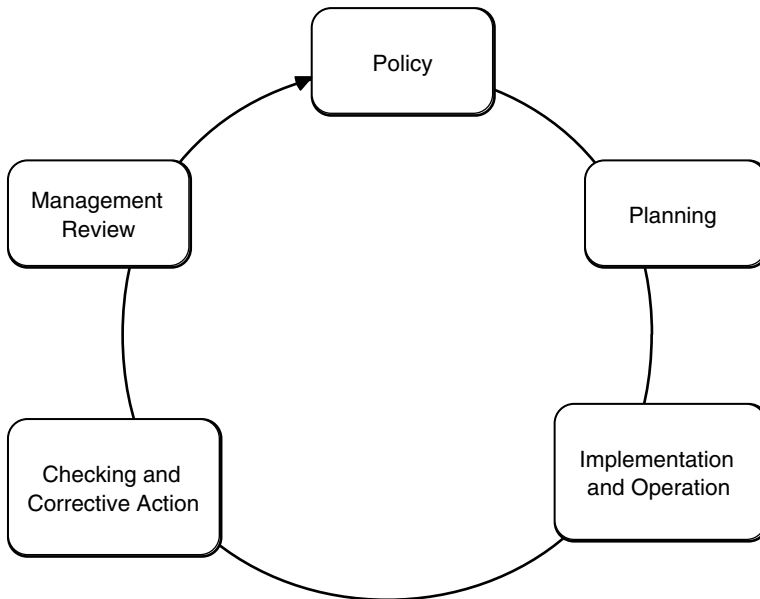


**FIGURE 4-1** IH/WBMS Cycle of Continuous Improvement.
SOURCE: Adapted with permission from IBM, 2005.

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**BOX 4-2**
**Integrated Health Practices at Johnson Space Center**

Johnson Space Center occupational health programs demonstrate a shared vision of the critical link between mission success and the health, safety and productivity of its workforce. That vision, established over many years, has created a culture that systematically links safety activities with occupational health programs and activities, and is reinforced by leadership and management through organizational practices and accountability. For example, the Executive Safety and Health Committee, chaired by the Center Director, requires weekly attendance by Division directors, including those from Safety, Life Sciences, Human Relations, and all other Operational directors.

Additionally, over a decade ago, JSC adopted the OSHA Voluntary Protection Program (VPP), which became the cornerstone of the safety/health integration and emphasis. The VPP program stimulated leadership, structure and metrics which could track and improve workplace safety. Leadership emphasis on VPP and demonstrated improvement in safety metrics lead to broader thinking about health and behaviors at home and in the community with an impact on safety, occupational health and performance at work.

This leadership- and metric-driven culture has resulted in a high level of program integration that can be tracked to the Center Director's emphasis on safety, the existence and support of "internal champions", and broad communication of successes which encourage employees to want to do more. Examples include a common language and easy-to-remember sayings used for emergency responses: "Clinic First" for all assessments of work-related injury or for emergency care while at the Center; "Feel the Squeeze, Dial the 3's" for chest pain ambulance response; and "Safety AND Total Health" and "Safety Actions=Health Results", used on educational materials, name tag holders and websites. These communication efforts clearly demonstrate a comprehensive perspective and emphasize the importance of an integrated approach to health, safety and productivity.

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ment system certification—providing them with an advantage in competitive bidding. IBM, for example, reports its performance reaching for its well-being goals in the former IBM *Well-being and Environment Report* (1999–2002), and currently in the IBM Social Responsibility Report (IBM, 2004). Box 4-3 illustrates a successful management systems approach for IBM.

Management provides direction and resources and ensures alignment with key enterprise goals. Employees contribute to priority setting as well

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**BOX 4-3**
**Case Vignette: A Management System Approach at IBM**

The integrated health/well-being management system (IH/WBMS) approach has facilitated global integration of core safety, industrial hygiene, and ergonomic workplace initiatives with workforce performance and productivity initiatives including disability, health promotion, prevention-focused health benefits design, and health care consumerism. Using the management system's approach, IBM has shown consistent improvements in its already low work-related injury/illness rates and compensable injury incidence, and has met customers' procurement requirements for health and safety performance and management system certification, thus providing IBM with an advantage in competitive bidding. IBM reports its performance against its well-being goals in the former IBM Well-Being and Environment Report (1999–2002), and currently in the IBM Corporate Responsibility Report (IBM, 2004). These annual documents are issued by the chief executive officer of the corporation.

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as to producing clarity regarding roles and responsibilities (e.g., establishing responsibility for healthy behavior; following safety procedures; and taking an active role in hazard recognition, reporting, and control). Within the system, controls are implemented and assessed periodically for effectiveness. Feedback from the reviews as well as other parts of the system (such as implementation and operation, checking, and corrective actions) is cycled back into the planning process to prioritize opportunities for improving health and productivity, as well as factors related to safety and hazard control.

## Policy

The management system typically begins with a policy statement that outlines the organization's commitment to continual improvements in employee well-being (ILO, 2001). It is the reference for measuring the suitability, adequacy, and effectiveness of the employee-integrated health management system. The employer, in consultation with employees and their representatives, devises this policy statement. The policy should be:

- Specific to the characteristics and needs of the organization;
- Clearly and concisely written and endorsed by senior management;
- Communicated to all employees in the organization;

- Continually reviewed, and revised as needed; and
- Made available to interested third parties.

The following objectives should be considered minimum components of an organizational health and safety policy statement:

- Protecting the safety and health of all employees through prevention policies;
- Complying with all federal, state, and local regulations; voluntary programs; and worker-management agreements for workplace safety to which the organization subscribes;
- Ensuring that employees are consulted and encouraged to participate in relevant programs in the management system; and
- Improving management system performance.

## Planning

Planning is the component that helps an organization select its strategies for meeting policy objectives. This step of the management system process requires the explicit articulation of specific short-term goals and objectives, commonly stated as "objectives and targets" (see Table 4-3). These decisions are based on a proactive assessment of the health experience of the workforce, planned changes to work organization or technologies required to perform work, or potential hazards and risks in the work environment.

The systems approach requires collective input from all elements of the management system during planning. Feedback from checking and corrective actions, management reviews, and channels of employee and management communications is required. Through such systematic data collection, the planning process is able to identify the best opportunities for advancing the enterprise mission by improving physical and psychological health as well as workplace safety.

Implementing this plan-do-check-act cycle requires addressing the elements summarized in Table 4-3 to deliver improvement and achieve sustained organizational focus over time. Once the objectives and targets are identified and agreed on, a plan to implement them can be developed and shared with management for discussion and allocation of resources.

Historically, health, wellness, occupational health, and related functions have not used "best management practices" which are applied to other core functions of an organization. The programming process translates the desired plan into resource allocation requirements. Systematic programming of resource needs (personnel, facilities, operations and maintenance dollars, etc.) is essential to ensure the attainment of organi-

**TABLE 4-3** Management Systems Standards

| Well-Being Aspects | Objectives and Targets | Examples of Outcomes |
|---|---|---|
| Health Promotion | 106 | • Primary prevention efforts including "flu" vaccine campaigns in Latin America, North America, and Europe, and hepatitis B immunizations for all employees in India and Korea. |
| Ergonomics | 100 | |
| Management Commitment | 28 | |
| Safe Environment | 27 | |
| Contractor Safety | 25 | |
| Training | 23 | |
| Self Assessment | 22 | • Development of a stress management program in Japan with training of over 1,000 managers including supporting resources on the IBM Intranet. |
| Mobility | 20 | |
| Climate | 14 | |
| Electrical Safety | 13 | |
| System Implementation | 11 | |
| Disabilities | 9 | • Global deployment of ergonomic information and training through IBM distance learning technology for all IBM office and remote and mobile workers in addition to manufacturing ergonomic training for employees in eight emerging market countries in seven languages. |
| Life safety | 8 | |
| Transportation/Travel | 8 | |
| Injury/ Illness Reporting | 7 | |
| Other (e.g., business transformation, fire prevention, work/life balance, toll design, etc.) | 240 | • Managers' self-assessment program which includes questions on health and safety training and records, provisions for ergonomics and special needs, requirements for handling potentially hazardous chemicals, facility inspections, and emergency procedures and reporting. |

zational goals following the creation of any major plan. This is particularly true of enterprise-wide functions that require collaboration and coordination between subdivisions within an organization that may have not been operating in an integrated fashion.

The creation or inclusion of an accounting and resource classification system for an integrated health performance plan is a prerequisite for programming in future years, budgeting for the current year, and informing future planning refinements based on performance. NASA's decision to implement a "full-cost accounting" system (Integrated Financial Management Program Core Financial Module Conversion to Full Cost Accounting; [http://www.hq.nasa.gov/office/oig/hq/]) uniformly across centers may represent a major opportunity to create the programming, budgeting, and performance-monitoring infrastructure that communicates to

**TABLE 4-3** Continued

| Well-Being Aspects | Objectives and Targets | Examples of Outcomes |
|---|---|---|
| | | • Enhancement of IBM's loss-prevention programs in one year involving 210 building reviews in 43 countries, covering the work locations of over 90,000 employees in Asia Pacific, Latin America, Europe/Middle East/Africa and Canada. |
| | | • Establishment of a program for qualifying vendors who do work for IBM with common contractor guidelines, training, and monitoring of vendors. |
| | | • Release of a Web-based health management solution for employees and their families that includes health-risk assessments and targeted health improvement programs. |

NOTE: Planning is the component which helps an organization select its strategies for meeting policy objectives. This step of the management system process requires the explicit articulation of specific short-term goals and objectives, here described as "objectives and targets." These decisions are based on a proactive assessment (risk assessment) of the health experience of the workforce, planned changes to work organization or technologies required to perform work, or potential hazards and risks in the work environment.

both leadership and workforce that an integrated health and performance approach is being implemented as well as ensuring accountability and evidence-based use of resources supported, over time, by metrics and performance data.

### System Implementation and Operations

The System Implementation and Operations component of the management system is about execution, or doing what you say you are doing. There are two general areas of implementation activities related to system operations. The first is providing, in as efficient a manner as possible, an appropriate level of risk control for current activities such as design and layout reviews, equipment and facilities maintenance programs, and ter-

rorism preparedness. With this core level of protection in place, the organization can apply resources for higher-order health objectives and targets such as improved functional status through condition management, improved health care consumerism, or enhancing the workforce's capacity to cope with workplace or personal sources of stress.

With system implementation, roles and responsibilities are defined and training is provided so that all parties can support the system in an effective and efficient manner. For example, it is important for an employee working with chemicals to understand both the hazards associated with the task as well as how his or her observations of potential risks or improvements are included in the integrated health management system's planning process.

The IH/WBMS also requires documentation and preservation of records to ensure system integrity. Documentation helps demonstrate system performance and helps ensure consistency and continuity of the employee-integrated health and safety process. The value of documented processes becomes clear when, in their absence, changes in personnel result in loss of tacit knowledge—this may include written processes for planning, tracking regulatory requirements, control procedures, management reviews, and communication (see Box 4-3).

## Checking and Corrective Action

Controls are defined and managed as a part of system implementation and operations. However, ensuring that these controls are effective is assessed through monitoring, measurements, inspections, and audits. Traditional programs check performance against specifications for safety procedures such as emergency eyewash testing, availability of fire extinguishers, exposures below permissible exposure limits, and training of chemical workers. Assessing the effectiveness of controls for employee-integrated health initiatives such as condition management programs might include auditing the security protections for electronic data interfaces, or examining the accuracy and completeness of claims databases for analyses of outcomes and financial performance and trends in utilization and costs. Checking and corrective action also require that reviews be conducted to determine whether the process includes the required inputs such as employee and management suggestions and participation, assessment of monitoring and measurements results, changes in business operations, and review of leading and lagging indicators.

## Management Review

This activity provides senior and lower-level management with data pertaining to progress on meeting the specific objectives and targets in a given cycle. It also enables management and the Occupational Health and Safety (OHS) or integrated health program team to discuss employee health and safety initiative alignment with changing business strategies, technologies, and workforce strategies. Accountability is established, and a determination made whether the system is suitable, adequate, and effective for meeting the objectives outlined in the employee-integrated health policy. Senior management priorities for the succeeding cycle of improvement are established at this time.

## A Health and Productivity Management System at NASA

The components of the management system discussed above can be adapted by NASA to create a multi-layered, employee-focused Health and Productivity Management System (HPMS) as described in Figure 4-2. The management system is effective when the individual employee at the center of the system is able to access integrated program components in a timely manner. Such a management systems approach, as first observed at Florida Power and Light (Personal communication, D.W. Edington [Modified from Florida Power & Light], February 2005), combined with the current safety program at NASA would provide a world-class systems approach to employee health and productivity.

The integrated HPMS system in Figure 4-2 works by first ensuring that the program is tied, if possible, to the design of the federal healthcare plan provided to NASA employees. Preventive care services, wellness programs, and positive behaviors should be covered, and appropriate incentives could be built into the plans to encourage and facilitate the individual employee's access to the covered benefits.

The second component of the system is to have a health advocate available to guide employees in selecting and utilizing benefits. In some instances, this advocate could assume the role of a health coach, who would be responsible for important environmental concerns related to effective performance at the worksite.

The third component is the behavioral health initiatives, including employee assistance and work-life programs, the purpose of which is to provide resources for employees to maintain a level of work performance that is sustainable. Further, health initiatives could provide a safety net if or when an employee's outside life events begin to affect performance at work. A model program that illustrates integration of health promotion with disability management, occupational health, employee assistance,

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**Employee Total Health Management**

**Health Plan Design**
- Health Maintenance Organization
- Child Health and Disability Prevention
- Preferred Provider Organization

**Disease and Case Management**
- Chronic Conditions
- High Risk Combinations
- Lifestyle Behaviors
- Catastrophic Conditions

**Fitness Center**
- Low Risk Maintenance
- Risk Reduction

**Absence Management**
- Short-term/Long-term Disability
- Federal Workers' Compensation
- Credentialed Staff

**Health Advocate**
- Environment Concerns
- Get the Care You Need
- Coaching and Outreach

**Primary Care Centers**
- Outpatient Services
- Cost-effective Fees
- Credentialed Staff

**Behavioral Health**
- Employee Assistance Program
- Work-life
- Healthy Behavior

**Occupational/Environmental Health**
- Safety-injury Prevention
- Occupational Medicine
- Environmental Health Programs
- Disaster Preparedness and Acute Care

**Health Portal**
- Stay Healthy
- Health Communications

**Health Risk Assessment**
- Assess Health Status (HRA)
- Maintain Health
- Address Health Risks

**Wellness Programs**
- Prevention
- Screening
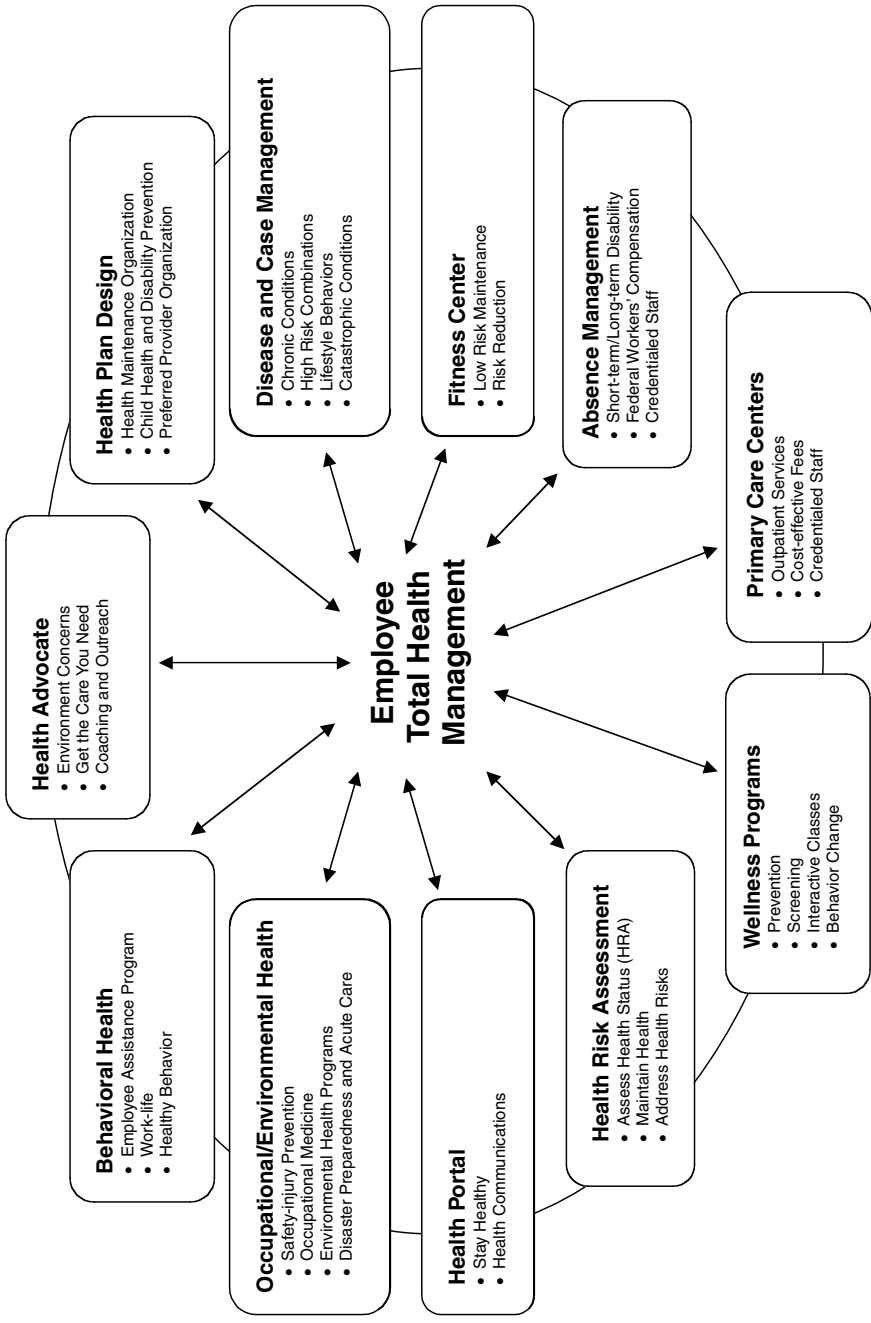- Interactive Classes
- Behavior Change

**FIGURE 4-2** An integrated and sustainable approach for Total Health Management.

SOURCE: Personal communication, D.W. Edington [Modified from Florida Power & Light], February 2005. The diagram above and the following examples illustrate how access to integrated programs and resources can help individual employees improve and maintain their health and productivity.

