Role of the Primary Care Physician in Occupational and Environmental Medicine

DIVISION OF HEALTH PROMOTION AND DISEASE PREVENTION

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Not only in antiquity but in our own times also laws have been passed in well-ordered cities to secure good conditions for the workers; so it is only right that the art of medicine should contribute its portion for the benefit and relief of those for whom the law has shown such foresight; indeed we ought to show peculiar zeal, though so far we have neglected to do so, in taking precautions for their safety, so that as far as possible they may work at their chosen calling without loss of health.

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Contents

A Note

The problems discussed in this volume are as universal and as old as work and the environment. For this reason we thought it appropriate to illustrate this new Institute of Medicine study with words and woodcuts that predate it by several hundred years. The woodcuts are from a sixteenth-century book published in Germany. The words are from the Italian physician Bernardino Ramazzini, scholar and professor of medicine at the University of Padua, who wrote them in the seventeenth century and spent his life studying the problems of workers and the environments they inhabited.

Although our quotations focus on occupation and its environment, we emphasize that the study and this report equally address more general concerns of the environment at large—in the home, on the street, as well as at work. The coupling of health and the environment is an ancient one that has left its mark on our language in such words as malaria ("bad air"). Even Hippocrates stressed environmental factors in disease in his writings *On Airs, Waters, and Places.* John Evelyn, a founder of the Royal Society, wrote of seventeenth-century London: "The inhabitants breathe nothing but an impure mist, accompanied with a fuliginous and filthy vapor which renders them obnoxious to a thousand inconveniences, corrupting the lungs, and disordering the entire habitat of their bodies, so that catarrhs, phthisics, coughs, and consumption rage more in this city than in the whole earth besides." He could have been describing any number of today's cities.

For their assistance to the committee in completing its task, we are grateful to Pamela Reznick and to Heather Wiley for the design and conception of this volume.

James V. Warren, *Study Director*

Preface

One of the most persistent trends in American society has been an insistence on the citizens' rights to be informed and to participate in all areas that affect their personal welfare. This has certainly been true in matters relating to health. With marked improvement in our overall health status and advances in our understanding of the causes of illness, we have come to believe that we have a right to good health, as well as a right to an explanation of why poor health occurs.

Among the external etiologic factors receiving particular attention in recent years have been the interrelation between work and health and the impact of chemical and physical agents in the workplace and general environment on well-being. We no longer accept injury and illness as inevitable consequences of occupation, nor do we quietly accept contamination of the general environment with chemicals. Indeed, the public outcry against such pollution parallels the concern that produced the Sanitary Revolution in the mid-nineteenth century. A relatively new dimension to the public's understanding of the potential threat of chemical and physical agents in the general environment or workplace has been the recognition that their effects on health can be insidious, developing only after decades of exposure. The nature of such effects, particularly cancer and reproductive damage, has further fueled public concern.

This increasing recognition and the concomitant call for reductions in occupational and environmental risks have not been without controversy. Laws have been passed, federal agencies have been established, and literally billions of dollars have been spent to protect public health and the environment. These activities and expenditures have had a considerable impact on U.S. industry, as employers and producers. They have also affected the practice of medicine.

Employers, workers, and individuals look increasingly to the health care system for information and advice about exposures and health risks, for diagnosis and treatment of diseases caused and exacerbated by toxic occupational and

environmental exposures, and for guidance about prevention. Medicine has evolved a boarded specialty in occupational medicine, and some occupational medicine specialists have provided leadership in the field. However, they are few in number.

For these reasons, the Institute of Medicine convened a committee to offer suggestions on how to foster the role of the primary care physician in environmental and occupational medicine. The committee approached this topic with an appreciation of the increasing number of roles that primary care physicians are asked to assume. The committee also recognized the broad responsibilities and multiple demands that confront these hardworking individuals. Thus, the committee's approach was to define an ideal goal, and then to focus its recommendations on practical ways to integrate the necessary information and skills into existing practice and education patterns. The committee also recommended system changes to facilitate the ability of primary care practitioners to actively participate in occupational and environmental medicine.

The committee's report contains a discussion of the extent to which occupational and environmental factors affect the practice of primary care medicine. Precise estimates are impossible because incidence and prevalence data are inadequate. But, with the paucity of specialists, there is no question that diagnosis, treatment, and the opportunity for prevention in occupational and environmental medicine are part of the practice of primary care physicians to a greater or lesser extent. It is also likely that the role of primary care physicians in this area will continue to increase. More and more, the controversial aspects of environmental problems are being fought at the local level, so the public will likely turn to local community physicians with their exposure/health effect questions and for advice about trade-offs between health and other local issues, such as job loss. Similarly, the new workplace right-to-know laws, and the likely advent of community right-to-know laws, will convey more information about exposures to potential and adverse working conditions to workers and to the public. The significance of this expanded information to the practice of medicine at the local level can be predicted.

In identifying problems, the committee attempted to look to their root cause and make recommendations on that basis. For example, the committee felt that it was insufficient to simply state that the U.S. workers' compensation system is a deterrent to physician involvement without looking to the reasons and the ways in which the primary care physician's role in treating workers under this system could be facilitated. Similarly, the committee's recommendations to enhance and improve medical school curricula in occupational and environmental medicine were developed with the realization that faculty presence and a willingness and capability to teach such curricula are crucial to their success.

The committee's recommendations are based on the existing structure of American medicine. Any overall change in this structure that would enhance the

role of the practicing physician as an agent for the prevention of disease and promotion of well-being would make the committee's goals more readily obtainable.

The committee's efforts were greatly abetted by the many individuals listed above who contributed their expertise in the form of commissioned papers presented at a workshop in Woods Hole, Massachusettes, in July 1987. The abstracts of these presentations are included as Appendix A of this report. Our report would not have been possible without the dedicated efforts of the staff, particularly James V. Warren and the consultant to the committee, Kathleen Rest.

B. D. Goldstein, *Chair*

Various and manifold
is the harvest of diseases reaped by certain
workers from the crafts and trades that
they pursue; all the profit that they get is fatal
injury to their health.

Executive Summary

Introduction

There is increasing concern that our highly sophisticated health care system is not well prepared to address problems in an important sector of medicine, those related to occupational and environmental factors. This concern arises in the face of the public's growing recognition and apprehension of adverse health effects associated with exposure to hazardous substances in the home, the workplace, and the general environment.

Only a small proportion of the more than half a million U.S. physicians are committed to occupational or environmental medicine. The American Board of Medical Specialties identifies only 1,064 physicians in the United States today who are board-certified in occupational medicine. Although about 4,500 physicians were members of the American Occupational Medical Association in 1986, only 400 physicians were members of the American Academy of Occupational Medicine, an association of full-time practitioners of occupational medicine. These figures indicate that most individuals with occupational or environmental illnesses and injuries must obtain their medical care from physicians who are not specialists in either occupational or environmental medicine. For these reasons, the Institute of Medicine convened a committee to study how to foster the role of the primary care physician in environmental and occupational medicine.

The physicians of particular concern to the committee include general internists, family physicians, osteopathic primary care physicians, emergency room physicians, and pediatricians. To the extent that other specialists, for example, cardiologists, gynecologists, and surgeons, provide general as well as specialty-specific health care, they, too, are part of the study's target audience. Some primary care physicians provide occupational medicine services through formal or informal relationships with companies, or, to a lesser extent, with labor unions. The small number of specialists in occupational and environmental

medicine, although not the main target of this report, becomes important as consultants or educators. Although the report limits its discussion to physicians, many of its recommendations will apply to other health care providers as well.

The focus of this study is, therefore, on the physician of first contact who initially sees a person seeking medical advice. It is this physician who must be alert to a potential occupational or environmental cause for the problem and who must then call on the resources of the complex health care system for an accurate diagnosis and appropriate therapy. The question becomes: Is the physician's educational background and the support system of health care available to the physician well attuned to this task?

The area of concern of this study on occupational and environmental medicine raised issues in definition. Some committee members favored use of the term *health* over *medicine* because the former emphasizes the broader preventive activities that are so important to the field. The term *medicine* was selected because it more accurately reflects the activities of the study's target audience.

The borders of occupational medicine and environmental medicine are difficult to define. For the purposes of its study, the committee opted for a broad definition of occupational medicine and a more limited contemporary definition of environmental medicine. In the broadest sense occupational medicine considers all aspects of the relationship between work and health, thus including the impact of disease on the ability to work. It is to a large degree concerned with the impact of work on the development of medical disorders.

The definition and scope of environmental medicine are more complicated. In a literal sense, the environment is at least in part responsible for all diseases, except those determined solely by genetics. Thus, environmental medicine in that sense touches almost every aspect of medicine. The current popular conception of environmental disease is related to illness caused by external chemical or physical agents. The committee interpreted its charge from the Institute of Medicine to limit this definition further to exclude diseases caused by nicotine, alcohol, diet, or other life-style factors. This decision in no way denigrates the important contribution of these "environmental" factors to serious disease. In short, the committee's use of the term *environmental medicine* includes caring for individuals exposed to toxic substances in their homes and neighborhoods through such media as contaminated soil, water, and air.

As a clinical specialty separate from occupational medicine, environmental medicine is in its infancy. There are no certifying examinations, mini-residencies, or prescribed courses of study. Moreover, with the exception of a small and controversial group known as clinical ecologists, few physicians, if any, devote their practices to environmental health problems.

Analysis of the Problem

A substantial amount of illness, injury, and death is attributable to or affected by occupational and environmental conditions. Precise incidence and preva-

lence data are unavailable, and available estimates have been the focus of considerable debate. In a recent report, the Panel on Occupational Safety and Health Statistics of the National Academy of Sciences concluded that even a measure as straightforward and important as annual occupational fatalities varied by a factor of 3 in 1984, from 3,740 estimated by the Bureau of Labor Statistics to 11,700 estimated by the National Safety Council.