Use of the Wellness Programs and the Fitness Center (see the respective boxes in the figure), for example, helps employees maintain their health and vitality. This is further enhanced by communication between the Health Plan Design team and Health Advocate (see the respective boxes in the figure), based on the health care needs of the employees, to assist them in finding the appropriate resources at the time they are needed.

As another example, in a Health Risk Assessment program, after a Health Risk Appraisal (HRA) screening identifies a worker with hypertension and increased stress, the worker is referred to the Behavioral Health and Disease and Case Management programs for care (see the respective boxes in the figure). While receiving care, specific metrics are collected, entered into an integrated database, and assessed. These data points can then be used to improve the relevant programs, and ultimately improve the success of the Employee Total Health Management system, the core of the integrated and sustainable approach represented by this figure.

As a final example, a worker with many absences would likely be referred to the Absence Management program (see the box in the figure). If, for instance, an instrument used within this program discovers that chronic back pain is the reason for the recurring absences, a further referral is made to the Disease and Case Management and Health Plan Design programs (see the box in the figure) for treatment. As in the first example, metrics would be collected under these programs, and entered into an integrated database. These metrics help identify opportunities for improving and strengthening the individual programs in this figure and the Employee Total Health Management system as a whole.

and work-life programs is that of Johnson & Johnson (described above and in Goetzel, 2005).

The fourth component is the integration of time away from work issues, including absence, disability, or the development of disease. The purpose of the integration of these measures among other components of the HPMS is the potential for interaction of sometimes independent developments. It is highly likely that an absence day could become a leading indicator of a future disease or behavioral health issue. The health advocate described above could be responsible for observing interactions and steering resources to individuals in need.

The fifth component of the HPMS is wellness, including a health risk assessment program, health portal, fitness centers, and other wellness offerings. The HRA represents the core technology of the total HPM approach. The HRA provides employees with an inventory of behaviors and risks that affect their personal vitality in a positive or negative way. The feedback to the employee points toward available resources within the system to facilitate the maintenance of positive factors and improve negative factors. The health portal is available for immediate information and to help employees make informed choices and personally track health behaviors, if appropriate. The purpose of the fitness center is to provide a convenient location to initiate or maintain a healthy physical activity program, or rehabilitation from injury. The wellness programs should have risk-reduction and low-risk-maintenance components available to serve the needs of a diverse workforce. These programs are offered in a variety of venues and are designed to provide employees with offerings appropriate to their needs and interests.

The final component is the medical or primary care center. This component can be offered in a variety of formats, including a full primary care center, or a small medical clinic to address occupational injuries. The clinic also could be the location of the employee's individual electronic medical record, if NASA decides to continue with this initiative.

Most of the components illustrated in Figure 4-2 and described above are discussed in greater detail in Chapter 5. In addition, not only must the HPMS programs be integrated and sustainable, as diagramed in the figure, but data must be integrated into the measurement and evaluation systems, as described in Chapter 6.

## FINDINGS

The current health vision for NASA employees, achieving an improved level of health status as a consequence of employment at NASA, does not establish a clear link to the larger organizational mission. As a consequence, it does not provide NASA leadership with a compelling rea-

son to commit resources and management attention to employee health needs beyond hygiene components, such as injury prevention, exposure and occupational hazard control, regulatory compliance, and emergency response.

A mission-driven vision for health should articulate why investment in health and employee-integrated health helps NASA achieve its core mission on time, under budget, and better than expected. Best-practice health and safety functions exhibit work organization and functional levels of integration, which are limited at NASA. Workplace safety is not an integral part of occupational health at NASA; it is linked instead to mission safety. In addition, health behavior and non-occupational health experiences are not a core source of data and engagement for the NASA occupational health team. As noted in Chapter 2, a uniform, consistent, and integrated database is key to monitoring program and system performance and providing necessary feedback for the design and implementation of health and wellness programs. Health benefits design and use are substantially disconnected from current OCHMO activities, and yet they present the most significant opportunity for health enhancement. Current approaches to employee health are work exposure driven, and except for centrally mandated surveillance programs, they tend to vary between centers in terms of resource allocation. Improved funding and resource allocation for agency-wide health priorities is needed to secure a standard level of health performance and resilience in NASA employees.

A management systems approach for NASA will serve as a means to establish and achieve specific integrated health priorities for its knowledge workforce. Benchmark management systems, such as described in Box 4-4, are available both in the private and public sector and could serve as useful models for design and implementation insights. Goetzel (2005), based on a comprehensive review of organizational best practices, has outlined a step-wise process for implementing an integrated approach to health, safety, and productivity improvement and management. The first step is "diagnosis," which utilizes data analyses that focus on the organization as a whole as well as the employees. The second step is "strategic and tactical planning" involving a team approach to evaluate diagnostic data, consider intervention options, and develop strategic plans to implement solutions. The third step is "intervention," in which solutions are first divided into the broad categories of disease management, health promotion, workplace environment, and organizational climate and culture, and then are implemented. The final step is "measurement": interventions are evaluated for success or failure and possible retooling (Goetzel, 2005).

This quality systems-based approach can be an effective mechanism for targeting increasingly scarce resources at higher-value initiatives re-

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**BOX 4-4**
**Case Vignette: IBM Corporation's Integrated**
**Health/Well-Being Management System**

IBM is an information technology company providing solutions and services to clients in over 160 countries with a global workforce in excess of 300,000 people. IBM implemented a well-being management system in 1999, at a time when standards in occupational health and safety management systems were just surfacing. Faced with major changes in its business (e.g. from products and manufacturing to services and solutions) and work process (e.g. fixed work locations to mobile, virtual, and client-based), IBM required a better system for supporting employee health, productivity and safety. New work methods and a highly dispersed and matrixed organization created inefficiency, effectiveness- and cycle time challenges within existing approaches to employee well-being and safety. IBM designed its well-being management system to integrate health improvement and health care into a single worldwide well-being process as well as addressing requirements in traditional safety, ergonomics and industrial hygiene areas. Since 1999, the IBM well-being management system has produced over 500 improvement objectives and targets worldwide, all aligned to corporate health priorities with linkages to local and regional health and well-being needs (Table 4-3).

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lated to the physical and psychological fitness and resilience of a high-performance workforce. An employee-integrated health management system is a tool that creates engagement and accountability, focuses on specific outcomes, and discipline to measure and improve employee health by integrating people, processes, and resources toward specific common goals and objectives.

## RECOMMENDATIONS

**1) To achieve an integrated health program which is grounded in a management systems approach to health and safety, as identified in Table 4-3, NASA should recast its employee health vision to improve linkage and support for NASA's core mission and goals; integrate workplace safety into the occupational health function; establish specific interfaces or linkages between health benefits design and administration in Human Resources and Occupational Health for analytic, intervention, and outcome assessment purposes; and adopt a management systems approach to actualize, sustain, and**

**improve NASA's commitment to and performance in employee health, safety, and well-being.**

**2) To the extent possible, NASA Headquarters should encourage consistency between core occupational health programs, health data collection, impact assessment, and program evaluation.** A management systems approach that consolidates local with NASA-wide health priorities can ensure harmonization. In addition, consistency in programs and data collection, assessment, and evaluation should be endorsed by the center directors and become a component of full-cost accounting.

**3) To achieve the integration required, NASA should incorporate those components of an integrated system most appropriate to its organizational needs, including:**

   • **Develop a data-based approach to policy, planning, programming, budgeting, implementation, operations, evaluation, and management.** Such an approach will serve to ensure agency-wide deployment of an integrated health program (see gap analysis from best practice organization and implementation);

   • **Create a standardized "health and performance" full-cost accounting framework to define, standardize, prioritize, fund, and evaluate resource allocation for human-related mission performance and workplace safety, health, and productivity.** Implementation of a standardized methodology using NASA's full cost accounting approach for a health and productivity element would greatly assist in this regard**;**

   • **Incorporate mission-essential elements of integrated health programs in contracting requirements.** In addition to ensuring basic health insurance coverage to all employees and access to preventive services and core fitness and health promotion programs, such elements should include: management of short-term disability, federal workers' compensation, family medical leave, and other applicable leave policies. Resourcing and cost sharing should be considered, within the legal and regulatory practices of NASA and the federal procurement rules.

**4) NASA should provide education and training to first-line managers and supervisors that focus on the relationship between health and productivity and the linkage to NASA- and center-specific missions.** This should include evaluation of common core program elements across sites; reevaluation of current training programs for the prevention, detection, amelioration of risk factors; and integration of content related to risk reduction across program components.

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# Implementing Integrated Health Programs

I ntegration of worksite health promotion and occupational health and safety provides a means for improving worker health behavior (Sorensen et al., 1996b, 1998; Sorensen and Barbeau, 2004). Following the management systems approach described previously, this chapter provides an overview of the characteristics of effective integrated health programs and approaches to setting program priorities; examines strategies for program implementation and evaluation; and explores implications for NASA. The chapter also reviews integrated workplace health programs and the implications for NASA occupational health programs.

Many organizations in both the private and public sectors are faced with similar challenges, that is, they are expected to do more with less and do it faster, better, and cheaper. Such expectations require a highly motivated and productive workforce. This, in turn, is dependent on a workforce that is mentally and physically healthy and a work environment that promotes learning, collaborative work, and enables the workforce to embrace frequent change. Occupational health strategies for advancing these workplace and workforce challenges require planning and implementation approaches that go well beyond traditional workplace health and safety constructs which employ isolated, segregated programs in a non-coordinated fashion. The latter is inadequate as a means to advance optimal health status and workforce productivity.

The integrated health approach is one which links programs into a single process emphasizing outcome, coordination, synergy, and measurement (Goetzel et al., 2002). In its most comprehensive form it ties together health promotion initiatives, medical benefits design and incen-

tives, short- and long-term disability, including programs for worker compensation, lifestyle, disease management and care, with additional evaluation of the effects of presenteeism on health status. A growing body of evidence shows that factors related to worker well-being—other than those addressed by traditional occupational health programs—have a quantifiable affect on workplace productivity, underscoring the value of extending programs beyond traditional health, safety, and health promotion, and into the realm of health-related behavioral change (Goetzel et al., 1998a; Burton et al., 1999; Sorensen et al., 2004).

## WORKSITE MODELS FOR HEALTH BEHAVIOR CHANGE

The health behavior change approach is based on a strong theoretical foundation. Theoretical models developed by the behavioral and social sciences have guided research on health behavior change. Various theoretical frameworks suggest that worker health is the result of a complex interplay of factors involving the individual worker, the immediate work environment, and factors within the larger contexts in which both the individual worker and the worksite are embedded (Robins and Klitzman, 1988; Sorensen et al., 1995; Baker et al., 1996; Stokols et al., 1996).

The social-contextual model (Sorensen et al., 2003, 2004) integrates multiple social and behavioral theories to describe factors influencing social disparities in health behaviors. Structural forces may influence the social context of workers' lives, reflected, for example, in their material circumstances or experiences of discrimination, and ultimately may shape health behavior outcomes. In their research, this team of investigators has applied this model to the design interventions for working class and multi-ethnic populations, aimed at health behavior changes such as tobacco control, diet, and physical activity. By applying this model in behavior change strategies, it may be possible to change some elements of the workers' social context, and also to enhance the quality and relevance of interventions through an understanding of the social realities of workers' lives.

The social-ecological model (see Chapter 3 and Table 3-1) provides a structure for incorporating theories that operate at various levels of influence, including at the individual, interpersonal, organizational, community, and public policy levels. This approach builds on an array of social and behavioral theories including the Health Belief Model (Rosenstock, 1982; Rosenstock et al., 1988), Theory of Planned Behavior (Expectancy X Model) (Ajzen, 1991; Montano et al., 1997), Social Cognitive Theory (Bandura and Walters, 1963; Baranowski et al., 1997), the Transtheoretical Model (Prochaska and DiClemente, 1994; Prochaska et al., 1997), and the Community Organization Model (Minkler and Wallerstein, 1997).

In following the social-ecological model, it is important that integrated health programs include efforts both to create healthy work environments and support individual workers to change health-related behaviors. Accordingly, the effectiveness of occupational health and worksite health promotion programs can be enhanced when coordinated interventions aim to promote worker health through direct education for individuals and their families by building social support and establishing social norms that encourage healthy behaviors, by assuring that policies and management actions provide a healthy workplace, and through linking worksite efforts to broader community and public policy initiatives that promote worker health (Linnan et al., 2001) (see also Figures 3-2 and 4-2).

This model also provides a framework for moving beyond the individual as the locus of intervention and responsibility for health, in recognition of management's central role in worker health (Sorensen, 2000). Thus, effective programs need to be aimed at and coordinated across multiple levels of influence. The following discussion provides a structure for the specific program information presented below.

### Environmental and Organizational Systems

Environmental- and organizational-level systems include the organizational context, management, and policy structures that support worker health by providing a healthy and safe work environment. Reducing the potential for hazardous work exposures within the work environment is the first line of defense for ensuring occupational health and safety. These environmental systems can also present both barriers and facilitators to individual worker health choices in the worksite. For example, social norms, availability, and accessibility are strongly influenced by environmental-level systems (Schmid et al., 1995). Management commitment to an integrated worker health program provides a key foundation for success (DeJoy and Southern, 1993; Sorensen, 2000).

### Programs for Individual Employees

Management participation in individual-level programs is essential to their success. Leaders can become role models, uniting the organizational vision for health with its mission, as well as providing support and encouragement for employee participation. Programs at the individual or interpersonal level focus particularly on educating individual workers and building social norms supportive of worker health, through mechanisms such as educational classes or one-on-one training programs (Refer to Chapter 2 for a description of NASA's preventive health programs, the NASA Occupational Health website, and the NASA Health Promotion

and Wellness Team). Such efforts require solid support from management in order to reduce structural barriers influencing workers' participation. Particular efforts may be needed to address disparities in access to programs. For example, blue-collar and service workers are less likely than white-collar workers to participate in health promotion programs (Gebhardt and Crump, 1990; Glasgow et al., 1993; Sorensen et al., 1996a; Morris et al., 1999). Supervisors may serve as gatekeepers and may need clear guidance to provide workers with access to health promotion activities—for example, by allowing employees to attend events on work time (Morris et al. 1999).

For maximum reach, interventions must target workers at varying stages of readiness to make changes, including, for example, programs that require minimal contact for those not yet ready to make health-related changes (such as health fairs); incentives and competitions; and group programs aimed at building skills to make health behavior changes (Prochaska et al., 1997). Recent advances in tailoring messages to individual workers provide promise for increasing the efficacy of these interventions (Willemsen et al., 1998).

## NEEDS ASSESSMENT

As noted previously, a critical requirement for integrating traditional health and safety with occupational and nonoccupational disability and health benefits is collaboration with health benefits program administrators and access to health benefits utilization data. This concept of integration is illustrated in Chapter 4, Figure 4-2, and examples are provided in the figure legend. In the private sector, leading employers have made their health plan contracts conditional upon specific requirements for the creation of integrated databases from all health plan suppliers. NASA's health benefits are provided under the Federal Employee Health Benefits Program, which, in 2004, included over 350 different plans covering more than 9 million employees, retirees, former employees, family members, and former spouses (Tingwald, 2004). Currently, the administration of this government-wide health benefits program does not provide for agency-specific utilization data. Such a deficiency thwarts efforts to improve occupational health care through agency-specific approaches to health care consumption behavior of NASA employees.

## Assessment Tools

A variety of resources and tools are available to assess the health and wellness needs of the workforce population. In choosing and evaluating health and wellness assessment instruments, it is important that NASA

follow standard guidance on measurement instrument reliability and va-
lidity. The instruments used should be periodically reviewed to ensure
reliability and validity within the NASA system (Gulliksen and Messick,
1960; Gulliksen, 1987). The basic tool for needs assessment is the Health
Risk Appraisal (HRA). Included in the HRA are the tools used to address
issues of mental wellness and productivity. Health care services assess-
ments are discussed in Chapter 4.

*Health Risk Appraisals*

The HRA comprises a questionnaire, risk estimation, and educational
information. This instrument is commonly used in worksite preventive
healthcare to identify the likelihood that an individual will develop a pre-
ventable or chronic disease based on personal, medical, and lifestyle indi-
cators. It is also used as a health promotion technique to assess health
status and the need for health intervention in employee and other popula-
tions (Foxman and Edington, 1987). More often, however, the HRA serves
as a component of needs assessment, health education, and behavior
change (incentive or motivation) programs.

Application of the HRA has changed over time. For example, early
worksite health promotion programs often consisted solely of HRAs com-
bined with screening, apparently under the assumption that medical or
risk information as such would motivate large numbers of participants to
reduce their health risks. Subsequent experience showed that effectively
supporting risk reduction required integration of the HRA into a compre-
hensive health promotion process that would include follow-up educa-
tion and behavior-change components (Schoenbach et al., 1987; Terry,
1987; Anderson and Staufacker, 1996; Edington et al., 1999).

The HRA not only allows employees to identify their own health risks
and behaviors and make modifications to improve their health, but ac-
counts for malleable risk factors affecting the health status of a popula-
tion. This is an important resource of information to support baseline data
for organization-wide as well as site-specific prioritization of employee
health needs, and to enable development of appropriate intervention pro-
grams. As an awareness and education tool, the HRA has been shown to
be useful. However, when used as a predictor of risk or cost, as a program
management or evaluation tool, or as a stand-alone behavior change pro-
gram, its validity has not been clearly demonstrated (Edington et al., 1999).

In choosing the most appropriate HRA, it is important to evaluate
which instrument will best meet an organization's objectives. More com-
prehensive tools with lifestyle and medical indicators are recommended
for health education and gatekeeping/incentives (see below for discus-
sion of incentives) (Hyner et al., 1999). Common considerations when de-

ciding on an HRA package are the inclusion of aggregate data reports, additional preventive health programming or materials, and retesting capabilities (Donnelly, 1993; Turner, 1995). To increase its impact, an HRA can be integrated into the medical benefits plan so that data obtained from it can be used by medical plan providers to recruit participation in disease management and other care coordination efforts.

*Tools for Assessing Mental Wellness*

As a part of the HRA, an assessment of stress experienced by employees may be of value. Ideally, the impact of stress would also be assessed via stress-related risk factors for chronic disease, such as high blood pressure, as well as the influence on performance of acute stress. Brief instruments for the assessment of perceived stress include the *Perceived Stress Scale* and the *Hassles Scale* (Cohen et al., 1983; Cohen, 1986; DeLongis et al., 1988). These, or related instruments, focus on individual stress regardless of its source. Stress imposed in part by the worksite should also be assessed with an instrument such as the *Job Content Questionnaire* (Karasek et al., 1998). As with all items of the HRA, the utility of these instruments should be periodically evaluated. An important assessment of stress unrelated to the HRA is manager and co-worker subjective evaluations of productivity and non-adaptive changes in work style, such as over-narrowing of a solution set or increased irritability with co-workers. Manager training could be designed to involve managers in the early identification and amelioration of worksite stress.