Frequencies and rates of occupational injury and illness are even more difficult to ascertain. There are several reasons for this difficulty: the long latency period between exposure and disease manifestation, multifactorial etiology of chronic disease, lack of recognition and diagnosis of occupational disease by physicians, and problems in underreporting. These factors become even more significant in the case of estimating environmentally related illness. There are virtually no reporting requirements, and the difficulties of recognition and diagnosis are further compounded by a paucity of defined clinical syndromes and some skepticism on the part of the medical community.

Problems in Medical Education

There is widespread agreement that, with few exceptions, physicians are inadequately trained in occupational and environmental medicine. Lacking a solid foundation in occupational and environmental medicine as well as in the related disciplines of epidemiology and toxicology, most primary care physicians are hard-pressed to keep up with developments in the field. Indeed, the general medical literature contains relatively little about occupational and environmental medicine.

To ensure adequate undergraduate, graduate, and continuing medical education in occupational and environmental medicine, there must be sufficient faculty at each U.S. medical school, but the inadequate number of trained medical school faculty in occupational and environmental medicine has been amply documented. Surveys by the Association of Teachers of Preventive Medicine indicated that only 59 percent of 102 U.S. medical schools responding to a questionnaire had any faculty in occupational medicine.

Current federal extramural funding pertinent to environmental and occupational health is obtained by medical school faculty primarily from the National Institute of Environmental Health Sciences (NIEHS) ($31 million in fiscal year 1986), particularly in the area of toxicology. In comparison, the National Institute for Occupational Safety and Health (NIOSH) awarded only $3.8 million in fiscal year 1986 to medical schools from its grossly underfunded ($6.2 million) extramural budget. Medical school faculty also received $3.4 million in grants and cooperative agreements from the Environmental Protection Agency's $200 million fiscal year 1986 extramural research and development budget. Through its extramural research budget and mechanisms such as career development awards, the NIEHS has brought about a significant increase in medical school faculty number and teaching of toxicology. A similar approach is needed for other environmental health sciences and for occupational health.

This lack of funding for faculty is the major cause of inadequate medical school teaching. A 1977-1978 survey of U.S. medical schools found that only 50 percent specifically taught occupational medicine as part of the required curriculum. By 1982-1983, the figure rose to 66 percent, but the number of required curriculum hours remained constant, 4 hours over 4 years. At the graduate level, a survey of 89 departments of internal medicine with identified divisions of general internal medicine found that 51 (57 percent) had no programs or clinics in occupational and environmental medicine. Only 20 programs (22 percent) offered clinical occupational medicine experience to residents: these courses were electives in almost all cases. The 1987 Association of American Medical Colleges survey of medical school graduates reported that only 1.4 percent of all students took electives in occupational medicine (fewer than in any other field of medicine), and 50 percent felt that their instruction time in public health and community medicine was inadequate (60 percent felt that way about prevention).

Constraints Affecting Practicing Physicians' Attitudes

Another problem in the system relates to physicians' attitudes toward health promotion and disease prevention. As the scientific basis of clinical prevention is strengthened, prevention should become increasingly incorporated into routine medical practice. Yet the evidence suggests that physicians do a less than optimal job of delivering clinical preventive services. The overall barriers to the implementation of preventive services in the clinical setting also have an impact on the ability and willingness of the physician to deliver occupational and environmental health services. There are numerous constraints to the active participation by the primary care physicians:

- Infrequent occurrence of occupational and environmental illnesses and injuries.
- Occupational and environmental events are often difficult and time consuming to diagnose.
- Lack of information support available to the primary care practitioner.
- Limited relationship of practicing physicians with local health departments.
- Lack of payment for clinical preventive services.
- Entanglement with the workers' compensation system, often with payment delays, nonpayment for services, and additional paperwork.
- Lack of understanding of legal issues associated with occupational and environmental health.
- Ethically difficult situations arise frequently in the care of working patients, particularly when the physician is employed by the patient's employers.
- Fragmentation of responsibility among potentially helpful government agencies, particularly at the national level.

Goals for Clinical Practice

What extent of participation by the primary care physician can realistically be expected? The committee recognizes the broad responsibilities and multiple demands on these hardworking individuals, and it is unreasonable to think that most primary care physicians will become experts in ergonomics, toxicology, epidemiology, industrial hygiene, and the other disciplines central to the practice of occupational and environmental medicine. But it is equally unreasonable to prescribe educational and other interventions without stating a clear goal. This goal can be stated as follows: at a minimum, all primary care physicians should be able to *identify possible occupationally or environmentally induced conditions* and *make the appropriate referrals for follow-up.* In order to carry out this minimum standard of care, physicians must:

- Know some basic principles of occupational and environmental disease and understand the difficulties in precisely defining an individual patient's exposures.
- Understand their responsibilities within the workers' compensation system.
- Know how to take an appropriate history in those clinical situations in which occupational or environmental disease are part of the differential diagnosis.
- Be sensitive to the ethical, social, and legal implications of the diagnosis of an intervention for occupational and environmental disease.
- Be alert to opportunities for the prevention of occupational and environmental illness in patients under their care.
- Call known or suspected hazards to the attention of public health agencies or other entities as indicated by the history and information obtained.

Principal Recommendations

The recommendations derived from this study fall into two major categories: those designed to enhance the role of the present-day primary care physician in the occupational and environmental aspects of practice and those designed to enhance the training of future physicians for greater abilities and appreciation of this aspect of medicine. Underlying these are important general considerations that are critical to both endeavors.

Recommendations to Foster the Role of Primary Care Physicians in Present-day Patient Care Activities

Disease and impairment problems attributable to environmental or occupational exposures present unusual complexities in clinical medicine because the necessary expertise to assist the practitioner in documenting etiology as well as determining appropriate preventive activity is fragmented and often unknown to the primary care practitioner.

Improved information sources are needed. The most practical way to assist the primary care practitioner to function effectively and knowledgeably when confronted with a patient suspected of having an occupational or environmental disease is to have a single-access point for all necessary clinically pertinent information. It should be designed so that a single telephone call satisfies the practitioner's informational needs. It could be based on an extension of the techniques used by the nation's poison control centers. The Institute of Medicine or other appropriate coalescing group, in cooperation with appropriate government agencies, should begin the efforts to achieve a meeting with the leaders of existing programs to initiate the establishment of such a project.

The committee recommends an increase in the scope and availability of practice-oriented computer-based data handling systems for occupational and environmental medicine. The National Library of Medicine, which is already involved in such activities, should take the lead in future development of these systems.

In addition, public health departments or other government agencies should make available to practicing physicians on a regular basis periodic reports of local disease incidence and exposure patterns for occupational and environmental illnesses to alert and remind physicians of current problems in the community.

The Institute of Medicine, or a similar body working with appropriate government agencies on a broad front, should bring to the attention of practicing physicians more information on occupational and environmental medicine by:

- Encouraging the publication of articles and reviews in the various journals dealing with clinical medicine.
- Encouraging special publications or bulletins, particularly from health departments, dealing with topics in occupational and environmental medicine.
- Encouraging the inclusion of occupational and environmental topics in programs of continuing medical education.
- Stimulating the development of mechanisms to inform and guide physicians on the nonclinical means of assisting their patients, for example, by guiding a patient on how to obtain disability assistance or workers' compensation.

There is a striking shortage of clinically trained specialists in occupational and environmental medicine who can serve as consultants and educators. There are only about 1,000 active board-certified specialists in occupational medicine in the United States, and the process of certification is difficult for candidates with a predominantly clinical background. Today, these few board-certified specialists in occupational medicine are for the most part employed by industry or academia and are not available to primary care physicians as clinical consultants. Additionally, only one-half of all medical schools have an identifiable faculty

member in occupational medicine. Perhaps the shortage could be relieved by a new mechanism of certification of special clinical competence in the field, similar to that currently being undertaken in geriatrics. The Institute of Medicine should convene an ad hoc group to explore and initiate a means of correcting the national deficiency. Efforts should also be made to increase the number of primary care physicians with some special interest and training in the field of occupational and environmental medicine, without creating more full-fledged board-certified consultants.

In addition to individual experts, primary care practitioners need access to referral centers that can provide comprehensive patient-specific occupational and environmental health services beyond those related to the diagnosis and treatment of disease. These should include services related to the evaluation of disability, facilitation of workers' compensation claims, rehabilitation and/or job retraining, and the provision of prevention-oriented resources. It is recommended that the Centers for Disease Control (CDC), through the NIOSH, convene a panel that would include representatives from the Social Security Administration, state workers' compensation programs, and other appropriate social service agencies to identify effective alternative means to meet this need such as through targeted support of labor education resource centers and comprehensive occupational health clinics (those that provide nonclinical support services in addition to the basic clinical services). Consideration of the appropriate distribution and funding of the alternatives considered should be addressed. The CDC, through the Center for Environmental Health, should convene a similar panel to identify alternative means to deliver such services to those affected by hazards in the general environment.

Due to the paucity of information about the practice patterns and activities of primary care physicians in today's changing medical scene with respect to occupational and environmental medicine, a broad and systematic survey of the needs and concerns of such physicians is recommended. Although it would be a major undertaking, a description of the evolving practices and problems of primary care physicians would be valuable in any future evaluation of the role of the primary care physician.

Recommended Interventions in the Health Care System to Foster the Role of the Primary Care Physician

The economic reward system for physicians dealing with the prevention and treatment of occupational and environmental problems should be improved. The current procedure-oriented reimbursement system and the emphasis on efficiency of practice is antithetical to the desired emphasis on prevention.

A new review and appropriate corrective actions regarding the provision of adequate compensation to individuals suffering work or environmentally related injuries and illnesses from either state or federal compensation systems are encouraged.

It is recommended that a second congressional review be undertaken to include specific consideration of the disincentives that the majority of workers' compensation programs present primary care practitioners with regard to their willingness to consider the role of work as the cause or a source of exacerbation of disease.

Steps should be taken to clarify the physician's legal status when handling problems in this field of medicine. The appropriate federal agencies in association with the appropriate professional medical societies, local and state medical societies, and malpractice insurance carriers should develop resources that will provide primary care providers with basic information on their legal obligations.