*Assessing Productivity-Presenteeism*

Incorporated into many contemporary HRAs are questions aimed at defining presenteeism in the workplace. Presenteeism is health-related productivity loss while at paid work and may include: time not on task (i.e., in the workplace, but not working); decreased quality of work (e.g., increased injury rates, product waste, product defects); decreased quantity of work; unsatisfactory employee interpersonal factors (e.g., personality disorders); and unsatisfactory work culture (Loeppke et al., 2003; Chapman, 2005).

Such measurement is in its infancy and currently consists of self-reported questionnaires that address an individual's ability to perform effectively on the job. In a study by the American College of Occupational and Environmental Medicine (ACOEM) Expert Panel, Loeppke et al. (2003) discussed and identified the core characteristics that an instrument should have to adequately assess workplace productivity loss. The core characteristics were grouped into four categories: supporting scientific

evidence, applicability to a variety of occupations and disease states, ability to support business decision-making (i.e., ability for data to be translated into a monetary unit), and practicality.

## THE PROGRAM IMPLEMENTATION PROCESS

The program implementation process relies on careful planning, beginning with the needs assessment. Employee involvement in planning and priority setting can help to assure that workers participate fully in the program. This section outlines key components of successful implementation.

### Employee Involvement

Employee participation in program planning can assure that programs respond to worker needs, readiness, cultural requirements, and priorities; and are situated within the overall context of the work organization, thereby enhancing program effectiveness. Typically, worker input may be provided through health and safety committees, health and wellness committees, or through joint coordination across committees. Health and safety committees provide an integral framework for engaging workers and management in joint efforts to promote a healthy workplace; the roles of this committee could logically be expanded to include health improvement efforts aimed at promoting healthy behaviors. Alternatively, health and wellness committees may take the lead in planning health promotion programming, and may coordinate with occupational health and safety committees to design integrated health efforts.

In considering the composition of these committees, it is important to provide equal representation and voice to workers from diverse groups. For example, participation of line workers in committees may be constrained by concerns about workers' time away from their jobs, or, because of obvious power differentials in joint worker-management committees, workers may hesitate to express their concerns in the presence of management (Sorensen, 2000).

Alternate methods may be employed to gain worker input in program planning; for example, through focus group interviews or informal conversations with diverse groups of workers. Worker participation has additional benefits for worker health. Participation in program planning and learner-centered educational methods may contribute to the development of skills that may be applied across health issues, such as problem identification, problem solving, and communication skills (Luskin et al., 1992; Wallerstein and Weinger, 1992; Blewett and Shaw, 1995; Baker et al., 1996).

As noted above and on the agency's occupational health website (http://ohp.nasa.gov/), NASA has established a multidisciplinary health and wellness committee to help guide planning for worker health initiatives, with representation from multiple NASA centers. This committee meets quarterly to review relevant reports such as *Healthy People 2010,* and develops campaign topics to be distributed throughout the agency. This committee aims to standardize outreach efforts to employees; communicate health and wellness information to employees; identify resources; and coordinate and plan programs, including identifying quarterly campaign topics and identifying and evaluating educational materials. An important component of employee involvement is representation by both civil servants and contract workers on the planning committee. Improving participation, however, is not enough. Population health management programs focus on the overall health goal, managing participation to reduce the most costly risks in the population. This means reaching the right individual with the right programs when they are ready to benefit from them (Serxner et al., 2004).

### Incentives

Along with managing participation in programs (see above), successful implementation of integrated workplace programs depends on achieving a significant participation rate among eligible employees. Across these varying programs, it is important to provide incentives for workers to participate. Consumer- and patient-focused financial incentives, even if modest, have been shown to be effective in the short run for simple preventive care and distinct, well-defined behavioral goals. A comprehensive meta-analysis demonstrated that, for preventive interventions such as obtaining clinical preventive services (e.g., immunizations and screening tests) and initiating health improvement behaviors (such as tobacco cessation, weight loss and increased physical activity), incentives are effective and important (Isaac and Flynn, 2001; Ozminkowski et al., 2002).

Terry et al. (1999) and Wang et al. (2002) showed that HRA response rates increase as a function of the intensity of recruitment efforts and financial incentives. Kane et al. (2004) found that economic incentives worked as a behavioral change incentive approximately 73 percent of the time. Cash incentives (as opposed to coupons, vouchers, gifts, "in-kind" awards, etc.) produced the greatest behavioral effect and demonstrated a dose-response relationship (Kane et al., 2004). All incentives, of various forms including spending account credits, gift cards, cash, or lower premiums on medical plans, tend to increase participation in the HRA. There is less evidence that incentives directed at individuals alone can sustain long-term improvement in behaviors and health outcomes. System-level

cultural expectations and aligned incentives at multiple levels are most likely to produce sustained behavioral change (Kane et al., 2004). Once incentives are in place, however, they are difficult to eliminate (Serxner et al., 2004).

## Barriers

### Health Disparities

Health risks are not evenly distributed among workers, and for this reason, it is important that integrated health programs consider the particular needs and concerns of diverse groups of workers. Disparities may exist between occupational groups, different racial or ethnic groups, and regular versus contractual workers. As noted in Chapter 2, approximately 75 percent of NASA workers are contractual employees. Exposures on the job as well as high-risk-related behaviors are concentrated among those in working-class occupations, meaning those employed in blue-collar or service occupations (Giovino et al., 2000; Barbeau et al., 2004) or in low supervisory, technical, semi-routine or routine occupations (National Statistics, 2004). These workers have higher work-related injury and illness rates than do professional employees (NIOSH, 2000). Blue-collar occupation and lower educational levels are also associated with negative health behaviors such as tobacco use (Giovino et al., 2000; Barbeau et al., 2004; CDC, 2004), overweight status (Galobardes et al., 2000; Everson et al., 2002; Mokdad et al., 2003; Sarlio-Lahteenkorva et al., 2004), poor nutrition (USDHHS, 2000a), and low levels of physical activity (USDHHS, 1996). These workers are also less likely to participate in health promotion programs.

It is also important to attend to disparities in worker health outcomes by race and ethnicity. Risk-related behaviors are disproportionately concentrated among some racial and ethnic minorities (USDHHS, 1996; USDHHS, 2000a; USDA/USDHHS, 2005). There is also evidence indicating that workers of color are more likely than other workers to be exposed to workplace hazards (Frumkin et al., 1999). Programs must be designed to attend to the cultural norms and priorities of ethnically diverse populations (IOM, 2002), the implications of acculturation, the potential for discrimination, and related social contextual issues (Sorensen et al., 2004).

It may be necessary to take special steps to engage diverse employees in integrated health programs—including male and female workers across multiple occupational groups, racial and ethnic groups, and from the ranks of both regular employees as well as contractual workers. Supervisors may serve as gatekeepers controlling access to programs (Morris et al., 1999)—for instance, to keep production lines moving, supervisors may

refuse to permit employees to participate in programs during the work-day. These workers may face other barriers to participating, such as over-time, shift work, a second job, car-pooling to work, long distances be-tween the plant and the employee's home, and responsibilities at home (Alexy, 1990). Worksites also need to consider family-responsive policies as a crucial component of the organizational culture supportive of worker health (Glass and Fujimoto, 1994).

*Other Barriers*

Belza et al. (2004) examined barriers and facilitators to physical activity perceived by underserved, ethnically diverse older adults in a community. In this study, health was reported as both a facilitator and a barrier to exercise. Other reported barrier issues were weather, transportation, and personal safety. Another study by John and Ziebland (2004) examined barriers to increasing consumption of fruits and vegetables among participants in a randomized controlled trial in primary care. This study found a variety of barriers among different groups in the population. Women reported that their partners and children were barriers to their efforts to eat more fruits and vegetables. Individuals on limited incomes reported the cost of fruits and vegetables as barriers. Some members of the population reported unexpected changes in their daily routines as unanticipated barriers to fruit and vegetable consumption. Participation in a cardiac rehabilitation program was reported by men and women to be hindered by concomitant illness, lack of transportation, and inconvenient timing of the program (Lieberman et al., 1998).

*Minimizing Barriers*

Management support can help to minimize barriers to participation by placing high priority on a comprehensive program supporting worker health, with the same levels of support communicated for different groups of workers. It is also important to examine ways to structure programs around the schedules of line workers, bringing programs to their work areas, or scheduling programs during break times (refer to Chapter 2 for discussion of workforce composition).

## Health Education and Awareness Activities

Health education and awareness activities take many forms, ranging from hard-copy literature dissemination to web-based resources and tools; and labor-intensive activities such as "brown-bag" or "lunch and learn" seminars or health fairs. These are useful means for increasing awareness,

are low in cost, and are popular with employers as starting points for dialogue with employees about health issues. However, these are not particularly effective as isolated activities in promoting any meaningful health behavior change (Robbins et al., 1987; Erfurt et al., 1991; Heaney and Goetzel, 1997). If on-site medical personnel are available, referral for additional support or case management can be made. Provision for privacy protection and the safeguard of protected health information are essential in these intervention activities. Increasingly, prevention efforts are being linked to medical benefits and health plans as either components of the coverage or incentives for willing participants (Stein et al., 2000; Lewis et al., 1996).

Health education programs include both worksite-wide initiatives, and efforts designed for helping individual workers make health behavior changes (Moher et al., 2003; Sorensen, 2000). The impact of a particular program is a product of both its *efficacy* in changing behavior and its *reach*, that is, the proportion of workers affected either through their direct participation, or indirectly through diffusion of health messages throughout the worksite (Abrams et al., 1996; Glasgow et al., 1999). Programs targeting individual workers have been found to be more efficacious in changing workers' health behaviors (Moher et al., 2003). The overall impact of comprehensive worksite-wide programs may actually be greater, however, given that these programs aim to reach a broad audience within the worksite, and may have an impact on social norms and social support, thus creating an overall climate supportive of worker health (Hunt et al., 2005; Hunt et al., forthcoming). Regardless of whether programs are delivered one-on-one to individual workers or to groups of employees, it is important that programs are employee-centric, and are designed accordingly, to respond to worker priorities, concerns and readiness to make health behavior changes.

## Opportunities for Integration

As described in Chapter 3, to create and support a healthy and productive workforce, integrated health programs must move toward programs that are integrated across multiple functions in the work organization rather than segregated within "silos," and that are employee-centric rather than driven by employer priorities. Figure 4-2 illustrates the functions within the organization that can be integrated in order to promote and sustain worker health, ranging from health risk appraisals to behavioral health programs, disease case management, and occupational safety efforts; examples are given in the figure legend. Thus, an integrated approach to improving the health of employees involves going beyond traditional medical or occupational health to include a variety of fitness and

wellness programs, not as add-ons, but as integral components to a comprehensive approach.

As described in Chapter 4, an increasing number of companies within the United States are adopting integrated strategies to promote worker health. A growing body of research is systematically assessing the effectiveness of these approaches (Sorensen et al., 2004). For example, the *WellWorks-2* study, a randomized, controlled study comparing the effectiveness of an integrated health promotion/occupational health program with a standard intervention, asked the question, "Does the integration of worksite health promotion and occupational health and safety programs increase program effectiveness over and above health promotion alone?" (Sorensen et al., 2002). The study design included 15 mid- to large-size manufacturing worksites, randomly assigned to receive either Worksite Health Promotion (HP) only or Worksite Health Promotion plus Occupational Safety and Health (OSH/WHP). The study hypothesized *a priori* that the integrated intervention would have the most relevance to workers in hourly positions where exposures to hazards on the job were more common than among salaried jobs. Smoking cessation rates among hourly workers in the OSH/WHP condition more than doubled relative to those in the HP condition (11.8 percent compared to 5.9 percent; p=0.04), and were comparable to cessation rates of salaried workers. This study also found that worksites in the integrated intervention group made statistically significant improvements in their health and safety programs compared to HP only sites (LaMontagne et al., 2004). Worker participation in intervention programs was also significantly higher in the integrated intervention condition than in the traditional health promotion condition (Hunt et al., forthcoming). This intervention targeted both the individual worker and the organizational level, through managers.

This total health strategy can be targeted on multiple levels. The social-ecological approach to worksite-integrated health provides a framework for thinking about health decisions as being influenced by multiple systems, including environmental and behavioral (see Figure 3-2). Integration of these functions thus occurs across the multiple levels.

At the organizational level, staff members working to promote worker health across these multiple domains can be effectively located in a single office to encourage coordination across content areas and functions. Additional staff training may be needed to effectively coordinate and integrate the diverse worksite functions influencing worker health. For example, the separate training programs for health educators and occupational health and safety professionals share little in terms of curricula and intervention methodology (Israel et al., 1996). Health promotion providers may not be trained to recognize and understand workplace health and safety hazards, for example, while occupational health

and safety professionals may have little training on worker health behavior. An expanded vision for worker health might be offered through joint training across worksite personnel responsible for worker health.

At the individual level, prevention programs such as those described below may also be enhanced through integration of content areas. As discussed above, for example, the WellWorks-2 intervention included educational messages to workers about the importance of smoking cessation in the context of hazardous job exposures, which together could increase risk for adverse health events. Such approaches build on opportunities for synergism across risk areas.

## PREVENTION PROGRAMS

Prevention efforts include those aimed at health behaviors (such as nutrition, physical activity, tobacco use, and stress and mental wellness); prevention through medical surveillance, and preventive care services. It is important that these efforts be based on assessments of employee health, as through HRAs, and that programs aim not only to improve health outcomes among high-risk employees, but also to maintain and support health among low-risk workers.

### Health Behavior

Once an employee's health risks are identified and their willingness to change determined, these programs provide the means for employees to take action and modify their health behavior. Lifestyle risk management programs can be offered in several formats, and often a combination of approaches is more effective in helping individuals make changes. Provision for privacy protection and the safeguard of protected health information are essential in these intervention activities. Increasingly, lifestyle modifications pertinent to health are being linked to medical benefits and health plans as either components of the coverage or incentives for willing participants.

*Nutrition*

*Trends in Dietary Intake*. Nutrition concerns in the American population have shifted away from adequacy of intake and toward over-consumption of food as well as choices with an impact on the nutritional quality of diets. Current trends in food consumption patterns mirror the rise in health status issues. For example, nutrition-related health concerns include obesity and related chronic disease such as diabetes (Fried et al., 2003). Thus, trends in U.S. food consumption patterns are important de-

terminants of employee food selection in the workplace that may contribute to the health status of the workforce.

To illustrate, during the 30-year period from 1970 to 2000, mean energy intake increased among adults and was matched by steady increases in the prevalence of overweight. Factors contributing to this increase in intake included a greater percentage of meals eaten away from home (especially at fast-food restaurants), larger portion sizes of foods and beverages, increased consumption of sweetened beverages, and changes in snacking habits (Briefel and Johnson, 2004).

Food availability in the workplace can have an impact on food choices and thus the overall health of individuals. Among food selection patterns that fall short of the U.S. Dietary Guidelines are intakes of fruits, vegetables, and dairy products. By the Dietary Guidelines standard, only one in ten people in the United States has a "good" diet (Briefel and Johnson, 2004). Cafeteria choices as well as availability of "healthy" foods in vending machines for snacking and late afternoon or evening meals can contribute to the choices made by individuals at work.

*Individual-Level Programs.* The Next Step intervention trial assessed nutrition interventions to increase low-fat, high-fiber eating patterns among high-risk automotive industry employees (Tilley et al., 1999). This study showed small but statistically significant intervention outcomes for fat, fiber, and fruit and vegetable intake at 1 year; however, at 2 years, intervention outcomes were significant for fiber only, and were greater in younger compared to older employees. Similarly, interventions to improve fruit and vegetable consumption among callers to the National Cancer Institute's Cancer Information Service showed significant results at 4 weeks, 4 months, and 12 months post-intervention, although the number of servings consumed daily was smaller at 4 and 12 months compared to 4 weeks (Marcus et al., 2001).

Several studies of worksite nutrition interventions have been offered across multiple levels of influence. One such example is the Treatwell 5-a-Day, which tested an intervention designed to increase fruit and vegetable consumption (Sorensen et al., 1998; Sorensen et al., 1999). Worksites were randomly assigned to the following interventions: minimal, worksite, or worksite-plus-family. Workers in the worksite-plus-family intervention increased their intake of fruits and vegetables by 18 percent on average, compared to a 7 percent increase in workers enrolled in the worksite-only intervention, and no change in the control condition (Sorensen et al., 1999). Change in the worksite-plus-family intervention represented a significant increase of one-half serving per day more than the minimal intervention group.

The Working Well Trial addressed nutrition within the context of a comprehensive cancer prevention intervention that addressed multiple health behaviors across multiple levels of influence (Sorensen et al., 1996b). The intervention programs tested included a kick-off event, interactive activities, posters and brochures, self assessments, self-help materials, campaigns and contests, and direct education.

A follow-up study was conducted to examine whether the nutrition interventions from the Working Well Trial were maintained (Patterson et al., 1998). The results of the study indicated a significant increase in nutrition activity scores at the end of the initial trial; however, at two years after the initial trial there was no significant increase in the nutrition activity scores of trial subjects and no significant difference between trial subjects and controls. The nutrition activity scores were indicators of change at the worksite, or organizational level; that is, organizational changes sustained over time. There were no measures in this study of whether or not health behaviors were sustained over time.

*Environmental-Level Programs.* Opportunities exist at the environmental level to facilitate healthful nutritional choices at the worksite. Environmental strategies to promote healthy eating are an important part of improving health behaviors. These strategies are valuable because they create opportunities for action to improve food selection and remove barriers to following a healthy diet. These strategies can be used in conjunction with individually-directed educational programs or they can serve as stand-alone interventions.

Glanz and Mullis (1988) reviewed environmental approaches to dietary behavior change. They identified four strategies for public health practitioners and researchers to consider in designing, implementing and evaluating nutrition behavior change programs:

1.  Health professionals must work collaboratively with the food marketing chain to promote healthy products.

2.  Appropriate scientific data must be gathered to support decisions about identifying desirable foods and food products and to identify the criteria upon which such decisions are based.

3.  Program plans need to take into consideration the time needed on the part of participants to accept and realize behavior change.

4.  Nutrition programs to improve health can contribute to long-term social change by exerting pressure for cultural change, and through stimulating and supporting private sector health promotion initiatives.

Five intervention programs were also described by Glanz and Mullis (1988). They include:

1. Changes in the food supply;
2. Point-of-choice nutrition information;
3. Collaboration with private-sector food vendors;
4. Worksite nutrition policies and incentives; and
5. Changes in the structure of health and medical care related to nutrition.