Steps should be taken to explore the ethical situation of physicians who deal with workers with occupational problems or those who work for businesses and industries. The appropriate professional medical societies should develop model standards for contracts for use when a primary care practitioner agrees to provide routine medical services to businesses. Physicians should be informed regarding the unique aspects of the physician-patient relationship under these circumstances.

Recommendations Related to the Education of Future Physicians

Occupational and environmental medicine should be better represented in the medical school curriculum. In the eyes of the committee, this will not happen without changes in the academic status of occupational and environmental medicine and its representation in the medical school faculty. Occupational and environmental medicine should be a vital part of the traditional student clinical assignments. Because preventive medicine is usually not taught in the clinical years, it is necessary that departments of clinical medicine include occupational and environmental medicine as part of their third- and fourth-year teaching programs.

Noting that only 50 percent of medical schools indicate that they have at least one identifiable faculty member who is primarily concerned with occupational health, efforts should be made to provide all medical schools with at least one such faculty member. Mechanisms should be mobilized for the creation of such new academic faculty with academic credentials in teaching and research. For example, more career development awards similar to those that have been successful in other disciplines in medicine should be established. Mechanisms and resources for current faculty to gain additional training in occupational and environmental medicine and the applicable basic sciences should also be established. In addition, a vigorous research program is required because too little research support is directed to this cause by the agencies that fund academic research. Government funding agencies should receive increases in monies for extramural funding. Such an approach would enhance faculty numbers and help to achieve the desired goals of better teaching, to yield better informed physicians in the future, and to produce more specialists and faculty

in the field as well as the much needed clinical consultants.

Residency programs directed toward the production of general physicians in both internal medicine and family practice should be adjusted to provide more active clinical experience in occupational and environmental medicine. They should also contain instruction in such topics as epidemiology and risk assessment.

Additional opportunities for the pursuit of specialized residency and fellowship training in occupational and environmental medicine should be established, and residents should be encouraged to participate in research activities.

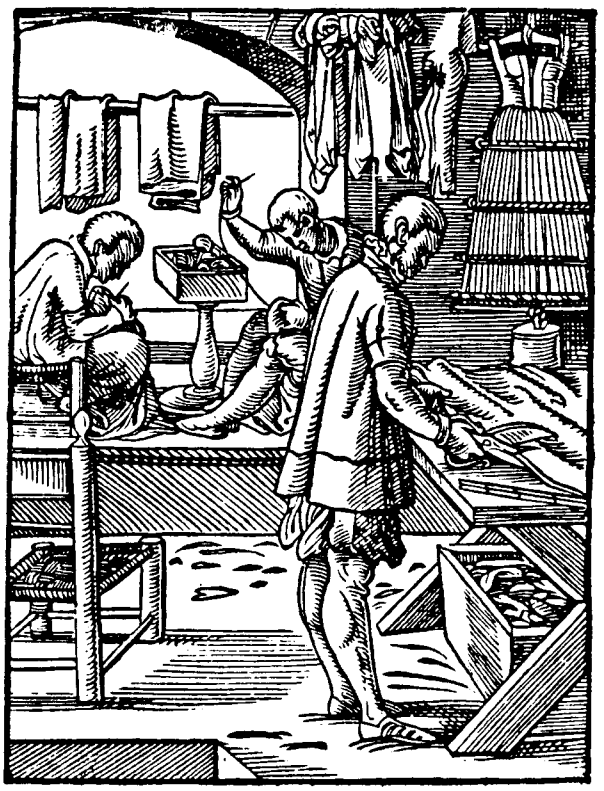
All educational efforts in occupational and environmental medicine should emphasize the physician's role in disease prevention and health promotion.

General Recommendations

Many of the proposals resulting from this study have a broad base in medical practice, medical education, and the functions of a number of government agencies. Assignment of responsibility for the pursuit of the recommendations to a single agency or group is often not appropriate. To ensure continued concern and activity, the committee recommends that the Institute of Medicine, in conjunction with representatives of government and private agencies, maintain an active ongoing program to pursue these goals.

In an effort to achieve a greater recognition of the important academic and clinical role of occupational and environmental medicine, steps should be taken to encourage greater representation of these areas in national and state board examinations required for certification and licensure.

Occupational medicine is an established and recognized medical specialty. The steps recommended in this report should strengthen the position of occupational medicine as a vital component of clinical medicine. In contrast, environmental medicine has only a minimal structure of clinical specialists, professional societies, and specialty journals. Recognition as a clinical specialty area by the medical profession and the public is missing. The recommendations from this study, to be pursued by the Institute of Medicine and other agencies, should accelerate the evolution of environmental medicine into a viable, recognized, and accepted part of clinical medicine.



Over and above the evil effects of a sedentary life, the affliction in store for such workmen as a result of their craft is myopia, a well-known affliction of the eyes which obliges one to bring objects closer and closer to the eyes in order to see them clearly; hence we may see nearly all such workers using spectacles when they are elaborating the details of their handiwork.

CHAPTER 1

Introduction: The Nature of the Study

The growing public recognition of adverse health effects associated with exposure to toxic substances in the home, the workplace, and the general community environment is reflected in an increasing concern that the health care system is not adequately prepared to address occupational and environmental problems. While the public tends to rely on its public health and regulatory agencies to protect it from hazardous toxic exposures and dangerous consumer products, individuals generally turn to the medical community for help when they are personally affected. Many, if not most, of these concerned individuals consult primary care physicians, principally general internists and family physicians. Physicians' limited training in occupational and environmental medicine, coupled with this expanding need, prompted the Institute of Medicine to examine the role of primary care physicians in occupational and environmental medicine and to seek ways of fostering their participation in these important areas of health care.

TARGET AUDIENCE AND FOCUS OF CONCERN

While recognizing the important contributions of nonphysician health care providers, the study focuses its efforts on physicians in order to examine specific problems and offer specific recommendations for one health care discipline. Although there are specialists in occupational and environmental medicine, they are not the main targets of this report. The committee was primarily concerned with primary care physicians, or, more accurately, physicians of first contact. These include general internists, family physicians, osteopathic primary care physicians, emergency room physicians, and pediatricians. To the extent that other specialists, for example, cardiologists, gynecologists, and surgeons, provide general as well as specialty-specific health care, they, too, are part of the

study's target audience. Some primary care physicians provide occupational medicine services through formal or informal relationships with companies or, to a lesser extent, with labor unions. These physicians constitute a special subset and are addressed in this report. Although the report limits its discussion to physicians, many of its recommendations will apply and be helpful to other health care providers as well.

The specific focus of the study raised difficult issues that were more than semantic in nature. Some committee members favored use of the term *health* over the term *medicine* because the former emphasizes the broader preventive activities that are so important to the field. The term *medicine* was chosen because it more accurately reflects the activities of the study's target audience.

The borders of occupational medicine and environmental medicine were more difficult to define. For the purposes of its study, the committee opted for a broad definition of occupational medicine and a more limited contemporary definition of environmental medicine. Occupational medicine considers all aspects of the relationship between work and health. It includes the impact of disease on the ability to work as well as the impact of work on the development or exacerbation of existent medical disorders. The broad goal of "humane work conditions" described by the World Health Organization is included in the committee's definition of occupational medicine.

The definition and scope of environmental medicine are more complicated. In the literal sense, the environment is at least in part responsible for all diseases, except those determined solely by genetics. Thus, environmental medicine in that sense touches almost every aspect of medicine.

Environmental health has had a long history in public health and preventive medicine. At the turn of the century, the major environmental health concern was drinkable water, a function of sanitary engineers and the new sciences of epidemiology and infectious disease. At that time, the major threat to water supplies in the United States was bacterial contamination. The epidemiologic component of environmental health can be traced directly from John Snow's identification of the Broad Street water pump as the source of a major cholera epidemic in London. The transmutation of environmental health from a focus on infectious disease to its present-day almost complete exclusion of diseases caused by microbial agents has been based primarily on two trends. One is the development of epidemiology and infectious disease into specialties that extend well beyond an initial focus on waterborne diseases. The second is the success of sanitary engineers in developing highly successful approaches to preventing such diseases. At the time the modern environmental concerns developed in the late 1960s, the focus of public health was to a large extent on infectious disease, as exemplified by the name change in 1970 of an arm of the Public Health Service from the Communicable Disease Center to the Centers for Disease Control. The term *environmental health* has evolved from its previous connotation and is now used as a designation for relatively new concerns.

Currently, the popular conception of environmental disease is related to illness caused by external chemical or physical agents. This definition excludes conditions that are a direct consequence of inheritance; infectious disease; nonoccupational violence, advertent or inadvertent; and iatrogenically caused illness and injury. The committee interpreted its charge from the Institute of Medicine to narrow this definition even further to exclude diseases caused by nicotine, alcohol, diet, and other life-style factors. This decision in no way denigrates the important contribution of these "environmental" factors to serious disease. Rather, it reflects a concern that non-life-style environmental factors, that is, toxic exposures, are less often considered and are equally deserving of study and attention. In short, the committee's use of the term *environmental medicine* includes caring for individuals who are exposed to toxic substances in their homes and neighborhoods through such media as contaminated soil, water, and air.

Chemists boast that they have mastered the art of subduing every kind of mineral, yet they themselves do not come off scot-free from their pernicious influence.

CHAPTER 2

The Cause for Concern: An Analysis of the Problem

INCIDENCE OF OCCUPATIONAL AND ENVIRONMENTAL DISEASE

A substantial amount of illness, injury, and death is attributable to or affected by occupational and environmental conditions. Precise incidence and prevalence data are unavailable, and estimates have been the focus of considerable debate. In a recent report by the National Research Council (1987), the Panel on Occupational Safety and Health Statistics of the National Academy of Sciences (NAS) concluded that even a measure as straightforward and important as annual occupational fatalities varied by a factor of 3 in 1984—from 3,740 estimated by the Bureau of Labor Statistics (BLS) to 11,700 estimated by the National Safety Council.