For example, more healthy food choices can be offered for sale in the cafeteria as well as provided for meetings, and in the variety of selections offered through vending services (French et al., 1997, 2001). In addition, opportunities to restructure the environment in which food is consumed include modifying the timing of cafeteria hours of operation, lunch periods and breaks. Healthful foods can be made available in convenient locations (Sorensen et al., 2004), at appropriate times and at an equal or lower cost than less healthful foods (Perlmutter et al., 1997; Buscher at al., 2001; Glanz and Hoelscher, 2004).

Decision-making in worksite food selection can also be influenced by signage that identifies healthful food choices (Sorensen et al., 2004). These decisions can be further supported by coordinating programs to support individually-oriented interventions with policies such as catering policies that encourage healthful choices or policies encouraging availability together with access to fitness programs. Marketing campaigns to promote healthy food choices can include promotions and campaigns that offer subsidies or other incentives to encourage healthful choices (Resnick et al., 1999).

Nutrition intervention strategies can further serve as a model for other types of health promotion activities in large populations such as the NASA workforce. For example, the Seattle 5-a-Day Work-Site Project utilized the approach of influencing policies related to food availability in a worksite cafeteria to achieve dietary behavior change (Beresford et al., 2000). The combined environmental and individual intervention reduced barriers for change through increased availability of fruits and vegetables in the worksite, and included informational and organizational support. The program outcome was a significant increase in fruit and vegetable intake and increased use of informational materials, compared to control sites, at a 2-year follow-up.

### Physical Fitness Programs

*Trends in Physical Activity.* Over the past century, as the workforce has changed from agrarian to industrial to technological, the energy expended at work has declined drastically for most employee groups. Physical activities have not been added to most leisure routines to make up for the

decrease in physical activity at work, and interest in physical activity to maintain good health seems to have peaked in the 1980s (Shephard, 1996).

The concomitant rise in the level of obesity in the last decade has been alarming, and obesity-related diseases may pose a threat to the health care system (Mokdad et al., 2003). In 2000, only 26 percent of U.S. adults engaged in moderate intensity physical activity for 30 minutes a day on most days of the week (CDC, 2003). Males, and those of higher socioeconomic status, are generally reported to have greater access to fitness facilities and neighborhood environments friendly to physical activity (Brownson et al., 2001).

*Individual-Level Programs*. Individual-level approaches include both informational and educational strategies, as well as behavioral and social activities that are targeted to promote increases in physical activity. Also included is the use of "mass media" which, in the case of worksites, would include newsletters, Internet sites, bulletin boards, and other dissemination channels to provide messages to encourage and promote health and physical activity. An additional strategy is the "point-of-decision" prompt, such as signs near elevators to encourage stair use. Incentives, contests, and other promotions targeted to individual behavior have also been found to be effective in worksite settings (Sorensen et al., 1998, 2004). Worksite social support systems can also be set up to facilitate activity groups to form, such as walking and sports clubs that promote physical activity.

An emerging consumer-friendly program for physical activity involves walking programs that include a pedometer. A pedometer is a step-counting device that objectively measures daily physical activity by step counts. Since it displays the number of steps taken at any time throughout the day, it provides a visible cue to obtain more physical activity as a continuous feedback mechanism. Hence, it is also considered a strong motivational tool for physical activity promotion, as well as being easy to use and inexpensive. Several programs have become widely available throughout the United States, many of which include websites that allow participants to track their progress (Lindberg, 2000; Pronk, 2003a; Wyatt et al., 2004). Box 5-1 provides a sampling of popular pedometer programs.

Research shows that the pedometer is an accurate tool to monitor physical activity when walking at normal to fast walking speeds (2.0 mph and up) (Melanson et al., 2004). In addition, the number of daily steps is related to health outcomes. First, there appears to be an inverse, although not causal, relationship between the number of daily steps and body mass index. This relationship has been noted among middle-aged women (Thompson et al., 2004), people with type 2 diabetes (Tudor-Locke et al., 2002), and older adults (Yamakawa et al., 2004). Secondly, an inverse rela-

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### BOX 5-1 Example Pedometer Programs

- www.10k-steps.com
- www.americaonthemove.org
- www.mainephysicalactivity.org
- www.presidentschallenge.org
- www.steptracker.com
- www.walking.about.com

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tionship has been noted between the number of daily steps and components of the metabolic syndrome i.e., blood pressure, blood lipids, and glucose tolerance, among adults (Chan et al., 2003).

*Environmental-Level Programs.* Environmental approaches include those that alter the worksite to facilitate movement and physical activity at work (this would include facilities such as fitness centers and shower facilities that encourage activity), as well as outreach for these programs.

Reported barriers to physical activity are lack of time, motivation, and access to fitness facilities (Brownson et al., 2001), thus worksite fitness programs provide a logical solution to increasing activity levels in the daily lives of the working public. Fitness facilities at the worksite are an important component of Occupational Health programs. However, published data on workplace fitness center utilization shows that overall utilization rates tend to be low relative to total worksite populations (Shephard, 1992; Lewis et al., 1996; Crump et al., 2001), and this appears to be true at NASA as well (see Chapter 2).

There are many reasons why on-site facilities attract certain users and not others, including dependent care and other worklife time conflicts; concern about supervisor perceptions of use during working hours despite flextime programs; the physical design, equipment, and programming of a center; self-consciousness and other socio-psychological issues related to fitness center clientele (Alexy, 1991; Bowles et al., 2002). Providing incentives to employees to increase their level of physical activity requires multiple interventions to meet the convenience, social, and personal preferences of individuals.

Following the framework of the social ecological model, the worksite offers opportunities to employees that encourage physical activity at individual and environmental levels. Interventions targeted to the environmental level have been defined as those that address availability, accessibility or social norms (Schmid et al., 1995). A supportive environment includes management encouragement for all employees to participate in

corporate, and other, health and fitness facilities; and programming and other corporate policies that support health.

An emerging area of interest is in the relationship between the built environment and health. Research is ongoing to determine ways to design communities, which includes worksites, that promote health and fitness (Brownson et al., 2001; Frank et al., 2004). Concepts in community design to promote walking and activity, such as connectivity and proximity, may be applicable in work settings as well. Connectivity and proximity are related to the ability to walk to a destination such as a worksite. Workplaces that are located within walking distance of neighboring communities, and have no major barriers such as turnpikes separating the site from neighborhoods, promote walking to and from work, therefore increasing activity levels of workers. Worksites that are located in safe areas near neighborhoods, with sidewalks, walking trails or bike paths, or near mass transit routes such as bus and train stops also facilitate worker physical fitness. Workers who must drive to work lose these opportunities for physical activity. Healthy worksites include multiple opportunities for physical activity, including fitness centers, safe walking distance to neighborhoods, and proximity to open areas and parks that facilitate safe, pleasant physical activity during the work shift (Frank et al., 2003).

NASA work sites offer a remarkable array of open areas on the grounds, with miles of walking and jogging trails—in some cases, through wildlife preserves. Additional programming to encourage utilization of this valuable NASA resource could increase employee physical activity. The Task Force on Community Preventive Services has found a multilevel approach for increasing physical activity to be supported, for the most part, by research (http://www.thecommunityguide.org/). Research generally suggests positive benefits can be obtained from fitness facilities and programs (Shephard, 1996; Brownson et al., 2001). Findings include that participants in worksite fitness programs show evidence of decreased obesity and overall benefits in health and fitness measures, reduced illness and injury, and cost savings from medical claims (Shephard, 1996). However, these reports remain inconclusive and difficult to interpret because of the lack of common measures and methodological problems.

### Tobacco Use

*Trends in Tobacco Use*. The overall prevalence of tobacco has been in decline in the United States (CDC, 2002). Of concern, however, are persistent disparities in use and cessation. Tobacco use differs markedly by occupation. In 1997, 37 percent of men employed in blue-collar occupations reported using tobacco, compared to 21 percent for men in white-collar positions; for women, the rates were 33 percent and 20 percent, respectively

(Giovino et al., 2000). Barbeau et al. (2004) found that occupation, education, and income were independent correlates of tobacco use rates; other indicators of socioeconomic position were not found to explain these occupational disparities. Smoking rates are also declining more slowly among blue-collar compared to white-collar workers (Nelson et al., 1994). Although there does not appear to be a socio-economic gradient in quiting *attempts,* success with quitting is highest among those with the greatest socio-economic resources (Barbeau et al., 2004).

*Individual-Level Programs.* At the individual level, worksite smoking cessation initiatives aim to help smokers quit smoking. Smoking cessation programs include a range of strategies, ranging from smoking cessation clinics or classes, medical interventions, minimal intervention programs, incentives and competitions, and social and environmental supports. The full range of programs is important to a worksite-wide tobacco control program, because the combination of strategies increases the chances of influencing smokers at varying stages of readiness to quit smoking (Eriksen and Gottlieb, 1998; Sorensen, 2000; Hopkins et al., 2001).

Worksite smoking cessation interventions directed toward individual smokers, including advice from a health professional, individual or group counseling, and pharmacological treatment, can contribute to increases in smoking cessation (Moher et al., 2003). The Public Health Service's *Treating Tobacco Use and Dependence* guidelines (USDHHS, 2000b) provide a standard of care for all tobacco control interventions, and recommend brief counseling with pharmacological treatment. Many worksites offer the same types of smoking cessation programs originally developed and offered in clinical settings, or, in some cases, provide referrals to clinic- or community-based programs, such as those of the American Cancer Society or the American Lung Association; for-profit programs (e.g., Smoke Enders); or health care organizations (Fielding, 1991).

Minimal-contact interventions often are used to promote smoking cessation among those not yet ready to quit, or to provide help with quitting for those not willing to invest time and energy in a group cessation program. Minimal-contact interventions may include promotion of a telephone help line or the Great American Smoke-out, self-help interventions such as written materials and short videos, and assessments with feedback, such as carbon monoxide assessments.

Within the context of a worksite-wide tobacco control program, minimal-contact intervention strategies may serve to engage smokers in thinking about quitting, increase participation in group programs, and support worksite norms encouraging non-smoking (Eriksen and Gottlieb, 1998). Such efforts may include incentives to promote smoking cessation, whether monetary or non-monetary. For example, employers have often

provided monetary incentives for quitting and maintenance of tobacco abstinence, including reduction in the cost of participation in a smoking cessation program; bonuses or payments for smoking cessation; or differential premiums for health or life insurance benefits (Fielding, 1991). There is limited evidence about the extent to which competitions and incentives increase employee participation in programs (Moher et al., 2003). As noted above, studies by Sorensen and colleagues have found that programs which integrate occupational health and safety and tobacco control are able to increase smoking quit rates for blue-collar workers (Sorensen et al., 1998, 2002).

*Environmental-Level Programs*. Tobacco control policies are designed both to protect non-smokers from the hazardous effects of second-hand smoke and to promote an environment supportive of non-smoking. Tobacco policies are a key component of an overall workplace tobacco control effort, and are central to supporting smoking cessation among workers. Worksite policies on tobacco have been shown to decrease worker exposure to environmental tobacco smoke (Stillman et al., 1990; Marcus et al., 1992; Hammond et al., 1995) and contribute to worker reductions in smoking, including quitting (Paulozzi et al., 1992; Kinne et al. 1993; Woodruff et al., 1993; Brigham et al., 1994; Pierce et al., 1994; Eriksen and Gottlieb, 1998). A recent review concluded that tobacco policies and bans are able to reduce workers' tobacco consumption and non-smokers' exposure to second-hand smoke during the workday, but found conflicting evidence about the impact of the policies on overall tobacco use prevalence (Moher et al., 2003). Employer efforts to promote compliance with smoking policies can contribute to an overall climate supportive of non-smoking (Sorensen et al., 1991). The effectiveness of worksite tobacco control policies are clearly enhanced when smoking cessation programs are offered as supporting measures.

Alcohol and drug abuse are also frequent problems among workers, and awareness of this in the workplace is important. Information campaigns based on the risks of alcohol and drug abuse can help keep employees informed (Saitz, 2005). Management education in recognizing potential problems and making appropriate referrals can be a useful approach for reducing workplace substance abuse.

*Stress, Mental Wellness, and Performance*

*Trends in Stress, Mental Wellness, and Performance*. The scientific definition of stress must include the stressor, the perception of it by the individual, and the individual's subsequent mental and physiological reactions. These different facets of what we popularly combine and consider as "stressful"

must all be taken into account when evaluating the impact of stress on an individual or organization. In evaluating the impact of stress at NASA two forms of stress, chronic and acute, should be considered. Chronic and acute stress may have different causes, may induce different reactions, and may have different implications for health and disease.

Chronic stress occurs over the time frame of years and is thought to contribute significantly to mental disease (e.g., Zuckerman, 1999) as well as chronic physical diseases, most particularly cardiovascular disease (Henry and Stephens, 1977; Sharpley and Gardner, 2001; see also brief review from workplace perspective, Rosenman, 1996). Situational factors, such as living or working in overcrowded settings, may impose chronic stress on an individual. Episodic but repeating incidents can also create chronic stress, e.g., day-by-day hassles or on-going conflict with co-workers or supervisors (Lazarus, 1991a,b). Individuals vary in their affective and physiological responses to such stressors, such that only some individuals may be placed at risk for disease from comparable exposures. Factors such as poor communication and interpersonal difficulties at the workplace can foster a chronic exposure to acute stress.

The pattern of physiological reactions induced by these chronic stressors has been conceptually related to cardiovascular disease by Krantz and Manuck (1984), and Treiber et al. (2003) reviewed supporting evidence. Most recently, prospective evidence has related blood pressure reactivity to transient challenges to both hypertension (Matthews et al., 2004) and coronary heart disease (Jennings et al., 2004). These demonstrations of the importance of stress to development of disease, however, neither identify specific psychophysiological mechanisms contributing to disease nor identify the bulk of the contribution of stress generally associated with disease.

Acute stressors are episodic threats to a person's or organization's achievement of goals. In the workplace context, these could be unpleasant exchanges with a colleague or a challenging deadline for task completion. The person typically feels stressed and will adjust to the stress through psychological processes altering the threat rationally or irrationally, through coping processes, or through behavior that may resolve the stress (Lazarus, 1991a). The physiological changes accompanying such stress can be energizing despite the potential for harm (Sapolsky, 1994). Acute stress can lead to both distress and poor performance, and excitement and energized performance. Energized performance can be useful but it can also be misdirected and not sufficiently guided by thought (Broadbent, 1971; Hamilton and Warburton, 1979; Eysenck, 1997).

Acute stressors pose a challenge to the organization, as productivity and employee morale may suffer. Acute stressors are, however, unavoidable, and not necessarily injurious to long-term health. Moreover, enhanc-

ing general health and improving coping skills can yield an individual that is resilient and thus less affected by stressors. Preventing acute reactions to stress in employees and appropriately channeling responses to stress has short-term benefits that are readily realized in appropriately guided performance, and staff morale.

Addressing stress factors is appropriately done at a programmatic level through restructuring of the environment and training of individuals and groups, using a top-down process designed to create a work environment that eliminates unnecessary workplace stress and improves productivity. A current emphasis is to integrate health programs to yield a healthy individual that is resilient and ready to face the challenges of everyday, and more significant, mission stress. Rather than reacting to the stressed employee, individual and organizational prevention is advocated. The role of managers and supervisors is to take responsibility for effective communication, for balancing job demands and job control as well as effort and reward, and for recognizing workers who may require assistance in communication skills, social relations, affect control, or treatment of serious mental disorder. The role of the Employee Assistance Program (EAP) professional is to provide triage and train managers in the recognition of symptoms suggesting that an individual is experiencing significant problems. Training programs should focus on integrating both health practices and job productivity with health promotion. Group programs have been designed to induce positive mental health or focus on emotions in the workplace; unfortunately, such programs have not been proven to improve productivity (Slaski and Cartwright, 2003), and employees' seeking emotional support on the job may be perceived as less productive (Bhanthumnavin, 2003).

*Individual-Level Programs.* Standardized stress-relief programs have a place in training the individual to cope with stress. Such programs, in conjunction with maintenance of overall health, create the resilient employee. For employees in their daily work lives, skills for increasing resilience can be taught. Some individuals seem naturally resilient (Kobasa and Puccetti, 1983), others work on resilience by enhancing general and emotional health. Much of our short- and long-term planning is directed at anticipating threats and providing ourselves with the capabilities to deal with them. Activities as diverse as buying a dead bolt lock and taking a course on time management could be considered as enhancing resilience. The typical stress program aims to reduce the physiological impact of stress (e.g., relaxation, meditation) or how to cope with stress (e.g., cognitive reframing, time management). Such training can often successfully reduce the impact of the stress on the individual's physiology and psychological affect (McCraty et al., 2003). Even though these skills have been shown to

be effective they require practice to maintain their efficacy, substantial initial investment in learning these skills, and a willingness to do both. Additionally, many individuals attempt to learn these skills only during or immediately after experiencing major stress rather than as long-term stress management skills. In short, programs in these areas can be helpful, but their impact may be limited. However, such programs may have greater effectiveness when made available as components of larger programs targeted at clusters of individuals, addressing stress concerns in conjunction with other risk factors.

*Environmental-Level Programs.* Acute stressors cannot be eliminated. Any individual or organization must face competitive challenges that can be defined as stressful, but which must be faced for the good of the organization or individual. Needless acute stress should obviously be eliminated, but stress is an aspect of life, and priority must be given to building resilience to stress, both individually and organizationally. Leadership and management can often increase resilience by considering a stressor as a challenge that a unit is prepared to meet. A basic resilience within organizations is conferred by positive affect/morale related to the organization.

George (1989) and George and Jones (1996), for example, found that high morale (positive affect) in an organization was an effective deterrent to absenteeism related to high levels of distress (negative affect). Cotton and Hart (2003) state that "…the simultaneous focus on employee health-related productivity (well-being) and performance recognizes the practical reality that having happy and satisfied staff is of little value to an organization unless staff are also performing efficiently and productively."

The most relevant form of chronic stress is worksite stress created by a perceived imbalance between the demands of a position and the control over the work (Karasek, 1979; Bond and Bunce, 2001; Polanyi and Tompa, 2004), particularly with the added factor of Effort-Reward Imbalance (Bosma et al., 1998). Such stress seems consistently related to psychological and psychosomatic complaints as well as injurious health behaviors such as alcohol abuse (Terry and Jimmieson, 1999). Moreover, a number of studies have observed that job strain (high demands and low control) is associated with high risk for hypertension and cardiovascular disease (Landsbergis et al., 1999; Tsutsumi, 2001; Markovitz et al., 2004). As Terry and Jimmieson (1999) show in their review, however, job control has many dimensions, and these may buffer in different ways the influence of high work demands and may influence outcomes differently, e.g., absenteeism may be influenced differently than reported morale. They further note that third factors such as social support and personality differences may influence how job control and work demands alter worksite outcomes.

Management training focusing on techniques to optimize communication, equitable workflow, and employee skills—thus balancing demands and control—should be a major focus of an integrated health and performance program. The organizational focus makes the manager responsible for facilitating communication, recognizing dysfunctional responses to stress, and generally minimizing acute stress that is due to organizational factors under his/her control. Occupational medicine and EAP then become partners with managers in the integrated health and performance focus. The primary role for occupational medicine is to develop, in conjunction with other NASA staff, the training program for managers (i.e., a program developed by and for NASA is advocated rather than use of contractors; see Chapter 4). Occupational medicine and EAP provide the professional backup for the manager and manage the resources for personal resilience. Occupational medicine and EAP professionals have the background training and knowledge that is appropriate to NASA, which should allow them to be the best trainers; however, they may require additional training to optimize their effectiveness in certain areas. This model adds productivity as a goal for EAP and occupational medicine personnel and brings them out to the workplace as part of their responsibility.

Prior programs have yielded positive results. Cotton and Hart (2003) review the success of such approaches. In addition, Bond and Bunce (2001) suggest that organizational resilience results from restructuring organizational command, control, and communication so employees have greater control of their jobs. Performance on the job has not been well evaluated as a function of such programs, however, and evaluating performance should be part of any new integrated health and performance program. The exact means for achieving the goals of such a program must be specific to both NASA as an organization as well as to individual work groups going through the program development process described in Chapter 4. NASA is composed of a truly strong and creative workforce that has the capacity for reorganizing itself to optimize both performance and human mental and physical health (see Box 5-2).

## Preventive Services

### Medical Surveillance Exams

Medical screening or surveillance is the periodic assessment of individual worker(s) in terms of occupational history, medical history, and symptoms and signs related to hazardous substance(s)/condition(s) exposure. Biologic screening is the periodic assessment of individual workers in terms of special investigations, e.g., blood or urine tests, related to

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**BOX 5-2**
**Integrated Prevention Programs**

NASA may effectively utilize the Health Risk Appraisal (HRA) along with additional assessment tools in the Total Health Management System (HMS) (see Figure 4-2) to design prevention programs tailored to meet both individual and group needs. All health promotion/prevention programs in the HMS would have an integrated core that emphasizes how health at home and work must include safety, good nutrition, stress reduction, exercise, and maintenance of positive social relationships. Analyses of integrated health management data obtained through the HMS could be used to identify risk profiles, e.g., exposure to safety hazards, alcohol and tobacco use, or nutrition and exercise patterns that place workers at increased risk for disease or disability. Prevention programs could then be designed to address, in a group setting, the needs of those workers with high risk profiles. Another outcome from the HMS assessment may be an individually tailored report, transmitted through a health advocate, that recommends one or more individualized programs to address the specific needs of a worker.

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exposure to hazardous substance(s) or condition(s) (Zenz et al., 1994). The purpose of these examinations is to determine potentially harmful effects, both acute and chronic, from exposure to specific substances or environmental conditions. The periodic evaluation of people potentially exposed to certain hazards is required by some Occupational Safety and Health Administration (OSHA) standards; it is also considered standard practice for some job duties, according to professional guidelines and the OSHA general duty clause (McCunney, 2001).

Employees at NASA undergo a variety of surveillance exams, depending on their exposure. In industry, engineering controls are being put in place that may mitigate the need for surveillance exams, as exposures in the workplace are lowered. When non-mandated examinations are performed, these are frequently initiated by an employer's occupational health and safety staff based upon local practice or "expert opinion." Unfortunately, many such discretionary periodic examinations are initiated based on good risk assessments, but are rarely re-evaluated, resulting in an ever-expanding set of examinations, at least some of which may no longer be warranted. One of the tasks for NASA is to reassess its current screening program and look at the environmental hazards in the workplace to determine which exams need to stay in place and which can be eliminated. Health screening for the employees can be otherwise per-

formed through the health risk appraisal, with appropriate referrals to a physician for identified conditions.

*Periodic Health Examinations*

There are two broad categories of examinations frequently offered to employees at the worksite: general periodic health examinations and occupational health examinations. While in some cases these two examinations are specifically designed to be complementary and synergistic, for most employers these are designed and managed separately and toward very different objectives. Employers who offer periodic health examinations in the context of a broad health and wellness program must insure that the results of the examinations are linked to the employee's ongoing source of primary care for follow-up of findings. Helping employees understand the usefulness of periodic health examinations is the first step. With the employee's approval, available personal health information can then be communicated to the physician.

Periodic health examinations consist of evidence-based clinical preventive services, defined as screening tests, counseling interventions, immunizations, and chemoprophylaxis. The U.S. Preventive Services Task Force (USPSTF), sponsored by the Agency for Healthcare Research and Quality, is the leading independent expert panel in prevention and primary care (http://www.ahrq.gov/clinic/uspstfix.htm). The USPSTF conducts rigorous, impartial assessments of the scientific evidence for the effectiveness of various clinical preventive services. The panel, consisting of private-sector experts, regularly reviews and grades the evidence of effectiveness for clinical preventive services based upon age, gender, and risk status and uses a consistent and rigorous hierarchy of evidence in deriving its recommendations.

Periodic health examinations represent "teachable moments" to not only identify risk factors for morbidity and premature mortality but also to educate and promote primary preventive behaviors. Specialty organizations (e.g., American Academy of Pediatrics, American College of Physicians) and public (e.g., Advisory Committee on Immunization Practices [ACIP]) and private voluntary organizations (e.g., American Heart Association, American Cancer Association) provide patient and professional information about health examinations.

*Immunizations*

Offering annual "flu" immunization programs has been the mainstay of many worksite wellness programs. Influenza can have a considerable effect on the health of working adults and thus a significant impact on

employers, resulting in millions of lost workdays and health-care-provider visits each year (Nichol, 2001). Lynch et al. (2004) focused on health activities and found that 90 percent of employers surveyed were offering flu shots to reduce absenteeism.

Numerous studies have been done that demonstrate the cost effectiveness of worksite flu immunization programs. Nichol et al. (1995) showed that immunization decreased the frequency of upper respiratory illness by 25 percent; absenteeism from work due to upper respiratory illness by 43 percent and due to all illnesses by 36 percent; and visits to physicians' offices for upper respiratory illness by 44 percent. The results of this study demonstrated a cost savings of $46.85 per person vaccinated. Many NASA sites offer immunization programs and the continuation of these is certainly supported by the literature.

## DISEASE, DISABILITY, AND INJURY
## MANAGEMENT PROGRAMS

### On-Site Medical Clinics

*Acute Care*

Acute care onsite occupational health clinics traditionally provide treatment for injuries or illnesses occurring due to a work experience or exposure. Most onsite clinics also provide basic treatment for minor non-occupational illnesses, such as headaches, gastrointestinal distress, and blood pressure monitoring. One occupational health clinic, though, has taken on the primary care treatment of employees, therefore offering an opportunity for them to seek care but not have to leave the workplace and take time away from work. This approach has proven effective in circumstances where the workplace is remote from usual providers of care, where even short periods of absence from a workstation can cause significant production shortages, or where occupational health is part of the health plan for workers and dependents with on-site facilities.

*Disaster Preparedness and Emergency Response*

The terrorist attacks of September 11, 2001, anthrax attacks of 2001, the threat of pandemic SARS and avian influenza, and natural disasters including Florida hurricanes in 2004 that damaged the Kennedy Space Center, have heightened awareness regarding the need for disaster preparedness and emergency response. Because of the heightened visibility and national security aspects of the NASA mission, NASA facilities must be prepared for any natural or man-made disaster and be self-sufficient in

response to any emergency. The last five years have seen the development of the Department of Homeland Security; a major expansion of funding for federal, state and local preparedness programs; the development of the Strategic National Stockpile (SNS); the Health Alert Network (HAN); and the Cities Readiness Initiative (CRI). The Department of Health and Human Services, through its Office of Public Health Emergency Preparedness (OPHER) and through the Centers for Disease Control, has provided direction and funding for public health preparedness through state and local health departments (Hupert et al., 2004).

Other federal agencies have been charged with the development of their own disaster preparedness and emergency response programs consistent with their mission, location potential for population center impact, and coordination with local and state authorities. State health departments and departments of homeland security, assisted by CDC-funded university-based centers for public health preparedness, have provided preparedness information, training and exercises. Emphasis has been placed on collaboration between public safety, public health and health-care facilities and providers within communities; preparedness training for all sectors; scenario execution for man-made and natural disasters; and prospective evaluation of programs at all levels.

*Integrated Disease Management, Counseling, and Monitoring*

Disease management programs are typically part of health benefits plans, either as components of health plan coverage or as stand-alone programs provided by a separate vendor. These programs are intended to identify individuals with specific diagnoses to whom special services are offered to improve self-care, treatment plans, care coordination among providers, and medical and cost-of-care outcomes. Common target diseases for these programs include cardiovascular disease (coronary artery disease and congestive heart failure), diabetes, asthma and chronic obstructive pulmonary disease, depression, chronic low back pain syndromes, and some cancers. Although clinical and functional benefits have been demonstrated for many of these condition management programs, few organizations have capitalized on this vast opportunity. Adverse morbidity and productivity impacts of prescription drug utilization such as antihistamines or migraine medications have been shown to be substantially reduced by aggressive workplace health initiatives that integrate health benefits utilization experiences into their worksite health processes.

Evidence for reduced medical claims costs attributable to these programs also exist for some programs (Musich et al., 2004). Goetzel et al. (1998b) used the Health Enhancement Research Organization (HERO) database to analyze relationships between the status of ten modifiable

health risk behaviors and medical expenditures. The results indicate important relationships between most of the risk factors analyzed and health care costs.

## Mental Health and Substance Abuse Treatment

Occupational medicine and its Employee Assistance Program (EAP) component at NASA provide professional services for individuals suffering from stress and substance abuse, as well as providing stress-reduction education. At the workplace, a number of individuals will experience mental illness and acute episodes of psychologically-driven incapacity. Cotton and Hart (2003) suggest that these cases are best treated (through EAP and professionals accessed through employee medical plans) with state-of-the-art individualized treatments, as opposed to standardized stress relief programs (e.g., relaxation, meditation). The latter can be effective as a preventive program (e.g., McCraty et al., 2003), but are likely ineffective with a severely stressed person or someone suffering from mental disease.

Individuals reporting significant stress may also suffer from significant mental disease. Individuals with substance abuse problems may similarly present themselves as severely stressed. Severe cases and those showing significant symptoms of mental disorders or substance abuse (DSM IV) should be identified by managers or co-workers, if they are not self-identified, and referred to professional EAP staff. Individualized treatment plans administered by EAP and/or health plan providers should then be initiated as appropriate. Although the Committee did not find evidence that drug and alcohol abuse were a specific problem at NASA, their incidence is likely similar to that in other comparable workforces. Alcohol continues to be a major drug of abuse, although use in moderation may confer limited health benefits (Saitz, 2005).

Basic health education should ensure that employees understand when substance abuse becomes a problem. These signs are self-evident—e.g., lost work time, marital difficulties—but require reinforcement so the employee can recognize and ideally admit to having a substance abuse problem. As part of an integrated health program, maintenance of a healthy social environment at work should remove some of the incentives for abuse, e.g., drinking to alleviate experiences of stress and anxiety. In situations where drug and/or alcohol abuse become apparent at the worksite, EAP staff should work with managers to identify and educate individuals who may benefit from professional services, and to facilitate referral to the appropriate level of care if treatment is deemed appropriate.

Prevention of alcohol and drug abuse must focus as much or more on maintaining abstinence in persons with a history of abuse. Many effective programs and therapies are available for individuals with substance use disorders. In addition to referral for professional treatment, employees with alcohol or drug abuse issues can be provided information about mutual support groups such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA) and encouraged to attend these programs. AA or NA is often used in conjunction with professional therapy, and after completion of therapy as an ongoing form of support. Employees with drug abuse or dependence problems also benefit from a comprehensive program that includes treatment, self-help such as NA, and urine monitoring.

## Disability Management Programs

*Disability Management*

Another component of employee integrated health programs is disability management across both occupational and nonoccupational settings. Disability management (also referred to as return-to-work-programs) can be defined as a proactive, employer-based approach to prevent and limit disability; provide early intervention for health and disability risk factors; and foster coordinated disability management administrative and rehabilitative strategies to promote cost-effective functional restoration and return to work (Habeck et al., 1991; National Institute of Disability Management Research, 2000; Williams and Westmorland, 2002). Disability management is a collaborative approach involving labor-management support to implement programs to reduce the impact of disability on the workplace (Westmorland et al., 2002). Best practice in disability management includes the integration of fitness-for-duty and return-to-work programs, Federal workers' compensation, long- and short-term nonoccupational disability programs, sick leave/incidental absence, Family and Medical Leave Act (FMLA) and Americans with Disabilities Act (ADA)-related workplace accommodations and Employee Assistance Programs.

Linking these programs with health risk assessments, lifestyle risk management, and disease management programs has the potential to help return employees to full functionality in a much more timely manner. When determining how to manage absenteeism, employers should carefully consider the impact that health promotion programs can have on rates of absenteeism and other employee-related expenses. Aldana (2001) found that the majority of studies tend to support the hypothesis that employees who participate in worksite health promotion programs have lower subsequent levels of absenteeism than non-participating employ-

ees. Reductions were found to be approximately 3 percent to 16 percent and were found towards the end of the evaluation periods (Aldana, 2001). This points to the fact that health promotion programs may take some time to demonstrate effects on disability, and to be successful, they will need to continue to be reinforced over time. Serxner et al. (2001) found that participation in a worksite health promotion program for a large tele-communications company had a significant impact on short-term disability (StD) use. Employees receiving StD who were participants in the health promotion program used an average of 6 fewer net days than similar employees receiving StD who were not participants in the program. At this point, NASA has not undertaken an organization-wide disability management program; opportunity exists to more proactively return employees to full functionality and work, if designed cooperatively with health improvement programs.

Measuring productivity is more complex than counting absent and disability days. The complexity comes with the realization that not all absent employees are automatically unproductive, and not all present employees are automatically 100 percent productive. Isolating the components of absenteeism, disability, workers' compensation, and presenteeism has facilitated a closer examination of the impact of health risks on overall productivity (Edington, 2001).

## PROGRAM EVALUATION

As programs are implemented, the "checking and corrective action" step in the Cycle of Continuous Improvement (see Figure 4-1) ensures that evaluation is a core component of all programs and services provided to NASA employees. This checking and corrective action step would include a model, such as that described by Ozminkowski et al. (2004), for ensuring NASA a return on its investment in the programs that can be tailored to the full cost accounting effort already in place. Considering evaluation an integral part of every program will support a data-driven approach to programming and is consistent with the continuous quality improvement methodology (Langley et al., 1996; Ozminkowski and Goetzel, 2001).

Overall program impact may be evaluated using data collection tools that are not necessarily program specific, e.g., HRA data collection and analyses. This type of evaluation will indicate, for example, that the numbers of risk factors present in the population have improved over the course of the year due to the integrated health program, or that physical activity levels have increased in response to all programming that was made available throughout the course of the year. However, these data are not specific to individual program effectiveness. Hence, integration of

an evaluation step for each single program is needed to make sure that the programs themselves generate the anticipated improvement in health status for the intended audience. This approach to evaluation has to be efficient, low-cost, and above all, meaningful to the program staff. The measures should be embedded in the program implementation processes so that data collection is ongoing, and allow for as close to real-time feedback and analysis as possible. The measures should be few, simple, easy to collect, and inclusive of process and outcome variables. A more in-depth description of this type of measurement approach is outlined in Table 6-1 under the Improvement column.

Important features of program evaluation to consider include a clear definition of the intended audience of the program, the degree to which the intended audience was reached, whether or not the program was implemented according to plan, and the assessment of desired outcomes. Specific variables to be collected are directly dependent upon the goals and objective for each unique program but should certainly include program reach, participation, and satisfaction. Ideally, reach and participation should be reported as a rate, i.e., an appropriate denominator needs to be identified for every program implementation effort. Absolute numbers are less informative than rates, especially considering issues such as program scalability and sustainability that underscore the importance of implementation efficiency and resource utilization on a program-by-program basis.

The process to conduct program evaluations is in itself an important consideration as well. The evaluation approach should be consciously planned, data to be collected need to be carefully considered, the analysis methods need to be appropriate to the evaluation approach, results need to be reported to the appropriate stakeholders, and the implications of the results need to be used for ongoing program improvement. All this needs to be considered in the context of appropriate use of resources available (McKenzie and Smeltzer, 2001).

Pronk (2003b) outlined an approach to program evaluation based on a set of simple rules. This approach represents a multi-level cascading model that systematically monitors program Penetration, Implementation, Participation, and Effectiveness (PIPE), and assigns a coefficient to each of these four steps. The product of the four coefficients describes the overall program impact and is referred to as the PIPE Impact Metric (see Table 5-1). To illustrate the PIPE Impact Metric using an example, consider a physical activity program designed to increase walking behavior among all NASA employees being announced and communicated to all employees. Subsequently, all employees would be invited to participate in the program, all program-related tools and support components necessary for employees to succeed would be made available, and a monitor-

**TABLE 5-1** The PIPE Impact Metric

| | Variable | Variable Definition | Rate Calculation | Coefficient |
|---|---|---|---|---|
| P | Penetration | The proportion of the target population that is reached with invitations to engage in the walking program | 10,000 of 10,000 employees reached = 10,000/10,000 | 1.0 (100%) |
| I | Implementation | The degree to which the program has been implemented according to the design specifications and the associated work plan | Following review, program staff concludes that 80% of the work plan was implemented | 0.8 (80%) |
| P | Participation | The proportion of invited employees who enroll in the program according to program protocol (e.g., signed up via a website specifically created for this program or enrolled via a mail-based method) | 2,000 employees enrolled = 2,000/10,000 | 0.2 (20%) |
| E | Effectiveness | The rate of successful participants. The criterion for success is set prior to program rollout and should be directly related to the program goals and objectives. For example, all participants who achieved 10,000 steps of walking per day at the end of week 8 of the program, a level of physical activity that is considered sufficient to achieve health benefits (USDHHS, 1996) | 1,500 participants achieved 10,000 steps per day at the end of week 8 = 1,500/2,000 | 0.75 (75%) |
| PIPE | PIPE Impact Metric | Overall impact score of the program | $1.0 \times 0.8 \times 0.2 \times 0.75$ | 0.12 (12%) improvement |

SOURCE: Pronk, 2003b.

ing and evaluation system would be in place to provide ongoing feedback to both participants and program staff, related to effectiveness and success rates. The PIPE Impact Metric would be a useful and simple-to-implement tool to support the program evaluation efforts. The table above presents the individual components and the overall impact score using the example discussed above—for purposes of this example, assume that data reflects a single NASA center with 10,000 employees.