Frequencies and rates of occupational injury and illness are even more difficult to ascertain. Through its annual survey, the BLS estimates that 5.3 million work-related injuries occurred in 1984, at a rate of 7.8 per 100 full-time workers (Bureau of Labor Statistics, 1986). Agriculture, mining, construction, and manufacturing had the highest injury rates—11.0 per 100 full-time workers. The service sector had a considerably lower rate of 6.0 injuries per 100 full-time workers. Occupational illness data are more problematic. In 1984, 124,800 new cases of occupational disease were reported by the BLS, but because occupational illnesses can take a long time to develop, this figure is almost certainly an underestimate.

The inadequacy of the data has long been recognized, and a concern about substantial underreporting exists. The previously mentioned NAS panel found no straightforward estimates of the extent of underreporting of occupational injuries in the BLS annual survey data. In 1984, a congressional committee reported that "no reliable national estimates [of occupational disease] exist today" (U.S. Congress, House, 1984). The same committee concluded that statistical information on occupational illness remained grossly inadequate in 1986.

Estimating the incidence of occupational illness is difficult for several reasons: the long latency period between exposure and disease manifestation, the multifactorial etiology of chronic disease, the lack of recognition and diagnosis

of occupational disease by physicians, and the underreporting problems noted above. These same factors become more significant in the case of estimating environmentally related illness. There are virtually no reporting requirements, and the difficulties of recognition and diagnosis are further compounded by a paucity of defined clinical syndromes and some skepticism on the part of the medical community.

More precise estimates are needed to target and evaluate public health and primary prevention activities, as well as to address social concerns about compensation costs, the burden on the medical care system, workers' quality of life, and effects on employees.

To help focus attention on the occupational health issues, the National Institute for Occupational Safety and Health (NIOSH) developed a list of the 10 leading work-related diseases and injuries based on disease prevalence and exposure estimates, as well as on their amenability to prevention-oriented activities (Centers for Disease Control, 1983). These are given in Table 2-1. Once again, it is important to remember that *work-related* is a two-pronged concept. It relates to diseases caused or exacerbated by work and to diseases that affect one's ability to work. In addition, the NIOSH has published morbidity, mortality, and exposure estimates in the *Morbidity and Mortality Weekly Report.* The data are acknowledged to be irregular and incomplete, yet they provide a helpful starting point.

Evidence of Need and Less Than Optimal Physician Participation

Nearly 104 million men and women make up the U.S. work force. Approximately 70 percent work in plants without any medical services. Only a small proportion of the more than half a million U.S. physicians indicate a commitment to occupational or environmental medicine. The American Board of Medical Specialties identifies only 1,064 physicians in the United States today who are board-certified in occupational medicine. Although about 4,500 physicians were members of the American Occupational Medical Association in 1986, only 400 physicians were members of the American Academy of Occupational Medicine, an association that requires its members to be full-time practitioners of occupational medicine.

As a clinical specialty separate from occupational medicine, environmental medicine is in its infancy. Physicians primarily identified as occupational medicine specialists are often referred patients with environmentally induced disorders. There are no certifying examinations, mini-residencies, or prescribed courses of study in environmental medicine. Moreover, with the exception of a small and controversial group known as clinical ecologists, few physicians, if any, devote their practices to environmental health problems.

Taken together, these figures suggest that most individuals with occupational or environmental illness and injury obtain their medical care from physicians who are not specialists in either occupational or environmental medicine.

Primary care physicians become involved in occupational injury and disease

TABLE 2-1 The 10 Leading Work-Related Diseases and Injuries in the United States, 1982

1. Occupational lung diseases: asbetosis, byssinosis, silicosis, coal workers' pneumoconiosis, lung cancer, occupational asthma
2. Musculoskeletal injuries: disorders of the back, trunk, upper extremity, neck, lower extremity; traumatically induced Raynaud's phenomenon
3. Occupational cancers (other than lung): leukemia, mesothelioma; cancers of the bladder, nose, and liver
4. Amputations, fractures, eye loss, lacerations, traumatic deaths
5. Cardiovascular diseases: hypertension, coronary artery disease, acute myocardial infarction
6. Disorders of reproduction: infertility, spontaneous abortion, teratogenesis
7. Neurotoxic disorders: peripheral neuropathy, toxic encephalitis, psychoses, extreme personality changes (exposure-related)
8. Noise-induced loss of hearing
9. Dermatologic conditions: dermatoses, burns (scaldings), chemical burns, contusions (abrasions)
10. Psychologic disorders: neuroses, personality disorders, alcoholism, drug dependency

NOTE: The conditions listed under each category are to be viewed as *selected examples,* not comprehensive definitions of the category.

SOURCE: Centers for Disease Control. 1983. Leading work-related diseases and injuries—United States. *Morbidity and Mortality Weekly Report* 32(2):24–26, 32; 32(14): 189–191.

in two ways. The first is when the physician's patient has an injury, illness, or risk factor that may be work-related. The second is when the physician has a formal or informal relationship with a company to provide medical services, such as preemployment physical examinations and injury care. Each case involves different assumptions about levels of service and obligation. Neither case ensures that the physician will have adequate training.

It is not known to what extent these physicians recognize and diagnose occupational and environmental illnesses, but it is assumed by many to be less than optimal, given the difficulties described previously and the paucity of training described in the following section. It is widely held that the occupational and environmental histories are the keys to uncovering occupational and environmental diseases (Felton, 1980; Goldman and Peters, 1981). In one study of an academic family practice center, only 24 percent of the 624 patient charts had any mention of occupation (or unemployment) whatsoever. Only 2 percent of the charts had any information on exposure, duration of present employment, and past occupation(s) (Demers and Wall, 1983).

In its 1990 objectives for the nation, the U.S. Department of Health and Human Services (DHHS, 1980a) identified the clinical setting as an important site for achieving its goals to prevent occupational illness and injury. One objective stated that, "by 1990, at least 70 percent of primary health care providers should routinely elicit occupational health exposures as part of patient history and should know how to interpret the information to patients in an understandable manner." In its 1986 midcourse review, the DHHS (1986) conceded that the objective was unlikely to be met. The present study goes beyond

the issue of history taking to address the broader question of the role of the physician of first contact in occupational and environmental medicine.

The primary care physician confronted by unfamiliar clinical problems of an occupational and environmental nature lacks a ready source of information and, if necessary, clinical consultation. These are hard to come by.

Standard textbooks of medicine and the more widely read medical journals provide little organized information about this field of medicine. At best, a brief list of references may be available, but this is of limited value to the busy physician. In the committee's meetings with practicing primary care physicians this lack of information was stressed as a major problem. As one put it, physicians need something similar to a 911 telephone number to get information quickly. Information on toxic substances and their effects is available from a number of government agencies, but the sources are a confusing array not well organized for easy access by the average physician. Furthermore, even with the best efforts, much needed information for practice does not exist.

If information alone was not enough for the clinical problem, then the physician might desire a consultation or wish to refer the patient to a referral center. There are problems in obtaining a consultant or finding a referral center.

In other fields of medicine, such as cardiology or gastroenterology, a steadily available clinical consultant is usually available to the general physician. Not so in occupational and environmental medicine. Of the approximately 1,000 active board-certified occupational physicians, most are employed in industry and academia and are not readily available as clinical consultants. In environmental medicine there are even greater limitations. The lack of availability of clinical consultants in this field of medicine is serious in the eyes of the committee. The number of certified physicians in occupational medicine (a subspecialty of the American Board of Preventive Medicine) has remained relatively constant in recent years. The committee is apprehensive that new requirements that stress extensive training in preventive medicine may limit even more the number of clinically oriented specialists available as consultants to the primary care physician. As will be discussed later, the small supply of clinically oriented specialists is also important in academia.

Changing Scene of Medical Care

The preceding discussion of who does and does not provide occupational and environmental medical care suggests a relatively static view of American medicine. Nothing could be further from the truth. The health care system in the United States is undergoing a sweeping transformation (Starr, 1982; Wenkenwerder and Ball, 1988) that affects every aspect of the delivery of curative and preventive services. When a system is being disturbed, it is ripe for change. What follows is a brief examination of three factors that may provide the seeds for changing the delivery of occupational and environmental health care services: the increasing concern for cost containment, the oversupply of physicians, and

the aging of the population. These three trends are particularly relevant to increasing primary care physicians' involvement in the delivery of preventive services, of which occupational and environmental medicine are a part (Nutting, 1986).

As medical care costs rise, new organizational forms of managed care will expand their influence. Depending on where they are located, these new organizations may see occupational and environmental medicine as potentially lucrative "product lines." This reasoning could result in an expansion of the delivery of those services. At the same time, institutionalized quality assurance programs may lead to the development of more "medicine by protocol." In such a system, adding occupational and environmental etiologies to the differential diagnosis is theoretically as simple as drawing one more box in the algorithm. Additionally, there may be an incentive for providers of managed health care to identify problems as work-related to the extent that these can be reimbursed outside the capitation system, namely, through workers' compensation.

On the other hand, the rise of managed systems may work against further delivery of occupational and environmental health services. Cost containment quickly gives rise to concern about provider productivity, which can easily translate into less time per patient encounter. This response can interfere with the often lengthy history taking that is required when all disease etiologies must be considered. Also, fear of alienating large corporate purchasers of care may encourage these prepaid plans to avoid the preventive aspects of occupational and environmental medicine—particularly if they involve following up known or suspected hazards—and instead concentrate on quick turnaround services like preemployment examinations or evaluation of on-the-job injuries.

Physician oversupply (U.S. Department of Health and Human Services, 1980b) might enhance the delivery of occupational and environmental health services as physicians seek to develop unique niches. On the other hand, some forces affecting the financing of health care may work against these efforts. Physicians will have to increase their efficiency, thereby forcing them to limit the amount of uncompensated time spent discovering the toxic etiology of a patient's symptom or consulting with the Occupational Safety and Health Administration. Further, they are likely to intensify their competition for the health care dollars of the most affluent members of society, those most likely to retain generous insurance coverage. This population is generally somewhat removed from occupational and environmental hazards. In addition, the spectre of more and more doctors chasing fewer and fewer health care dollars would tend to increase a bias toward high-technology medicine and away from relatively low-cost preventive services.