The process to calculate the PIPE Impact Metric score has been described and reported using actual program implementation data (Pronk, 2003b). However, no normative data are currently available against which others can compare their relative performance. For NASA this approach may be very practical in that implementation of this simple approach to evaluation can be implemented across centers and thereby immediately generate comparative scores that have high relevance for NASA administrators. This example provides several data-driven opportunities for improvement. The limiting factor in program success based on the PIPE coefficients is the participation rate. Program design changes can be implemented to facilitate a higher participation rate; for example, through the use of incentives. Also, PIPE Impact Scores can be compared between centers and an exchange of ideas for implementation can support outcomes successes.

## FINDINGS

Many of the programs and interventions addressed in this chapter can be found on the NASA Occupational Health website. However, a common finding among large, decentralized organizations that also appears to be true at NASA is the development of communication gaps between the centers and Headquarters, as well as between managers and employees, which has an impact on the effectiveness of these programs. The Committee's specific findings, based on observation of NASA programs and characteristics of established integrated health programs, encompass four general areas as follows:

(1) Variability in support for occupational health-related programs and resources weakens their effectiveness. Further, there is a need to connect the goals and objectives of occupational health programs with the NASA mission. Before initiating a large, systematic approach to employee health and medical record-keeping, NASA should define its mission-related data requirements so that they are in alignment with the vision of an integrated health program.

(2) Variability in access to health programs between civil servants and contract workers may have an impact on disparities in health outcomes among the NASA workforce.

(3) The current system of collecting health metrics lacks consistency among centers. Without uniform metrics to inform program planners of the needs of participants, it is difficult to design and implement preventive health care programs that optimize health outcomes for participants.

(4) There is a lack of integration among programs designed to optimize health, safety, and productivity at NASA (refer to Chapter 2, site visit observations). Furthermore, the current use of a segregated approach to program administration without integration across functions among large organizations such as NASA results in a less effective health care system. The Committee also found a need for effective policy development among upper-level managers and occupational health leaders in order to establish more effective health care program strategies for the centers.

## RECOMMENDATIONS

The overarching recommendation (see Chapter 3) from this report is that NASA adopt a mission-driven vision for an integrated health program for all employees. The foundation for such a program is acquisition of evidence-based knowledge of the current health status of health program participants and appropriate metrics to define and predict participant needs. **In order to establish a system whereby health data is collected in a consistent and useful way that will contribute to the design and implementation of health and safety programs that meet the NASA vision for a healthy workforce, the Committee recommends that:**

**(1) NASA should obtain health care cost and utilization data for its civil service employees enrolled in the Federal Employee Health Benefit Program (FEHBP) to inform, target, and optimize agency benefits, policies, and workplace interventions as private-sector employers do. Ideally, these data could be analyzed and reviewed at the directorate level to further inform and optimize local programmatic efforts.**
**(2) A basic health assessment tool such as a Health Risk Appraisal (HRA) should be selected from those available in the marketplace and offered to all NASA workers. For contract employees, NASA occupational health leaders should identify ways to channel HRA information back to the contracting company for its use in designing and implementing uniform health care programs, and prioritiz-**

**ing and monitoring longitudinal health and performance status that is consistent with the NASA vision.**

The HRA can be used as a basic component to build an agency-wide database of aggregate health data that will inform the design, development, implementation, and evaluation of health programs to meet the needs of NASA employees. The subsequent recommendations flow from this vision for a uniform database.

**(3) NASA should offer coordinated and integrated individual- and environmental-level health promotion policies and programs that promote worker health across content areas including diet, exercise, job stress, tobacco use, alcohol and substance abuse, and worksite hazardous exposure to meet the health needs of a diverse workforce.**

All programs should include program promotion strategies as well as financial and benefit-designed incentives to foster program participation across the diverse NASA workforce.

Examples of policies and programs include:

- Developing policies for making healthy food options available throughout the workplace, for all shifts, through a combination of cafeteria and vending options, and offering a variety of nutrition education programs targeting both healthy workers and those with nutrition-related diseases;

- Ensuring a physical-activity-friendly atmosphere and environment that is supportive of employees' efforts to achieve physical activity guidelines for health benefits as outlined by national policy, including Healthy People 2010 and the Dietary Guidelines for Americans;

- Providing support for non-smoking employees by uniform adoption and enforcement of tobacco control policies, and through a broad spectrum of tobacco use cessation programs for tobacco users at varying stages of readiness for change. Further, review the medical benefit screen for tobacco cessation counseling and pharmacological support;

- Implementing an approach to reducing stress and building resilience that focuses on enhancing output through enhancing organizational health-focused productivity. Perceived stress and job control and strain should be screened as part of the Health Risk Appraisal and further assessed, if needed, through referral to appropriate follow-up programs. For employees with stress concerns, individual programs should be made available that address both resilience, through integrated health promotion, and reduction of individual stress reactions. At the organizational level, managerial training should be organized within NASA and across contractors and civil servants. This training should address communication and job control issues that

impact both stress and productivity. Training should also include how to recognize and handle the stressed or mentally ill individual, in conjunction with EAP personnel;

• Developing financial- and benefit-designed incentives to encourage employee participation in health promotion and disease management programs.

**(4) NASA should reexamine the allocation of resources at the center level for periodic health examinations, in consideration of an integrated risk factor reduction program, and evaluate the data requirements, periodicity, and effectiveness of existing occupationally-related medical screening examinations.** To achieve this goal requires a clear rationale, policy, and practice that drive accomplishment and resource allocation at the center level. The Committee recommends the following strategy:

• Establish appropriate databases to provide health metrics to inform the evaluation process;

• Define desired goals for periodic health examination programs and medical surveillance data requirements;

• Stratify health and safety requirements into occupationally mandated standards;

• Link health promotion and disease prevention examinations, if and when uniformly performed, through a standardized process, to the employee's primary health provider and the Health Risk Appraisal.

**(5) NASA should conduct program-specific evaluations to ensure the effectiveness and appropriate use of available resources.** Ideally, each program should include some level of evaluation integrated into the program implementation process that will inform program staff about reach, acceptability, participation, and effectiveness.

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6

# Data Integration and Health Management

**D**ata management is a key concept in the successful implementation, conduct, and measurement of any integrated health management program. The previous chapters presented reviews of current NASA programs as well as best practices in the conduct of programs designed to maintain and improve the health of the workforce. This chapter presents an approach to world-class data management processes that give program managers ready access to common data and information related to data-driven management of a healthy workforce and workplace.

## ADOPTING CHARACTERISTICS OF WORLD-CLASS PROGRAMS TO DATA MANAGEMENT

Chapter 4 presents an overview of characteristics found in world-class programs. The characteristics highlighted in that chapter clearly outline the advantages of an integrated data management strategy. The chapter also emphasizes the importance of systematic data collection, an approach that allows for data integrity and consistency.

Data that are collected on occupationally related health programs can serve a variety of purposes in an integrated data management system. First, data can be used to report statistical information on program usage and effectiveness. Such information is critical to the design and management of these programs. Second, such reports ensure that program implementation is effective and provide a measure of accountability for the program's performance. Third, data are used for ongoing program revi-

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sion. For example, baseline needs assessments can be used to identify barriers to opportunities and indicate corrective actions. Further, they allow for the quantification of results following the implementation of program changes. Finally, data are used to report program performance to aid in the generation of new hypotheses that could be tested by others in a research setting or context and, in return, may benefit the entire field of worksite health management (Edington, 2001).

## ORGANIZATIONAL FRAMEWORK FOR DATA MANAGEMENT

### The Four Faces of Measurement: An Organizing Principle

An effective data management and measurement system can support organizational objectives such as

- Decision making,
- Accountability,
- Improvement, and
- Surveillance, including longitudinal analyses and knowledge discovery.

A systematic approach, incorporating these "four faces of measurement" described in the quality improvement literature (Solberg, et al., 1997; Pronk, 2003a), can serve as an organizing framework for data management- and data measurement-related objectives. Such a framework adds to the realities of the business setting that demands an approach to data-driven decision-making processes.

This framework also encourages managers to explicitly recognize various approaches to data collection and use, measurement, and reporting, and thus provides support for the reporting needs at the various levels within the NASA organization. A discussion of each organizational measurement aim from this framework follows.

*Measurement for Decision Making*

Measurement can be used to support decision making. To do so, leadership at appropriate levels must be aligned with its respective decision-making authority and have access to specific data analyses and information. At NASA, for example, to make decisions regarding investments in specific health-related programs, leadership at the headquarters level as well as at each individual center needs to be informed on environmental policies and risk factor prevalence statistics to be addressed; cost-related

data that will support the business case; and readiness of the workforce and management teams to participate and support the proposed programs.

For management to make decisions in a timely manner, the data to be considered should be valid and reliable and may need to include projections based on data-driven assumptions (e.g., as related to projected return on investment) and should not be overwhelming. Moreover, there must be reasonable assurance to management that the data collected are representative, accurate, and reliable, thereby supporting their use for decision making that prompts action.

### Measurement for Accountability

Measurement can also be used for accountability. One method of accountability for achievement of program objectives is periodic reporting of a set of measures created *a priori*. Moreover, program staff may assume accountability in a very proactive manner when the measures against which they are held accountable are known in advance. These measures may include process measures, but for the purposes of accountability, most of them will be outcomes or results-type measures. They are also useful for monitoring overall program performance. Measurement accountability should be reported openly, however, so that it can be used for performance comparison.

Assurance that the measures used for accountability are accurate and valid requires a focus on a few vital measures. In addition, the measurement process may need to include external staff or independent audits and be appropriately adjusted for validity. Furthermore, the creation of the measures themselves should be done in a collaborative manner so that agreement exists on the measures themselves.

### Measurement for Improvement

The Plan-Do-Study-Act (PDSA) cycle is a good example of a measurement for improvement strategy (Langley et al., 1996). This approach includes data collection and measurement that identifies potential problems, barriers, or opportunities for improvement; facilitates the implementation of improvement initiatives; and follows with data collection to measure the improvement or change that has taken place. Following such an approach, measures and data used for improvement should be simple, easy to implement, and collected and reported in effective and efficient time frames. In addition, all data analyses should be capable of specific as well as centralized analyses.

*Measurement for Surveillance, Longitudinal Analyses, and
Knowledge Discovery*

Measurement for surveillance, longitudinal analysis, and knowledge discovery supports the need for uncovering unanticipated problems related to integrated health programs; allows for retrospective analyses of data that may provide critical insights into specific health-related questions or issues; and provides an opportunity to position an organization or agency as a leader in the field of integrated health management. Ongoing surveillance methodology is an important component of data-driven management of health-related trends. In addition, this approach supports the need to more fully understand what may explain underlying drivers of trends in health management or decline in health status. The objectives and complexity of such analyses and data programming practices require well-trained expertise; however, it also provides opportunities for the generation of a research agenda and new knowledge. In the case of NASA, application of such an agenda will enable a meaningful contribution of new knowledge to the field of health management.

## Who, Why, What, When, How?

Effective data management and data mining require integration and consistency in data collection. In addition, maintaining the confidentiality and security of the data collected requires sustainable diligence. The result of this strategy is a more valuable database that can increase in value over time.

The overarching goal of this framework approach to data management (described above) is to drive collection of universal and reliable data that will satisfy common program goals and ensure that information obtained is meaningful to all participants. In Table 6-1, rows labeled "who, why, what, when, and how" are specific to NASA's needs for data integration and health management across the four faces of measurement. Specific attention is given to the respective programmatic needs of NASA centers as well as the role of Headquarters as a leader and coordinator in driving health-related goals and objectives.

## A DATA MANAGEMENT SYSTEM FOR AN EFFECTIVE INTEGRATED HEALTH MANAGEMENT PROGRAM

A data-driven approach is the core technology needed to implement an integrated and sustainable health management program to achieve world-class status. Figure 6-1 illustrates a systems approach that represents a comprehensive data management strategy. The figure denotes four

**TABLE 6-1** Framework for Data Management

|  | Decision-making | Accountability |
|---|---|---|
| **Who?** | | |
| Audience (For whom?) | • NASA Top Management<br>• HQ Director Team<br>• Center Director Team | • NASA Top Management<br>• HQ Director of OHS<br>• Center Director |
| **Why?** | | |
| Purpose | • Understanding of cost-benefit<br>• Prioritization<br>• Understanding of need and demand | • Demonstrate performance<br>• Comparison<br>• Reassurance<br>• Identify need for change |
| **What?** | | |
| Scope | • Specific to HQ<br>• Specific to individual centers | • Specific to NASA<br>• Specific to HQ<br>• Specific to individual centers |
| Measures | • Few<br>• Reasonable, reliable and valid<br>• Projected estimates with acceptable assumptions | • Very few<br>• Accurate, reliable and valid |
| Time Period | Intermediate, past, projected (estimated) | Long, past |
| Confounders | Consider, but rarely measure | Describe and try to measure |
| **When?** | | |
| Timing and timeliness | • Annual<br>• Periodic based on schedule<br>• In time to inform budget-related decisions | • Annual<br>• Insync with comparison units and centers |
| **How?** | | |
| Data collection staff | Internal with external expertise as required | Internal with external expertise as required |
| Sample sizes | Large or specific to identified population | Large |
| Data collection process | Sufficiently complex to assurance acceptable level of accuracy, reliability and validity to take action | • Complex<br>• Requires moderate effort and cost |
| Confidentiality and Privacy | • Very high<br>• De-identified data only<br>• Comply to HIPAA and ADA regulations | • None for purposes of comparison—the goal is exposure and transparency<br>• De-identified data only<br>• Comply to HIPAA and ADA regulations |

| Improvement | Surveillance, Longitudinal Analysis, and Knowledge Discovery |
|---|---|
| • Program staff<br>• Center leadership<br>• HQ leadership | Program leadership at every level |
| • Understanding of process and user groups or employees<br>• Baseline assessment<br>• Evaluation of changes | • Notice patterns and trends<br>• Explain areas of concern<br>• Monitor population health statistics of special interest |
| Specific to individual centers | Universally applicable to all levels of NASA |
| • Few<br>• Easy to collect<br>• Simple<br>• Approximate | • Many<br>• Complex collection<br>• Precise, reliable, and valid |
| Short, current | Long, past |
| Consider, but rarely measure | Measure and/or control |
| • Ongoing<br>• Insync with improvement cycles<br>• Insync with program implementation efforts | • Ongoing<br>• Specific to issue or topic needing to be examined |
| Internal | Internal if expertise is available; otherwise external |
| Small | Large |
| • Simple<br>• Minimum cost required<br>• Integrated with program implementation<br>• Usually repeated frequently in order to create sun charts | Highly complex |
| • Very high<br>• De-identified data only<br>• Comply to HIPAA and ADA regulations | • High<br>• De-identified data only<br>• Comply to HIPAA and ADA regulations |

*156*
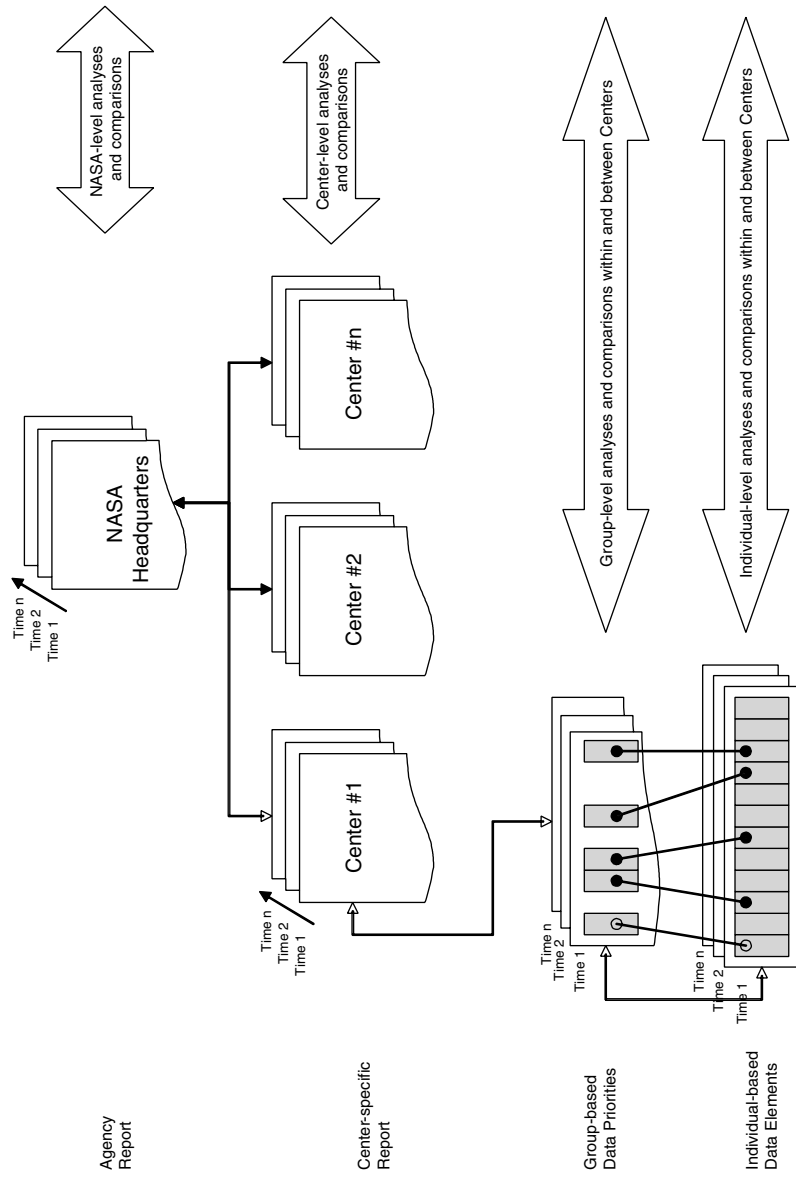


**FIGURE 6-1** A systems approach to data management for NASA.

levels of nested data domains. Each of the nested levels allows for analyses that are supportive of each of the columns in Table 6-1. This type of data management system will enhance development of an information database that can be directly tied to mission-critical goals and objectives. Such an approach specifically addresses the needs for data collection and management, quality assurance and standardization, data protocols and standards, data elements and priorities, scorecards, stratification, and benchmarking and best practices.

Whereas the nested levels of this approach to data management allow for vertical integration, there are two additional features illustrated in the figure that are important to recognize as well. First, horizontal integration is also supported by this approach because it allows data to be compared between individuals, groups, and organizational centers. It may even support the comparison of an agency-specific set of measures to external organizations. Second, this type of data management system supports collection of longitudinal data for comparison measures collected at any of the levels.

### Data Collection and Management

Effective data management begins at the data collection stage. Having a common set of core metrics throughout an organization ensures that the primary goals of the organization are addressed. Applied to NASA, the system illustrated above allows for and encourages each center to have its own unique priorities and data needs.

### Quality Assurance and Standardization

Good quality assurance requires the creation of a common and preferred set of processes and protocols that can be followed in selecting data collection tools. Following such common and preferred processes and protocols provides an opportunity to report data in a standardized manner and ensures consistency in data integrity, collection, and management processes.

### *Data Management, Protocols and Data Standards and Elements*

Core data elements also need to be standardized to generate meaningful metrics comparison. This requires the ability to designate the additional data elements that will be needed for effective programming and continuous improvement in a unique location or within a unique mission.

*Data Protocols for Consistency*

Consistency in data collection is a critical component of quality metrics. Achieving consistency requires communication and agreement on core data measures throughout an organization. In cases such as NASA, where a decentralized system is in place, collecting additional but similar data requires standardization of protocols.

## Data Warehousing

The establishment of data warehouses to store data on health, safety, and productivity management is a trend in data management. Data warehouses are generally designed to organize existing databases to provide the organization with common metrics across multiple employee benefit plans (Goetzel et al., 2004). In the case of NASA, as a component of the central system, each center would maintain its own data warehouse, containing its own data, with physical servers located either in one central location or at each of the centers. This would allow for local access and use of data but would not compromise the overall central warehousing and analyses of NASA-wide data. The primary criterion is that the individual data tables are accessible across centers, according to the level of agreed data sharing.

*Technical Standards*

Common protocol and technical standards are a recurrent theme throughout the establishment and implementation of a data-driven system. Data need to be standardized, and computer hardware and software need to be standardized. For effective data-sharing and report generation, each data table and aggregation rules are uniform across work sites in decentralized organizations. In addition, special attention to security and confidentiality needs to be in place as a component of an organization's standard operating procedures.

*Data Capability*

Maximizing an organization's data capability requires placing computer hardware and software as well as data collection and input into the data warehouse. The multiple functional and relational databases that are created by accessing the data warehouse require similar analytical characteristics for uniform report generation.

*Eligibility Rules*

Avoiding potential problems when unifying a data management system is important; thus, each individual in the system is coded to his or her status within an organization. In that way, analyses and reports can be created using the appropriate employee codes that protect the privacy of individuals. In the case of NASA, each individual center would have to manage its own program eligibility requirements because of differences in contract agreements.

## Data Elements and Priorities

*Health Behaviors and Other Personal Risk Factors*

Health behavior data are considered core measures for programs designed to influence the overall health of an individual. Employee data records that capture this information include short- and long-term disability and other disability metrics such as EMPAQ measures (see Box 6-1 and http://www.empaq.org/empaq/), Family Medical Leave, and Worker Compensation data. Additionally, data collected through the use of a self-reported Health Risk Appraisal (HRA) tool are often supplemented with biometric measurements. Self-reported health risks and behaviors are among the type of data collected and may include questions

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**BOX 6-1**
**Employer Measures of Productivity, Absence, and Quality**

In 2003, The Washington Business Group on Health (WBGH), now the National Business Group on Health, established a council of employer members to address issues related to disability, absence, and health-related productivity. This group became the Council on Employee Health and Productivity (CEHP). An important goal of this group was to develop tools to support innovative ways to improve absence and productivity management. The product of CEHP's efforts is a document known as *EMPAQ: Employer Measures of Productivity, Absence, and Quality*. EMPAQ provides a methodology and set of standardized metrics for employers to accurately measure program outcomes, participate in meaningful benchmarking, evaluate vendor performance, and identify best-in-class organizations and practices. In a complex arena that includes many different stakeholders, EMPAQ provides a common lexicon and platform for consistent and rigorous measurement.

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on body weight and height, physical activity levels, tobacco use, safety habits, dietary habits, use of preventive services, and psychological perceptions of health, stress, and life and job satisfaction (see Chapter 5 for detailed discussion of HRAs).

### Medical and Pharmacy Utilization

Privacy and liability issues can pose data collection barriers to an organization by limiting access to medical and pharmacy utilization data from its employees. However, because these are the most frequently used outcome measures to demonstrate success of occupational health management programs, they are important metrics to collect. This problem can be overcome by the use of proxies for medical or pharmacy claims. For example, questions that are frequently integrated into self-reported HRAs, which can be used as proxies, include the frequency of medical visits, utilization of emergency room services, and length of stay in the hospital during the past year.

### Productivity Indicators

Productivity measures are time-away-from-work measures, such as absence days, short-term disability days, and workers' compensation days, that are often common throughout an organization. Self-reporting surveys have been developed that collect data related to productivity, such as presenteeism, which is an indicator of on-the-job productivity (see Chapter 5). In addition, questions related to productivity indicators, such as presenteeism, are often included in an HRA. They can also be used as stand-alone questionnaires. Samples of these surveys can be found in the "Gold Book" distributed by the Academy for Health and Productivity Management (IHPM, 2001).

### Quality-of-Life Indicators

Quality-of-life measures are frequently considered core to the central objective of an organization like NASA. These measures are a function of an individual's perception of their physical, mental, and emotional health and are critical to how they perceive their overall life and job satisfaction. Quality-of-life indicator data are often collected as part of a self-reported HRA. Examples of functional questions that provide an additional dimension to quality-of-life indicators that may appear on the HRA include an employee's perception of how easy it is to do daily tasks.

*Environmental Policies and Factors*

Health professionals now recognize that environmental policies and factors at the workplace are important determinants of overall health (Golaszewski and Fisher, 2002; Golaszewski et al., 2003). The autonomy available at the worksite and how one interacts with others likely affects one's health and productivity. Simple things, such as opportunities for flexible scheduling, healthy choices in vending and cafeterias, stairway alternatives to elevators, ergonomic and safety considerations at the individual's workstation, and so on all contribute to a positive work environment (see discussion in Chapter 5). In addition, this is an area of overlap with effective leadership, management, and supervisor training.

*Program Participation*

The number and range of employees who participate often determine the success of a health management program. These data are necessary to assess the effect of participation and changes in health status and environmental policies. Data on program participation, however, requires that extensive records be kept on program participants and date of participation.

## Scorecard Report Management

The data collection and management framework presented above allows for the initiation of a "Scorecard Report Management" approach that may facilitate an ongoing method for health improvement. This approach uses scorecards as a tool to monitor health status and health improvement progress of employees. Based on characteristics presented in Table 6-1, the measures reported in scorecards are considered to be measures of accountability. Measures of this type can be an important source of information on the health status of individual employees. Scorecards are advantageous because they accommodate unique metrics designed for specific areas within an organization as well as organization-wide metrics. The scorecard management approach is not, however, intended for interorganizational comparisons, although it can be used to compare performance in an ongoing context and provide an opportunity for sharing information from successful initiatives within an organization.

## Stratification

*Identification of Targeted At-Risk Populations*

Loss of productivity because of absence and disability can account for up to 29 percent of health- and productivity-related expenditures (Goetzel et al., 2003). Specific subsets of the workforce population that can be considered at risk may include, but are not limited to, those who:

- Have specific chronic conditions (e.g., diabetes, heart disease, hypertension, asthma)
  - Smoke
  - Are obese
  - Have applied for gastric bypass surgery
  - Are at high risk for diabetes
- Are identified as having more than three modifiable risk factors out of the top four actual causes of mortality

Databases can be used to collect information on high-risk health conditions and identify at-risk employees in the workforce so that they can be channeled into appropriate programs.

*Predictive Modeling*

There is ample evidence that identification and intervention of at-risk populations by single risk factors may not be the most effective way of improving the health status of either individuals or populations. Recently, data-driven analytical techniques have been developed to identify clusters of risks that could lead to disease or loss of productivity (personally as well as on the job). The most celebrated cluster is metabolic syndrome, a cluster of five risk factors, the presence of any three of which puts one at higher risk for diabetes, heart disease, and a variety of other metabolic diseases (NIH, 2001; Ford et al., 2002; Pearson et al., 2003).

*Identification of Targeted Low-Risk Populations*

The objective of including low-risk populations in data stratification is to maintain that population in the low-risk category (Edington, 2001; Musich et al., 2003). Whereas most traditional health promotion programs target populations defined as at-risk for a single risk factor (smoker, high blood pressure, high cholesterol, overweight and obese, etc.), a more comprehensive health management program considers the total population, which includes the low-risk population as well. An important distinction

between traditional and comprehensive programs is that resources in comprehensive programs are targeted to provide for a healthy worksite that includes environmental concerns, convenient physical activity options, and healthy food choices in cafeterias and in vending machines (see Chapter 5).

### Benchmarking and Best Practices

Any field of care, including health management, uses benchmarking and best practices to measure effectiveness, ensure use of common metrics, and achieve consistent high-quality programs. Benchmarking and best practices—concepts that arose out of the quality movements—have been implemented in a wide variety of situations (see Chapter 4). Best practices is a term applied to those protocols that are considered the most effective, either in a given situation or with individuals that share common health characteristics. In the case of health management, for example, benchmarking is used to make comparisons between populations of employees. Both of these concepts are considered essential components of world-class programs.

A recent benchmarking study found that achieving "best practice" levels of performance in health and productivity management would help companies realize savings of as much as $2,562 per employee—a 26 percent reduction in the overall $9,992 per employee costs distributed among group health, turnover, absenteeism, disability, and workers' compensation programs (Goetzel et al., 2001). As indicated above, the use of benchmarking and best practices allows an employer to use resources wisely and make comparative measures of effectiveness. This mode of operation also ensures that individual participants are receiving the best possible care and attention.

### Regulatory Requirements

Federal agencies such as NASA must be constantly vigilant about regulatory requirements, protection of personal health information, and quality assurance guidelines. Having common metrics and protocols increases the likelihood that guidelines will be implemented and followed as outlined in the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The Centers for Medicare and Medicaid Services (CMS) are responsible for the implementation of HIPAA. These provisions include Title I (1996), which protects health insurance coverage for workers and their families when they change or lose their jobs, and Title II, the Administrative Simplification provisions, which require that the U.S. Department of Health and Human Services (USDHHS) establish national

standards for electronic health care transactions and national identifiers for providers, health plans, and employers. It also addresses the security and privacy of health data. It is essential to adhere to personal data protection as provided for in HIPAA as databases are built, maintained, and shared within an agency.

### Interaction of Data Sets

Data collection and management processes occur at multiple levels within any large organization, including NASA. Further, these processes occur at the individual, departmental, center, and multicenter levels, up to the level of Headquarters. Given such circumstances, multiple levels of data can also interact with each other. It is at those places of interaction that the need to ensure protection of privacy, anonymity, and confidentiality arises.

Figure 6-2 presents an example of how worksite health promotion data at the personal and group level may interact (Pronk, 2003b). In this figure, a worksite would consider how to ensure protection of personal health information and decide on the type and importance of data used for sharing across multiple groups. For example, whereas personal information that allows an individual to be identified remains in the domain of personal health management, some of those data are needed to connect information among the various data sets to the correct person. Importantly, this type of data should not be shared while identifiers are attached, although it may be reported in aggregate format.

### FINDINGS

The committee gathered evidence for NASA's investment in the health of its workforce, both civil servants and contract employees, from information and data provided by the agency, invited presentations, and site visits to selected NASA centers. Although the overall goal of occupational health-related programs—to improve and maintain the health status of the workforce—was clear, evidence for consistency in program application, implementation, and evaluation between centers was less apparent, and evidence showing that the goals and objectives of the various centers are coordinated was not found. The committee was particularly concerned about organizational structure, eligibility rules, programs, and evaluation measures, including:

- Overview of practices by site;
- Addressing issues of intra- and intercenter consistency;

**Worksite Health Promotion and e-Health Technology**
Interaction of Personal and Group Information Factors



**Personal Health Management**
•Personal information
•Self-care logs
•Online behavior change
•Self-care access
•Personal health library

•Unique ID
•Biometrics
•Medications
•Medical history
•HRA (individual)
•Health insurance

**Health Management by 3rd Party**
•Health care cost
•Health care utilization
•Pharmacy utilization
•Benefit design features

•Anonymous data
•Regulatory reporting
•Community resources

•Cultural data
•On-site education
•Team-based reports
•Workplace hazards

•Group reports
•Aggregate data
•Health care costs
•Health care utilization

**Population Health Management**
•Human Resources files
•HRA (group report)
•Disease management
•Disability management

**FIGURE 6-2** Interaction of personal and group information factors.
SOURCE: American College of Sports Medicine (ACSM).

- Headquarters oversight of data practices;
- Current activities around benchmarking, quality assurance, common protocols, and so forth;
- Materials available to the workforce; and
- NASA-generated research and reports.

### Data Collection and Management

Site visit observations of specific occupational health programs at NASA, findings from the literature, and comparisons with "best practice" models described in Chapter 4 further indicated that there was a

need for data-driven integration and health management capabilities across NASA and within its centers, so that a truly integrated health management program can be implemented. Consistent with many organizations that follow a traditional approach, occupational health programs and initiatives at NASA tend to be program specific, and although readily available to the centers, the selection of such programs and initiatives does not appear to be based on health-related, employee-based, NASA-wide data- or center-specific analyses. For example, whereas the HERO analysis (Wasserman et al., 2000), conducted for NASA, was informative and may be regarded as an important contribution to the field, the data were not derived from NASA employees or center-related observations, and thus may not reflect a NASA-based assessment of need. The health improvement data at NASA that are available for program planning, prioritization, and resource allocation tend to be fragmented and sparse. Therefore, because NASA is interested in moving forward as a world-class integrated health program, it is imperative that a robust, agency-wide, center-specific, and employee-centered data management system be implemented.

### Closing the Gap Between Traditional and World-Class, Integrated Health Programs

Although the NASA health program has a long and distinguished history, the current traditional approach to occupational health care does not meet the needs of a world-class program. Data management agency-wide as well as at the level of the individual centers is an important area for improvement. The descriptions in Table 6-1, when compared to the committee site visit observations at NASA centers, illustrate an immediate need to create a comprehensive data management system that will support data-driven decision making and information for program improvement, assessing accountability, and long-term observations and knowledge discovery. The committee determined that primary gaps are most likely to occur in the following three areas:

- Common metrics;
- Common procedures and quality assurance; and
- Clear eligibility guidelines.

Addressing and filling these gaps will be an important step toward crafting a comprehensive data management system.

### Benchmarking at NASA

Observations by site visit teams to selected NASA centers (see Chapter 2) also indicated that the occupational health programs in place were not consistently using effective benchmarking. In all too many cases, local preferences dominated program selection and use. This may not be undesirable, because there are many dedicated professionals conducting the programs to meet the unique needs of the various centers. However, it does indicate a need for more consistent and uniform metrics to maintain and improve the quality of NASA's occupational health programs.

### RECOMMENDATIONS

As discussed above, NASA can, through intra-agency cooperation and data sharing, become a world-class best practice organization through both center-specific as well as NASA-wide improvements in strategies and tactics for collection and management of employee health data.

The core recommendation (see Chapter 3), that NASA adopt a mission-driven vision for an integrated health management program, requires the establishment of an agency-wide system for data collection to serve as a database that can be readily accessed and used in program planning, evaluation, decision support, and knowledge discovery.

**(1) NASA should implement a systems-based approach to data management that includes the following components:**
- **Data collection, management, and reporting according to agreed-on protocols and standards;**
- **Consistent data practices across all NASA centers; and**
- **Longitudinal tracking of data across all centers and the agency as a whole.**

**(2) NASA should adopt a framework (see Figure 6-1) for measurement that will allow the agency direct access to data collected for the purposes of decision making, accountability, improvement, surveillance, longitudinal analyses, and knowledge discovery.**

**(3) NASA should create and initiate a data-management collaborative that includes representatives from all centers as well as Headquarters who are trained and well informed about measurement and evaluation.** At a minimum, the objectives of the collaborative would include
- Generation and ongoing monitoring of performance data measures;

• Initiation of a data-driven exchange of improvement strategies and tactics for practitioners at the centers;
• Provision of input and feedback to center- and agency-specific health initiatives; and
• Provision of specific recommendations for data management-related resource needs, training, and integration.

**(4) NASA should establish agency-wide data architecture and technology, that may or may not include a comprehensive electronic medical record, to support its operational goals.** Clarification of occupationally-related, compared to general, health promotion and disease prevention and management data requirements is an essential step in defining agency-wide technology solutions.

**(5) NASA should use the opportunity of building such new programmatic endeavors to contribute to knowledge about program effectiveness, cost benefits arising from these programs, and factors that can contribute to the success of these programs.** Implementation of a standardized methodology using NASA's full cost accounting approach for a health and productivity element (as discussed in Chapter 4) would greatly assist in this regard. In this way, NASA's experiences can help to inform the directions taken by other worksites.

Specifically, the Committee recommends that NASA consider research in program outcomes (including improved health outcomes for workers and overall cost savings), factors that contribute to program success (e.g., as measured by employee participation rates or behavior change), barriers and facilitators that contribute to worker participation in programs—and how these barriers and facilitators differ by type of worker, center, and other factors—and factors that contribute to each center's ability to initiate, implement, and sustain integrated health programs.

## SUMMARY

In an organization like NASA, where measurement and evaluation is a cultural norm, a data-driven decision-making system is a prerequisite for success. However, observations made by the committee at site visits to selected NASA centers indicate that this type of system is not uniformly in place across the agency, or in complete form at the observed centers. As a process of moving its health management programs toward a world-class standard, it is imperative that NASA institutes a common operating measurement system throughout the agency that includes each of its cen-

ters. The system discussed in this chapter is designed to provide for autonomy at each center while encouraging the use of common metrics, quality data collection, and management- and system-wide reporting.