Finally, the emergence of geriatrics as a central concern in medical practice may work for or against the wider delivery of occupational and environmental health services. Patients will be older, and fewer may be employed. On the other hand, the aging of the population may create pressures for retaining the elderly on the payroll, enhancing their ability to work, and recognizing occupational and environmental diseases early in life to preserve the functional indepen-

dence of the elderly. Indeed, prevention of disability in elders has already become part of public policy (U.S. Department of Health and Human Services, 1979).

There is little doubt that these and other factors of the rapidly evolving health care system will affect the delivery of occupational and environmental health care services. The opportunity for change is there; the direction is yet uncertain, but it is amenable to influence.

There are numerous reasons why primary care physician involvement in occupational and environmental medicine has been less than desired. Some are related to a lack of training and competence in the area; others flow directly from physicians' attitudes regarding health promotion and disease prevention. The economic, legal, and ethical aspects of providing occupational and environmental health services also provide some powerful disincentives. These issues are examined in the following sections.

Inadequate Education

There is widespread agreement that, with few exceptions, physicians are inadequately trained in occupational and environmental medicine. A 1977-1978 survey of U.S. medical schools found that only 50 percent of them specifically taught occupational medicine as part of the required curriculum. By 1982-1983, the figure rose to 66 percent, but the number of required curriculum hours remained constant, 4 hours over 4 years (Levy, 1985). At the graduate level, a survey of 89 departments of internal medicine with identified divisions of general internal medicine found that 51 (57 percent) had no programs or clinics in occupational and environmental medicine (Cullen, 1987). Only 20 programs (22 percent) offered clinical occupational medicine experience to residents, and in almost all cases these were electives.

Among the reasons for the lack of occupational and environmental health training are an absence of clinical role models, a limited research presence, and the perennial problem of an overcrowded curriculum in which all departments vie for limited time. To be sure, occupational diseases and the impact of work and the environment on health may be addressed piecemeal in many different courses and electives, but they are not usually emphasized. As a result, with certain well-known exceptions, students are not prone to think of possible occupational or environmental etiologies.

Medical students themselves appreciate the inadequacy of their training in the field. A survey of medical school graduates done by the Association of American Medical Colleges reported that only 1.4 percent of all students took electives in occupational medicine (fewer than in any other field of medicine), and 50 percent felt that their instruction time in public health and community medicine was inadequate (60 percent felt that way about prevention) (Association of American Medical Colleges, 1987).

Lacking a solid foundation in occupational and environmental medicine as well as in the related disciplines of epidemiology and toxicology, most primary

care physicians are hard-pressed to keep up with developments in the field. Indeed, the general medical literature contains relatively little about occupational and environmental medicine (see the abstract of the paper by Lerman and Goldstein in Appendix A [Lerman and Goldstein, 1987]). It is little wonder that the primary care physician's knowledge base in this field is limited.

Lack of Medical School Faculty

To assure adequate undergraduate, graduate, and continuing medical education in occupational and environmental medicine, there must be sufficient faculty at each U.S. medical school. The best curriculum is of no value if there is no one capable of teaching it. The inadequate number of trained medical school faculty in occupational and environmental medicine has been amply documented. Surveys by the Association of Teachers of Preventive Medicine indicate that only 59 percent of the 102 U.S. medical schools have any faculty in occupational medicine (Association of Teachers of Preventive Medicine, 1986).

The paucity of faculty in occupational medicine is due to weakness in both demand and supply. As described later (see Chapter 4), the lack of demand reflects the reluctance of deans and department chairs to hire full-time occupational medicine faculty because of the almost complete nonavailability of federal competitive research funding. Such support, if available, would permit the classic pattern of medical research that is a primary justification for the hiring of full-time teaching faculty at a medical school.

The lack of supply is evidenced by the difficulty experienced by those medical schools attempting to hire faculty in occupational medicine. It would require more than 10 percent of the total number of active board-certified physicians in occupational medicine to supply just one faculty member for each U.S. medical school.

With rare exceptions, active medical school programs in occupational medicine have been the 14 programs that are part of the National Institute for Occupational Safety and Health Educational Resource Center (ERC) network. This very important program was begun by the NIOSH in part to develop professionals in all areas of occupational health. While achieving some success, the ERC program has been in almost constant budgetary crisis, including many years in which the initial NIOSH budget request has had a zero support level. The resultant survival atmosphere has not been conducive to the development of strong sustainable programs that can serve as the source of faculty for U.S. medical schools. The number of ERC-supported medical school programs that could survive a total withdrawal of NIOSH support has been a matter of frequent speculation. Without another source of funding, such as a well-financed extramural grants program, relatively few ERCs would likely survive. Vigorous support of the ERC program is necessary to provide additional faculty for training future primary care practitioners in occupational medicine.

One exception to the dearth of faculty in occupational and environmental medicine is in the field of toxicology. Sustained extramural funding of toxico-

logic research by the National Institute of Environmental Health Sciences, as well as by Career Development Awards, has inevitably led to the development of medical school faculty with interest and expertise in teaching this subject. There are full-time faculty members from 79 U.S. medical schools who are members of the Society of Toxicology (Society of Toxicology, 1987), an organization that generally requires a modest amount of peer-reviewed publications for membership.

Practicing Physicians' Attitudes Toward Health Promotion and Disease Prevention

Another problem in the system relates to physicians' attitudes toward health promotion and disease prevention. As the scientific basis of clinical prevention is strengthened, prevention should become increasingly incorporated into routine medical practice (Relman, 1982). Yet the evidence suggests that physicians do a less than optimal job of delivering clinical preventive services (Gemson and Elinson, 1986). When surveyed, they cite a variety of constraints, including inadequate reimbursement, lack of expert consensus on the types and frequency of services to be provided, minimal patient demand, structure of the medical care encounter, and lack of training in patient education skills (Wechsler et al., 1983; Orleans et al., 1985; Nutting, 1986; Henry et al., 1987). These overall barriers to the implementation of preventive services in the clinical setting also affect the ability and willingness of the physician to deliver occupational and environmental health services. In addition, occupational and environmental medicine bring their own special constraints to the arena of clinical practice

Problems in Practice

While physicians are always motivated to improve patient care, several practical problems may surface as they attempt to integrate occupational and environmental medicine into their practice.

Low-Frequency Events

The primary care physician sees a variety of diseases that approximate the patterns of illness in the community as a whole (McWhinney, 1981). These include, for the most part, acute, self-limited illnesses; prevalent chronic diseases (for example, hypertension, diabetes, arthritis); and behavioral problems. The clinical adage "when you hear hoofbeats, don't think of zebras" is part of the primary care physician's everyday mental construct. Events that appear to occur infrequently will be considered infrequently.

Is occupationally induced disease an uncommon event in primary care? If one simply considers an estimate of incident cases and divides it by the number of family physicians and internists, one may conclude that occupational disease is a low-frequency event in primary care. This view ignores prevalence and the

importance of risk factor recognition, and fails to take the comprehensive view of work relatedness described earlier. Occupational and environmental risk factors are *not* low in frequency, nor are health problems that affect one's ability to work. For example, recognition of occupational noise exposure as a risk factor can prevent an incident case of noise-induced hearing loss. Likewise, determination of the appropriate time to return to work following recovery from an acute myocardial infarction may be of central importance to patient well-being. Environmental risks also appear frequently in primary care. Counseling a parent whose child plays in a lead-contaminated environment can prevent an incident case of childhood lead poisoning.

Time Constraints

Diagnosing occupational and environmental illnesses is not easy because few have specific, pathognomonic findings (Imbus, 1975). When confronted with a possible occupational or environmental etiology, family physicians may need to consult textbooks that are not likely found in an office library or conduct a literature search (Michaels et al., 1983). Such activities can be both time-consuming and expensive and are somewhat outside the realm of routine patient care. The physician needs ready resources and a systematic approach.

Lack of Support

When primary care physicians encounter or suspect an occupational or environmental health problem, they may need information on exposures, informal or formal medical consultation, and advice about the nonclinical aspects of caring for the patient. Such support may be totally lacking in a given area, or it may be so fragmented as to make it virtually unavailable to the busy practitioner. Physicians may be at a loss as to where to look, who to call, and how to proceed.

Limited Relationship with Health Departments

While physicians may turn to local, state, and federal health departments for help with infectious diseases and food-borne illnesses, they may be totally unaware or skeptical of the health departments' roles in other areas of medicine and health. Primary care clinicians have little experience with health departments and are unlikely to consider them part of their normal support system.

Economic Issues

The economics of diagnosing and treating occupationally and environmentally mediated diseases may affect the primary care physician's willingness to get involved. A number of incentives and disincentives can be identified.

Impact of Level of Reimbursement

In general, when a physician identifies a medical condition as work-related, the patient's health insurance does not pay for treatment. Instead, benefits are

paid under the applicable state workers' compensation statute, but only if the worker decides to file a claim. Such action may place the patient in an adversarial relation to the employer and may require the patient to consult an attorney. So-called first-party insurance differs from workers' compensation in benefits covered and options available for cost containment. These differences can affect the quantity of medical services demanded and the level of payment for specific procedures.

Most state workers' compensation systems pay all "usual and reasonable" charges for medical care in the course of processing a claim. Few have the rigid cost-containment procedures often found in first-party coverage. In this context, workers' compensation payments may be higher than first-party payments for identical procedures. Some states, however, have strict cost controls and pay all charges based on a fixed fee schedule. In such states, the workers' compensation payment is generally lower than the first-party payment.

Moreover, balance billing—billing the patient for charges above the amount allowed by the workers' compensation carrier—is generally not permitted. This limitation can further reduce the physician's reimbursement for treating a work-related condition to below that of treating a nonoccupational disorder.

Thus, when cost controls are tighter under workers' compensation than under first-party insurance, fee-for-service providers face a loss in income when treating workers for occupational illnesses or injuries. Prepaid plans, on the other hand, may have a cost-shifting incentive to label conditions as occupationally related.

Payment Delays and Nonpayment

Medical care providers who report an illness as occupational may discover that no insurance payments are forthcoming at all. The first-party insurer does not cover work-related conditions. The workers' compensation claim may be contested, especially in the case of occupational disease. Workers' compensation insurers and self-insured employers contest 60 to 80 percent of all long-latency occupational disease claims, denying that the conditions are work-related (Barth and Hunt, 1980). In most states, contested workers' compensation claims are not paid by either insurer until this issue is resolved.

Typically, this can take 1 to 3 years. The delay can create significant cash flow problems for physicians. Additionally, the escalation of a claim to the level of litigation may be a further economic cost to the physician. If, however, the legal dispute involves the tort system and not the workers' compensation system, the physician will likely be well compensated for his or her time.

Paperwork

The paperwork burden is generally much greater for workers' compensation than for first-party claims. Forms must be completed and letters written to explain when the patient may return to work, the nature and extent of work restrictions, the extent of permanent disability attributable to workplace expo-

sure, the extent of preexisting disability, and the rationale for the assessment of work relatedness. This additional effort is uncompensated and constitutes another barrier.

Nonpayment for Prevention

Lack of reimbursement for clinical preventive services is an important barrier to their delivery (Gemson and Elinson, 1986). Some important medical services related to occupational and environmental health are preventive in nature—notably, surveillance of individuals by means of examinations, laboratory tests, or radiographs. Insofar as private insurance resists paying for preventive services, it will resist paying for these services as well.

Legal Issues

The level of annoyance, time lost from other clinical activities, and inconvenience engendered by paperwork or by the gatekeeper function are small compared with the costs of becoming entangled in litigation over work relatedness, readiness to return to the job, or the extent of permanent impairment or disability. In some occupational disease claims, the treating physician may be summoned to testify or depose about these issues. The doctor-patient relationship is always at risk when the doctor testifies in court. A single such experience may greatly reduce the physician's interest in determining the work relatedness of similar illnesses among other patients in the future. On the other hand, physicians may enjoy the challenge of the scientific inquiry involved in testifying. They may further enjoy the generous financial remuneration that often flows from tort action.

The legal system creates another powerful *incentive* for physicians to recognize occupational and environmental etiologies of disease—the spectre of malpractice liability.

Physicians have some statutorily determined legal obligations in the areas of occupational and environmental health. These generally relate to the discovery, reporting, and treatment of occupational disease. Other duties are derived from the common law, which defines the standards for physician accountability. For a person to prevail in a malpractice action against a physician, it must be proved that the physician owed the plaintiff a legal duty, the duty was breached, and harm was done as a result of that breach. Physicians are expected to act reasonably with regard to the circumstances of the case. Reasonable actions encompass but are not limited to the standards of practice established by their peers. Further, the duties imposed on a primary care physician acting in the role of a patient's individual physician may differ from those that arise when the care is related to the patient's employment—for example, preemployment examinations or examinations conducted as part of a workers' compensation claim.

In the context of primary care, a central question is whether the physician has a duty to take occupational and environmental histories. Another issue is

whether there is a duty to discover an occupational risk factor or disease or to realize that an illness is related to employment or to exposures from other sources. One might expect a greater duty to be imposed on physicians who practice in an industrial area or in an environmentally polluted community. Physicians who function as part-time company doctors may be construed as claiming a special competence in occupational medicine. If so, the physician could be held to a higher standard.

Ethical Issues

There is growing recognition of the ethical dimensions of occupational and environmental medicine (Rosenstock and Hagopian, 1987). Ethically difficult situations arise frequently when physicians care for working patients, especially when the physician works for a company, even on a part-time basis. The problem of divided loyalties occurs when the physician has both a patient and a client (the company), each with conflicting demands and expectations. In this context, employers may expect physicians to function as agents of social control, making determinations about when, where, and if an individual will work. Patients, on the other hand, may expect physicians to protect their interests and function as advocates when problems arise at work. While it may seem inherently clear to primary care physicians that their primary obligation is to their patient, regardless of payment source, this perception is challenged when medical services are provided through agreements with employers.

The issue of confidentiality is routinely encountered when physicians care for working patients, especially in the context of preemployment physical examinations and periodic medical screening programs. The former are done for job placement purposes, while the latter are done to assess an individual's current health status or future risk and his or her relationship to job performance or possible financial expenditures for the company. It is not surprising that employers desire information on the results of such examinations and tests. Workers, on the other hand, usually consider the personal and medical information they share with physicians to be confidential. Client companies do have a right to know about an individual's ability to work and whether specific restrictions are necessary. They also have a need to know about health problems caused or aggravated by exposures at work in order to take effective preventive measures. Patients have a right to privacy when it comes to personal and diagnostic information. Primary care physicians must decide where to draw the line.

A more subtle but equally important issue relates to the extent to which physicians are ethically responsible for reporting or otherwise acting on known or suspected hazards. Informing a patient about his or her condition and the risks involved with that condition is an integral part of patient care. Failure to go beyond this may place the patient and his or her coworkers at risk of immediate or future harm. But taking action is not a simple matter. Most primary care

physicians are unsure of how to proceed in these situations. Indeed, their actions are not without risk to themselves and their future interaction with the company and to the patient, who may suffer discrimination or job loss as a result.

Fragmented Agency Responsibility

The responsibility for occupational and environmental health in the United States is spread among a number of federal organizations. Some of these organizations are primarily regulatory, some are primarily aimed at developing the scientific and technical information base for public health decisions, and some are a mixture of both. In the Department of Health and Human Services, these include three components of the Centers for Disease Control (the National Institute for Occupational Safety and Health, the Agency for Toxic Substance and Disease Registry, and the Center for Environmental Health), the National Institute for Environmental Health Sciences, and the National Center for Toxicology Research. The Environmental Protection Agency is an independent federal agency that has both research and regulatory responsibilities. The Occupational Safety and Health Administration is a regulatory agency located in the Department of Labor. Pertinent research is also performed at a variety of other organizations within the National Institutes of Health, including the National Cancer Institute. This multiplicity of agencies reflects certain aspects of our federal administrative system and the wishes of Congress.

Efforts have been made by a variety of interagency groups, such as the Task Force on Environmental Causes of Cancer and Heart and Lung Disease and the Committee to Coordinate Environmental and Related Programs. However, any substantive activity must involve the bureaucracies and the cumbersome clearance procedures of each of the participating agencies.

Many of the issues discussed in this report do not fall clearly within the purview of any single federal agency, but rather are of interest to all agencies. Physician education and activities to enhance the effective functioning of primary care practitioners in occupational and environmental medicine are examples of such issues. These issues are not of the highest priority at any one agency, but are of some interest to many agencies. This results in the unfortunate but common practice of each budget-starved agency claiming that there is no need to support a program because some other agency is responsible. The inability to clearly and cleanly assign responsibilities greatly complicates the implementation of many recommendations made by this committee.

Thus, a wide spectrum of factors exist that may limit the optimal participation of primary care physicians in occupational and environmental factors in the patient care that they deliver.

Pitiable therefore is the lot of these workers, for since they very often have no other home than a small boat, when they fall ill they are obliged to go into a hospital, where it is impossible to enter on the precise and proper treatment for them unless the doctor knows clearly in what sort of occupation the patient is engaged.

CHAPTER 3

Goals and Interventions for Clinical Practice

If one is concerned with fostering the role of the primary care physician in occupational and environmental medicine, one must ask to what end this should be done. It is unreasonable to think that most primary care physicians will become expert in ergonomics, toxicology, epidemiology, industrial hygiene, and other disciplines central to the practice of occupational and environmental medicine. But it is equally unreasonable to prescribe educational and other interventions without stating a clear goal. There must be a definition of success—that is, a vision of what a properly trained and adequately supported primary care physician should be expected to do.

At a minimum, all primary care physicians should be able to *identify possible occupationally or environmentally induced conditions and make the appropriate referrals for follow-up.* In order to carry out this minimum standard of care, physicians must:

- Know some basic principles of occupational and environmental disease, including such concepts as latency and multifactorial etiology. Physicians should also understand the difficulties in precisely defining an individual patient's exposures and the concept of a threshold dose.
- Understand their responsibilities within the workers' compensation system.
- Take an appropriate history in those clinical situations in which occupational or environmental disease is part of the differential diagnosis.
- Be sensitive to the ethical, social, and legal implications of the diagnosis of and intervention for occupational and environmental disease.
- Be alert to the opportunities for the prevention of occupational and environmental illness in patients under their care.
- Call known or suspected hazards to the attention of public health agencies or other entities as indicated by the history and information obtained.

Primary care physicians with a special interest in occupational and environmental medicine, or whose practices include a number of patients with those

illnesses, may reasonably be expected to do more than the minimum. With greater involvement, for example, primary care physicians may wish to diagnose and treat individual patients with occupational or environmental disease and refer them for preventive, legal, and other interventions. At a still higher level, physicians may elect to participate in the prevention and legal activities themselves. These greater levels of participation could not be expected of all primary care physicians, but the committee feels that at least the minimum amount outlined here should be expected of all of them.

Interventions

As described in Chapter 2, primary care physician involvement in occupational and environmental medicine is hampered in a number of ways. The health care delivery and public health systems do little to facilitate physicians' involvement; clinically useful information and accessible support systems are lacking; and economic, legal, and ethical matters sometimes present formidable constraints. Yet primary care physicians have a crucial role in efforts to address the growing concern with occupational and environmental diseases in the United States. Attempts to foster this role must necessarily address both the microenvironment of primary care office practice and the macroenvironment of the health care and public health delivery systems, including the influence of economics, law, ethics, patient demand, and professional societies.

The committee examined both of these environments and recommended a number of interventions that, if implemented, should both ease and promote the more active involvement of primary care physicians in occupational and environmental medicine.