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**Websites:**
www.empaq.org/empaq/
www.ihpm.org/publications/assessment.html

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# Glossary of Terms and Abbreviations

| | |
|---|---|
| Absenteeism | Habitual absence from work; may reflect demoralization or dissatisfaction on the part of the employee |
| ACIP | Advisory Committee on Immunization Practices |
| ACOEM | American College of Occupational and Environmental Medicine |
| ACSM | American College of Sports Medicine |
| Agency | Refers to the NASA organization |
| AIHA | American Industrial Hygiene Association |
| APQC | American Productivity and Quality Center |
| Benchmark | The process of measuring standards of actual performance against those achieved by others with broadly similar characteristics to improve quality so that individuals, organizations, or services can raise their own performance to that of the best |
| CAIB | Columbia Accident Investigation Board |
| CDC | Centers for Disease Control and Prevention |
| Center | Refers to one of the 14 individual worksites that comprise the NASA organization |
| CHAA | Corporate Health Achievement Award |
| CHDP | Child Health and Disability Prevention |
| CHMO | Chief Health and Medical Officer |

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| Claim Cost | The total cost of claims against insurance that includes medical and indemnity benefits, and administrative and incentive fees |
| Comprehensive | Refers to the intention to strengthen all sectors of well-being, including social, educational, economic, physical, and cultural components, while addressing the interrelationships among them |
| CRI | Crisis and Readiness Initiative |
| Data Architecture | Defines how data is stored, managed, and utilized in a data management system |
| Direct Cost | The value of all goods and services that are consumed in the provision of an intervention or in dealing with effects or future consequences that are linked to it |
| Disability | Refers to any long- or short-term reduction of a person's activity as a result of an acute or chronic condition |
| EAP | Employee Assistance Program |
| EHRS | Electronic Health Record System |
| FEHBP | Federal Employee Health Benefits Program |
| FFRDC | Federally Funded Research and Development Center |
| FMLA | Family and Medical Leave Act |
| FTE | Full-Time Equivalent |
| HAN | Health Alert Network |
| HERO | Health Enhancement Research Organization |
| Health Promotion | A comprehensive social and political process that embraces actions directed at strengthening the skills and capabilities of individuals, and changing social, environmental, and economic conditions to relieve their impact on individual and public health |
| HIPAA | Health Insurance Portability and Accountability Act |
| HMO | Health Maintenance Organization |
| HPMS | Health and Productivity Management System |
| HPWT | Health Promotion and Wellness Team |
| HRA | Health Risk Appraisal |

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| IH/WBMS | Integrated health/well-being management system |
| Indirect Cost | Refers to productivity gains or losses related to illness or death |
| Integrated | A system that combines services within a health plan to provide the complete spectrum of care for its participants. In a fully integrated system the key elements are in balance in terms of matching resources with the needs of participants |
| Medical Cost | The direct medical expenditures associated with illness, disease, or disability |
| Meta-analysis | A method for combining and integrating the results of independent studies of the effect of a given intervention |
| Metric | A quantitative measure of performance that should drive appropriate leadership or management action |
| NASA | National Aeronautics and Space Administration |
| NIEHS | National Institute of Environmental Health and Safety |
| NIOSH | National Institute of Occupational Safety and Health |
| Occupational Health | The promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and adapting work to people, and people to their jobs |
| OCHMO | Office of the Chief Health and Medical Officer |
| OH | Occupational Health |
| OHSMS | Occupational Health and Safety Management Systems |
| OPHEP | Office of Public Health Emergency Preparedness |
| OPM | Office of Personnel Management |
| OSHA | Occupational Safety and Health Administration |
| PIPE | Penetration, Implementation, Participation, and Effectiveness |

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| Population Health Approach | Recognizes that health is a capacity or resource rather than a state; it corresponds to the notion of being able to pursue one's goals, to acquire skills and education, and achieve personal growth. This approach is focused on population-based data rather than on data on individuals in a population |
| PPO | Preferred Provider Organization |
| Predictive Modeling | A technique used to predict future behavior and anticipate the consequences of change; data is collected, a statistical model is formulated, predictions are made and the model is validated (or revised) as additional data becomes available |
| Presenteeism | On-the-job productivity loss that is illness related; for example, problems such as allergies, asthma, chronic back pain, migraines, arthritis and depression; also related to productivity loss resulting from caregiving, lack of job satisfaction, and organization culture |
| Preventive Medicine | A branch of medicine concerned with preventing disease |
| Productivity | The amount of work or production output per unit of input from labor, equipment, and/or capital used |
| R&D | Research and Development |
| Resilient | Able to adapt and rebound readily following an adverse event |
| Risk Factor | Social, economic, or biological status, behaviors or environments associated causally or increase susceptibility to disease, illness, or injury |
| SOLAR | Site for On-line Learning and Resources |
| StD | Short-term disability |
| STEPS | Steps to a Healthier U.S. Workforce Initiative |
| USDHHS | U.S. Department of Health and Human Services |
| VPP | Voluntary Protection Program |

| Well-Being | An optimum condition of health, based on a balanced lifestyle, in which an individual experiences satisfaction and confidence in personal levels of fitness |
| Wellness | A health care process that fosters awareness of and attitudes toward healthy lifestyles that enable individuals to make informed choices to achieve optimum physical and mental health |
| WHO | World Health Organization |

# B

# Open Session and Workshop Agendas

**Committee to Assess Worksite Preventive Health Program Needs for NASA Employees**

**Food and Nutrition Board**
**Institute of Medicine**
**The National Academies**

**National Academy of Sciences**
**Keck Building**
**500 Fifth Street, N.W.**
**Washington, D.C.**

**March 25, 2004**

*Preliminary Open Session Agenda*

**Open Session**

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| 1:00 p.m. | **Welcome, Introductions, and Purpose of the Session** |
| | *James Merchant* |
| | **Presentations from Representatives of the National** |
| | **Aeronautics and Space Administration:** |
| 1:15 | *Catherine Angotti, Office of the Chief Health and Medical Officer* |
| 1:45 | *Alan Gettleman, Office of the Chief Health and Medical Officer* |

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| 2:15 | *Guy Camomilli, Office of the Chief Health and Medical Officer* |
| 2:45 | *Mae Hafizi, Dynamac Corporation* |
| 3:15 | *Wyck Hoffler, Dynamac Corporation* |
| 3:45 | Committee Questions to the Panel |
| 4:30 | Adjourn |

**Committee to Assess Worksite Preventive Health Program Needs for NASA Employees**

**Food and Nutrition Board**
**Institute of Medicine**
**The National Academies**

**The National Academies**
**Members Room**
**2100 C Street, N.W.**
**Washington, D.C.**

**Creating a Healthier Workplace Environment**

**June 21, 2004**

*Agenda*

**10:15 a.m.-Welcome**
*Ann Yaktine, Ph.D., Food and Nutrition Board*

*Morning Session*
*Moderated by Martin-Jose Sepulveda, M.D. (Committee Vice Chair)*
**Designing and Developing Health Promotion Programs**
*Michael O'Donnell Ph.D., M.B.A., M.P.H., President and Founder, American Journal of Health Promotion*
**High Performance Workplace Models in the Private Sector**
*Wayne Burton, M.D., Senior Vice President and Corporate Medical Director, Bank One*
**Panel Discussion**

**12:00-1:00 p.m.-Break for Lunch**

*Afternoon Session*
*Moderated by James A. Merchant, M.D., Dr.P.H. (Committee Chair)*
**Occupational Health and Safety at NASA**
*James Jennings, M.B.A., Associate Deputy Administrator for Institutions and Asset Management, NASA*
**Models for Best Practice in Government**
*Paul Schulte, Ph.D., Director of Educational and Information Division, National Institute of Occupational Safety and Health (NIOSH)*
**Measures for Worksite Preventive Health Programs: Process Vs. Outcome**
*Michael Feuerstein, Ph.D., M.P.H., ABPP Professor, Departments of Medical and Clinical Psychology and Preventive Medicine and Biometrics, Uniformed Services University of Health Sciences*
**Electronic Records and Health Data System in the Private Sector**
*Karl Auerbach, M.D., M.S., M.B.A., F.A.C.O.E.M., Assistant Professor, Occupational and Environmental Medicine, University of Rochester*

**3:00 p.m.-Break**

**Electronic Health Records System at NASA**
*Wyckliffe Hoffler, M.D., Physician Consultant, Occupational Health Support Contractor, Dynamac Corporation*
**Managing Health Benefits and Increasing Productivity**
*Camille Haltom, National Practice Leader, Managed Consulting Practice, Hewitt Associates LLC*
**Managing Health Care: Program Utilization**
*Bill Whitmer, M.B.A., President and CEO Health Enhancement Research Organization (HERO)*
**Federal Employee Health Benefits**
*Jim Tingwald, Chief, Performance Culture Team, Personnel Division, Office of Human Resources, NASA*
**Panel Discussion**

**5:30 p.m.-Adjourn**

**Committee to Assess Worksite Preventive Health Program Needs for
NASA Employees**

**Food and Nutrition Board
Institute of Medicine
The National Academies**

**J. Erik Jonsson Woods Hole Center of the National Academies
Carriage House
314 Quissett Avenue
Woods Hole, MA**

**September 28, 2004**

**Open Session**

2:00 p.m.     Videoconference Presentation from Sponsors
*Richard Williams, Chief Health and Medical Officer*
*Catherine Angotti, Director, Office of the Chief Health and Medical Officer*

4:00 p.m.     Break

# C

# Committee Member Biographical Sketches

**James A. Merchant, M.D., Dr.P.H.** (*Chair*) is Dean of the College of Public Health and Professor of Occupational and Environmental Health and Internal Medicine at the University of Iowa. His research interests focus on the epidemiology of occupational lung diseases, particularly organic dust-induced lung disease; rural health and injuries; occupational/environmental health care delivery models; occupational health policy; and international rural and environmental health. Dr. Merchant's committee assignments include the National Advisory Committee for Occupational Safety and Health of the DOL and DHHS, the Board of Scientific Counselors of NIOSH, the Advisory Committee to the Director of the CDC, the IOM Committee to Assess Occupational Safety and Health Training Needs, and the IOM Roundtable on Environmental Health Sciences, Research, and Medicine. Dr. Merchant received his M.D. from the University of Iowa in 1966 and Dr.P.H. in epidemiology from the University of North Carolina at Chapel Hill in 1973. He is a member of the Institute of Medicine.

**Martín J. Sepúlveda, M.D.** (*Vice-Chair*) is Vice President of Global Well-being Services & Global Health Benefits for the IBM Corporation. His research interests include health information privacy reform, health promotion programs and risk reduction program measurement, value-based health care purchasing, and global occupational health services delivery. He is a fellow of the American College of Physicians, the American College of Occupational and Environmental Medicine, and the American College of Preventive Medicine. Dr. Sepúlveda was recently awarded the

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Distinguished Alumnus Award for Professional Achievement by the University of Iowa, and his team has achieved numerous national and international awards in occupational health & safety. He serves on the Board of Directors of the Employee Benefits Research Institute, the Board of Advisors to the School of Public Health at the University of Iowa, the Board of the National Business Group on Health, and is a member of the Wye River Group on Healthcare. He received his M.D. and M.P.H. degrees from Harvard University, completed internal medicine residency at the University of California Hospital & Clinics, and occupational medicine residency at NIOSH, CDC.

**Ann M. Coulston, M.S., R.D.** is a Clinical Development Associate with Eli Lilly and Company, working with the obesity drug development program. Ms. Coulston has a more than 20-year history of clinical research at Stanford University Medical Center where her research is centered on the nutritional management of diabetes and insulin resistance. She is a Registered Dietitian, a Fellow of the American Dietetic Association, and a past-president of the American Dietetic Association. The American Dietetic Association Foundation has recognized her for Excellence in the Practice of Clinical Nutrition and in the Practice of Research. Ms. Coulston holds membership in the American Diabetes Association, the American Society for Nutritional Sciences, and the North American Association for the Study of Obesity. Ms. Coulston received her M.S. in nutritional science from Cornell University in 1972.

**Dee W. Edington, Ph.D.** is a Professor of Movement Science in the Division of Kinesiology and a Research Scientist in the Health Management Research Center at the University of Michigan. Dr. Edington studies the relationships between individual health behaviors and future health care utilization and costs for both individuals and organizations. His research focuses on the health behaviors of individuals such as physical inactivity, overweight, smoking, high blood pressure, and high cholesterol. He is interested in how these health behaviors and risks interact to result in poor health status and future increased utilization of the health care system. He is a member of the American Academy of Kinesiology and Physical Education, and the Society of the Sigma Xi. Dr. Edington received his Ph.D. in Physical Education from the Michigan State University in 1968.

**Pamela A. Hymel, M.D., M.P.H.** is Senior Vice President and Corporate Medical Director for Sedgwick CMS. She is former Vice President of Medical Services and Benefits at Hughes Electronics, Inc. In her 16 years of employment with Hughes Electronics, Dr. Hymel was instrumental in the development of WorkWell, an integrated wellness program designed to

address modifiable risk behavior for employees in Hughes' self-funded medical program focused on reducing health care costs before they happen. Dr. Hymel is a Fellow of the American College of Occupational and Environmental Medicine (ACOEM) and under her leadership, Hughes was awarded the ACOEM Corporate Health Achievement Award and the C. Everett Koop Award Honorable Mention. Dr. Hymel received her M.D. from Louisiana State University.

**J. Richard Jennings, Ph.D.** is a Professor in the Department of Psychiatry and Psychology in the Western Psychiatric Institute and Clinic at the University of Pittsburgh. His research interests are in the areas of cognitive psychophysiology, brain imaging, cardiovascular functioning and aging. He has published research on the influence of sleep deprivation on processes of supervisory attention, autoregulation of blood pressure and thought, and cardiovascular reactivity associated with atherosclerosis. Dr. Jennings is a member and past-president of the American Psychosomatic Society and the Society for Psychophysiological Research and a Fellow of the American Psychological Association. Dr. Jennings received his Ph.D. from the University of California-Berkeley in 1969.

**Tom B. Leamon, Ph.D.** is a Vice President of Liberty Mutual Insurance Group and Director of the Liberty Mutual Research Institute for Safety. Dr. Leamon is responsible for the research program in occupational safety and rehabilitation and has published research on integrated approaches to occupational injury and illness, industrial ergonomics, and evaluation of criteria for the prevention of low back pain disability. He also serves as a Lecturer on Environmental Health at the Harvard School of Public Health and is a term member of the NORA liaison committee of the National Institute of Occupational Safety and Health. Dr. Leamon is a Fellow of the Ergonomics Society, Human Factors and Ergonomics Society, and the Institution of Electrical Engineers (U.K.). He is a board certified Professional Ergonomist, a Chartered Engineer (U.K.), and a European Engineer. Dr. Leamon received his Ph.D. in Industrial Engineering from the Institute of Technology, Cranfield.

**Rebecca M. Mullis, Ph.D., R.D.** is Professor and Department Head of Foods and Nutrition at the University of Georgia. Her research interests include developing intervention approaches for individuals, groups, and populations. Her areas of interest include both clinical and community-based programs for chronic disease risk reduction and health promotion. Dr. Mullis is particularly interested in policy and environmental approaches to reducing cardiovascular disease. Dr. Mullis serves on the USDA Food and Consumer Service Expert Round Table, and is a member

of the Shape Up America Campaign Advisory Council. She is also spokes-person for the American Heart Association's Heart Check Program. She is a Registered Dietitian and received her Ph.D. in Interdisciplinary Home Economics from the University of Tennessee in 1976.

**Michael D. Parkinson, M.D., M.P.H.** is Executive Vice President and Chief Health and Medical Officer at Lumenos. He is responsible for over-sight and integration of consumer, patient, provider, and purchaser strat-egies to identify, promote, and deliver high quality health programs and health care. Dr. Parkinson has published in the areas of screening and preventive health care services and reimbursement for preventive care. He is President-Elect of the American College of Preventive Medicine, a Fellow of the American College of Preventive Medicine, the former Vice Chair of the American Board of Preventive Medicine, and member of the Armed Forces Epidemiological Board. Dr. Parkinson is a retired Colonel of the U.S. Air Force. He serves on the editorial boards of the *American Journal of Medical Quality* and the *American Journal of Preventive Medicine*. Dr. Parkinson received his M.D. from George Washington University in 1979 and M.P.H. from Johns Hopkins School of Hygiene and Public Health in 1987.

**Claudia K. Probart, Ph.D.** is Associate Professor of Nutrition at the Penn-sylvania State University. In her work at Penn State, Dr. Probart has ex-plored a variety of innovative delivery systems for nutrition education. Her research interests include the psychosocial aspects of food decision-making behavior, nutrition and health marketing theory and practice, gen-der issues in consumer nutrition behavior, nutrition and health communi-cation for special population groups, and worksite nutrition intervention for cancer risk reduction. Dr. Probart serves as director of the Interna-tional Program in Nutrition at Penn State. She is a technical editor of the *Food, Nutrition, and Agriculture Journal* and a reviewer for the *Journal of the American Dietetic Association*, the *American Journal of Health Promotion*, and others. She is a member of the American Institute of Nutrition, the Ameri-can Dietetic Association, and the American Society for Clinical Nutrition. Dr. Probart is a Registered Dietitian and received her Ph.D. from the Uni-versity of Oregon in 1987.

**Nicolaas P. Pronk, Ph.D.** is Vice President of the HealthPartners Center for Health Promotion. He is also a Research Investigator in the HealthPartners Research Foundation, where he serves as co-director of the Population Health Unit. In this role, he conducts studies in the areas of behavior change, population health improvement and the impact of systems-level change on health-related outcomes. Dr. Pronk has a broad

background in exercise science and behavioral medicine. He has published extensively in the areas of exercise and physical activity, behavior change and the integration of health risk management strategies in population health initiatives. He currently serves on the Editorial Boards for *American College of Sports Medicine (ACSM) Health and Fitness Journal, Disease Management & Health Outcomes,* and the e-journal *Preventing Chronic Disease.* Dr. Pronk is a member of the *NIDDK*'s Clinical Obesity Research Panel (CORP) at the National Institutes of Health. He has also served on the Translation Advisory Committee for Diabetes Prevention and Control Programs at the Centers for Disease Control and Prevention in Atlanta. He is a Fellow of the ACSM. Dr. Pronk received his Ph.D. in Exercise Physiology in 1992 from Texas A&M University, and completed a Postdoctoral Research Fellowship in Behavioral Medicine at the University of Pittsburgh School of Medicine.

**Glorian Sorenson, Ph.D., M.P.H.** is a Professor in the Department of Society, Human Development and Health at the Harvard School of Public Health and is Director of the Center for Community-Based Research at the Dana-Farber Cancer Institute. Her research interests include worksite- and community-based studies that test the effectiveness of theory-driven interventions targeting individual and organizational change. Her research has focused particularly on the health of workers, with a focus on cancer prevention, including tobacco control, diet and physical activity, as well as occupational health and safety. She has conducted studies in worksites as well as in collaboration with labor unions. Her research team conducted the first randomized controlled worksite intervention trials to integrate messages on occupational health and health behaviors and was instrumental in conducting the first randomized trials to integrate messages on occupational health and health behaviors.