The Microenvironment of Primary Care Office Practice

In making recommendations that will affect the microenvironment of primary care office practice, the committee made the following assumptions. First, primary care physicians care for individual patients; they tend to base their practice patterns on short-term outcomes and, to some extent, on recognized long-term risks. Most do not orient their practice to public health or research needs. Second, recommended interventions must foster activities that are realistic for busy primary care clinicians who may not consider occupational and environmental health to be any more important than many other areas of concern. In addition to all of the clinical aspects of their own specialty, primary care physicians must consider numerous other factors defined by social rather than strict biological criteria, such as family dynamics, human sexuality, alcoholism, and child abuse, of which occupational and environmental disease is simply one more. Indeed, the committee recognizes that providers who attempt to take a complete history in order to detect occupational and environmental illnesses,

substance abuse, domestic violence, psychological depression, nutritional disorders, and the like will seldom get past the first patient. While clinicians may be willing to change their practice to include a quick screen for a documented problem, they will not be willing to become epidemiologists or pure public health practitioners.

The third assumption is that activities that clinicians are encouraged to implement should be those demonstrated to be of significant short-term benefit to their patients. It is unrealistic to expect providers to devote much time to evaluating problems for which they see no useful intervention. Finally, primary care providers already engaged in the practice of occupational medicine through some link with a company or labor union have somewhat different roles, responsibilities, and needs in the diagnosis and management of occupational and environmental disease. Interventions designed to help these physicians may vary from those specifically designed to foster the role of the first-contact primary care physician.

In its deliberations, the committee was hampered by the paucity of information about the practice patterns of primary care physicians vis-a-vis occupational and environmental medicine. Although its meetings with small groups of primary care practitioners were helpful, the committee quickly recognized the need for a broad and systematic survey of primary care physicians' needs and concerns in this area. While it would be a major undertaking, a description of primary care physicians' current and evolving practice patterns in occupational and environmental health care would be extremely valuable for the implementation of any of the recommendations made in this report. A survey could elicit physicians' perceptions of realistic and acceptable roles in occupational and environmental health care, as well as to help identify and further specify barriers to achieving these roles. Such a survey could serve as the basis of a conference, which would be convened to elaborate guidelines for primary care practice in the areas of occupational and environmental medicine. Such a consensus-building approach may enhance the credibility and acceptability of any guidelines among community-based physicians. The committee recommends that one organization or agency, such as the Institute of Medicine (IOM) or the Centers for Disease Control (CDC), assume responsibility for conducting the survey and convening the conference.

The subgroup of primary care physicians already engaged in some way in the practice of occupational and environmental medicine should be identified, surveyed, and involved in a similar consensus-building effort to develop guidelines relating to those areas most often addressed by these physicians, such as preemployment physical examinations, periodic screening, workers' compensation, and injury care. Such a conference could also provide the groundwork for establishing the regional physician networks described later in this chapter. At the same time the committee understands the complexities of actually establishing such an arrangement.

Information: What Is Needed?

Before primary care physicians can be expected to assume a more active role in occupational and environmental medicine, they will require readily available information. Some of these needs can be met by slight modifications to office practice. Most will require the sustained effort and involvement of outside resources. To care for working patients and individuals exposed to toxic agents in their environments, primary care physicians may require information on:

- Causative agents in occupational and environmental illnesses.
- Signs, symptoms, diagnosis, and treatment of occupational and environmental illnesses.
- Availability of consultants.
- Nonclinical and supportive interventions.
- Disease and exposure patterns within the community.

The signs and symptoms associated with occupational and environmental diseases are seldom pathognomonic, and thus make such illnesses sometimes difficult to diagnose. When physicians need assistance, they may consult their office library or consult with their colleagues. Unfortunately, the number of primary care physicians who have expertise in occupational and environmental medicine is presently too small for convenient consultation. Ideally, each medical community should have at least one established physician who can be a source of this information on a regular basis.

To encourage primary care physicians to assume such a role, mechanisms to support training and to provide ongoing assistance and encouragement must be developed. These could include routine communication via printed material and telephone contact with academic centers. Such active encouragement and support would likely expand sources of consultation for health maintenance organizations and large group practice associations, emergency rooms and urgent care centers, and hospitals. These efforts could also serve as the basis for the eventual development of regional networks of primary care physicians trained and interested in occupational and environmental medicine. These physicians would be readily available to provide information and first-line consultation. For example, an emergency room resident might call a local internist with known expertise in occupational and environmental medicine for help in dealing with a patient with a possible pesticide exposure.

Even if primary care practitioners with special interest in occupational and environmental medicine could address the most immediate requests for local and informal consultation, a secondary need for more formal consultation would remain. The need for such a second-line consultation can be illustrated by a case in which a primary care practitioner sees a patient with chronic active hepatitis, no history of alcohol abuse, and possible solvent exposure at work. In this situation, the primary care physician might consult an occupational medicine specialist just as he or she would other clinical consultants. Local providers

need to know where they can obtain consultations with such specialists in their area. Because these specialists are relatively few in number, their availability and accessibility to primary care physicians should be supported and encouraged through the efforts of state and local health departments and through the active involvement of professional occupational medicine organizations.

Occupational and environmental illnesses and injuries may result in serious problems for the patient that are nonclinical in nature (Sullivan and Sokas, 1985). For example, they may need help obtaining disability assistance and workers' compensation as well as help in dealing with employers and government agencies. Most physicians have no familiarity with public or private systems that offer assistance to patients with these types of problems. Experience has shown that physicians are not very effective in dealing with such diagnoses as child abuse, alcoholism, or the lack of appropriate home environments for chronically ill patients. Physicians are rarely adept at maneuvering through the maze of public and private assistance programs, nor are they often willing to help the patient through the system. Most, however, accept a role that includes identifying and referring the patient to the providers or programs they need. While they may be familiar with the types of agencies and social service programs that help patients deal with drug and alcohol abuse problems, they may be totally unaware of the types and availability of resources needed by patients with occupationally or environmentally related health problems. Indeed, in most areas, these resources may be totally lacking or so fragmented as to be virtually unavailable.

There are, however, several types of organizations that could provide these types of nonclinical interventions. They include programs for occupational and environmental health within academic institutions and large clinical facilities. Local community organizations such as Coalitions for Occupational Safety and Health and nonprofit groups organized around specific environmental issues, volunteer organizations such as the American Lung Association and the American Cancer Society, and, perhaps, existing social service agencies could also help in this capacity. Some of these organizations would require support to add staff to handle these types of patient-centered services.

Once established, the availability of these resources must be publicized among local physicians. State and local health departments could help in this effort. It is important to remember that the resources continued use may be heavily influenced by the perceived success of the first few referrals. It is professionally embarrassing to refer a trusting patient for help, only to learn later that the patient received none. To be successful, organizations that provide the nonclinical support services must do more than trigger a range of possible actions; they must satisfy the patient and provide feedback to the referring physician.

Even with the assistance of all the support systems described above, it may be difficult for newly interested primary care physicians to focus their attention on

an approach to occupational and environmental diseases. These diseases encompass a broad range of conditions, etiologies, and patterns. To enhance their practical interest and capabilities, primary care physicians need up-to-date and accurate descriptions of exposure and disease patterns in their immediate geographical area. While national statistics may be of some interest, information on local experience would be most helpful. Such information includes case reports, descriptions of exposure problems endemic to the industries or environment of the particular area, and statistical summaries of disease and exposure patterns in the area to help providers keep abreast of incidence and trends.

Information: How to Provide It?

The foregoing discussion suggests that primary care physicians need several types of information to enhance their role in occupational and environmental medicine. This information can be provided in numerous ways, some of which have been briefly described. The format and manner of providing this information will greatly influence its utility to primary care physicians. This section recommends a variety of complementary modalities for providing timely and clinically useful information to primary care physicians. These include:

- A single-access information center.
- Enhanced practice-based resources.
- Enhanced clinical consultative resources.
- An expanded role for public health agencies.
- Continuing medical education.

A Single-Access Information Center

The committee recognizes a critical need for coordination of the wide range of information that may be needed to deal with patients' occupational and environmental health problems. The information needed extends beyond that usually available in the primary care physician's office and through routine consultation networks. The committee feels that a single-access center, perhaps established on a state or regional basis, will most effectively serve the occupational and environmental medicine needs of primary care physicians. Available to all physicians by telephone, and itself a center of expertise in occupational and environmental medicine, the single-access center must be able to respond at many different levels, ranging from a simple telephone consultation on specific technical issues to requests for advice regarding available services for the comprehensive management of large-scale occupational and environmental problems.

The single-access center should encompass expertise or offer access to a range of services that cover all aspects of patient care and exposure reduction. These include education, industrial hygiene, case reporting, diagnostic and treatment

services, legal assistance, counseling, social services, and assistance in dealing with government agencies such as the Occupational Safety and Health Administration (OSHA) and the Mine Health and Safety Administration. This assistance involves maintaining an up-to-date list of such services and knowing the types of responses that can be expected when these resources are used. For example, the center should know the policy of the local OSHA office regarding requests for inspections so that they can avoid suggesting an option that may be unavailable.

If it is to be successful and widely accepted, the single-access center should be:

- Credible—primary care physicians should know it by reputation and trust its competence.
- Capable—the center should have a plan to handle growing demand.
- Clinically oriented—providers will be looking for specific clinical guidance, not research suggestions, statistics, or general discussions.
- Accessible—it must be consistently available on demand or short notice.

As described above, the single-access resource center would offer access to comprehensive clinical and nonclinical services through a consultation structure, primarily utilizing other organizations to provide these services. The similarity between the single-access occupational and environmental health center and the poison control centers operated in many communities is obvious. Traditionally, poison control centers answer calls from the public about household exposures and ingestions, particularly by children. In recent years, however, many centers have expanded their mission. For example, the University of California at San Francisco, San Francisco General Hospital Center, has a much broader data base and receives many calls from industry, government agencies, and physicians as well as from the public. It operates 24 hours a day, 7 days a week. Similarly, the sophisticated center in Cincinnati (University of Cincinnati, Cincinnati General Hospital) also operates around the clock with a broad data base. It is widely used by physicians, and has a contract from the National Institute for Occupational Safety and Health (NIOSH) to train its own staff. The committee recommends that such systems be explored as models for the development of the single-access center described here. Like effective poison control centers, the single-access occupational and environmental health center needs an excellent communications system, a sophisticated and reliable data base, and well-trained communicators who interact well with health care providers.

Practice-based Information Resources

Primary care physicians are more likely to consult reference materials if they are accessible and easy to use. Several bibliographies of occupational and environmental medicine have been published (American Medical Association, 1981, 1984). Some could easily become part of an office library. These printed

resources are handy, but they often become quickly out-of-date. Computerized data bases are beginning to offer access to current and clinically useful information.

Data Bases

A *medical decision support system* has been defined as "any computer program designed to help health professionals make clinical decisions" (Shortlife, 1987). Three types have been defined: bibliographic search systems, such as MEDLINE; factual data bases, such as TOXNET; and expert systems for supporting clinical decision making, such as DXplain (Barnett et al., 1987; Harris, 1987; Masys, 1987). These systems are underutilized by practicing physicians, perhaps because of the time required for information retrieval, lack of knowledge about their existence, unfamiliarity with computer use, unavailability of a microcomputer and modem, and costs.

Younger physicians tend to be more comfortable with computers, and many physicians are acquiring microcomputers for filing and record-keeping. As a result, more physicians will become computer literate, and will be better motivated to extend their use of the equipment to patient care. They may turn increasingly to the computer for assistance in diagnosis, treatment, and management. It is, therefore, imperative that the developing expert systems include, when appropriate, the dimensions of occupational and environmental medicine. Systems that relate clinical signs and symptoms to occupational and environmental exposures would be most useful to primary care physicians in establishing a differential diagnosis.

The committee recommends that the National Library of Medicine take the lead to:

1. Develop and refine factual data bases relating to occupational and environmental medicine.

2. Include the dimensions of occupational and environmental medicine in expert systems.

3. Disseminate information about the usefulness of data bases for diagnosis of occupational and environmental diseases.

4. Encourage the inclusion of lectures and workshops relating to the clinical value of microcomputer technology in continuing education programs.

Record Systems

Office-based record-keeping systems can help busy practitioners focus on occupational and environmental health issues. Although several occupational and environmental history forms have been developed, they have not been widely used by primary care physicians (Felton, 1980; American Lung Association of San Diego and Imperial Counties, 1983; Demers and Wall, 1983; Rest et al.,

1983a). Because of the breadth of their diagnostic challenges, it is unlikely that primary care physicians will use any detailed, highly focused, unidimensional record-keeping system. Rather, they should be encouraged to elicit information about the home, workplace, and community environment as part of the demographic and social history. Questions on exposures should be included in any standardized history forms widely used by primary care physicians. When positive patient responses arouse suspicion, a more detailed history could follow. Practitioners who seek more detail or who want a way to organize a more comprehensive work and exposure history need validated and effective forms to collect this information.

First, the committee recommends that the Centers for Disease Control (CDC) work with the appropriate professional societies to encourage practicing physicians to include basic questions relating to occupation, neighborhood, and home environments, including hobbies, in the social and demographic data base of each patient. These include questions on possible exposures and questions on the patient's perception of the relationship of these exposures to the symptoms or illness in question. Second, the Centers for Disease Control, with the assistance of the professional societies, should review, evaluate, and validate existing occupational and environmental history forms for use in primary care settings. Results could be reported in the appropriate medical journals and introduced in medical school courses. Finally, professional societies should encourage the manufacturers of standardized patient record-keeping forms to include questions on occupational and environmental exposures and risk factors on their forms.

Enhanced Clinical Consultative Resources

In most subspecialty areas of medicine, the primary care physician has a readily available clinical consultant, such as a cardiologist or gastroenterologist, in his or her community. Due to the small number of clinical active specialists in occupational and environmental medicine, this is not true in this field. The process of certification in this specialty has been made more restrictive to those candidates with extensive experience in preventive medicine, so that the outlook for expanded numbers of clinically oriented specialists is not encouraging. The committee recommends that the Institute of Medicine (IOM) and appropriate professional agencies mobilize efforts to explore and initiate means of correcting the national deficiency of specialists in this field available as clinical consultants. In addition, similar needs exist in academia for clinically oriented faculty for the recommended expansion of clinical instruction in occupational and environmental medicine.

Enhanced Consultative Services

In addition to individual experts, there is a need for sophisticated comprehensive referral centers for patients needing occupational or environmental diagno-

sis and treatment of complex medical problems. The centers of excellence supported by the NIOSH in some way fit into this category. The center should be able to undertake the evaluation of disability, facilitate workers' compensation claims, give guidance regarding rehabilitation or job retraining, and other related activites. It is important that communication with the referring physician be maintained and a plan for the future management of the patient's problem be developed. The committee recommends that the Centers for Disease Control (CDC) through the National Institute for Occupational Safety and Health (NIOSH) convene a group of representatives of other agencies to undertake the development of these consultative centers.

Public Health Agency Information and Support Systems

With few exceptions, public health agencies at all levels of government have been ineffective in giving primary care physicians the information they need in making occupational and environmental medicine a part of their routine. practice (Rosenstock and Landrigan, 1986). Even physicians who provide occupational health services to companies and labor unions have often lacked information relevant to their local practice area. The committee recommends that local, state, and federal health agencies develop and disseminate information on community disease and exposure patterns based on their surveillance and enforcement efforts.

Previous outreach efforts in occupational and environmental diseases have produced either exhaustive lists of all etiologies or summaries of the average national experience (Centers for Disease Control, 1983; Rutstein et al., 1983). Since most communities have highly specific occupational and environmental profiles, it would be much more effective if providers recognized the occupational and environmental diseases indigenous to their areas. To accomplish this, the CDC, the Environmental Protection Agency, and the National Institute of Environmental Health Sciences in cooperation with state health and environment departments could regularly assemble a profile of disease and exposure patterns by community. These data could be distributed to all practicing physicians, along with information about the medical approach to these problems. Because the goal of this effort is to influence clinical primary care practice, the community surveillance report should emphasize case reports, experience patterns in local hospitals and clinics, and reports of the early detection and intervention efforts of the medical community. To enhance interest in the document, case reports could be attributed to the physicians involved in the case. Brief versions of the community profile could be incorporated into hospital intake forms and medical histories in the form of a checklist. By noting changes in the disease profile over time, the report could also have an evaluative function.

At least one state health department (California Department of Health Services [CDHS]) has undertaken an educational outreach effort to enhance the ability of local primary care physicians to deal with hazardous waste site

contamination (Neutra et al., 1987). Evolving from their investigations and the concern of local citizens, the CDHS has developed an educational program to help practitioners deal with the growing issue of environmental contamination. Other states have alerted physicians about the threat of radon in high-risk communities. While outreach should not be limited to providing educational programs, such efforts are a commendable activity for state health departments.

State public health agencies, with the help of the CDC, could further expand their role in fostering occupational and environmental medicine in primary care practice by establishing associations or networks for primary care physicians who provide formal occupational and environmental health services. As general physician awareness and use of occupational and environmental medical consultations grow, the demand for physicians with skills in occupational and environmental medicine will increase. States could help meet this demand by sponsoring and supporting a network of providers involved in different levels of occupational health care. To encourage primary care physician participation in the network, the state health agency could fashion several incentives. For example, on enrollment, the agency could add the physician's name to a list of specialists, which is then made available to individuals, employers, or unions who contact the health department for help. Enrollment could also make the physicians eligible for further state-supported training and, perhaps, establish them in part-time positions at local hospitals, in cooperation with local health authorities. The authorities could, in turn, designate the hospital for health department referrals.

Continuing Medical Education

Medical schools and scientific societies offer courses on a broad range of topics for which category I continuing medical education (CME) credits are given. Such accreditation has been established by national guidelines, first by the American Medical Association and then by the Liaison Committee on Continuing Medical Education, to preserve quality standards. These credits are required in some states for relicensure or for membership in state medical societies. Physicians have complete freedom to choose the category I credit courses of their choice, the criteria for which may include subject matter, location, costs, loss of income, expected gain in income, and vacation time.

Those who offer category I CME courses to primary care providers face unusual obstacles to success. Attendees vary markedly in their basic scientific knowledge, clinical competence, and motivations for attending the course. Additionally, primary care physicians are selective in the types of CME courses they will attend. While they may be willing to spend 2 to 3 days to be brought up-to-date in cardiology and rheumatology, they are less likely to spend a comparable amount of time in courses relating to hematology or pulmonary disease. These decisions relate to the nature of primary care practice. For these reasons, the committee recommends that information concerning environmental and

occupational medicine be included within standard category I courses aimed at primary care practitioners, but the committee warns of the problems in developing successful separate courses devoted exclusively to occupational and environmental medicine for primary care practitioners unless warranted by a specific local issue.

Even excellent continuing medical education conferences and authoritative consensus statements may not change physician behavior significantly. The need to develop and maintain an educational approach that provides a broad, repetitive, and prolonged exposure to appropriate messages is clear (Perry, 1987). Useful media include medical journals as well as nonprint sources, such as audio and video tapes and television and radio programming. Effective use of these media requires both the submission of more clinically relevant materials on occupational and environmental medicine and better research reports, as well as a willingness of the media to publish this material. Publication of articles by experienced and capable physicians in both society-sponsored and controlled circulation journals would be of value. If better and more research in the field could be attained, then good research reports should follow with more visibility in prestigious medical journals. Agency-sponsored publications based on the *Morbidity and Mortality Weekly Report* model could also be used to alert physicians to occupational and environmental concerns. Well-targeted physician bulletins and newsletters developed and issued by Agency for Toxic Substance and Disease Registry (ATSDR) or local and state health departments would also assist primary care physicians in their continuing efforts to keep abreast of developments in occupational and environmental health.

The Macroenvironment of Medical Practice

System Interventions

A variety of forces confront the physician who is involved in occupational and environmental medicine. As described earlier, many of these are economic, legal, and ethical in nature. While much can be done to enhance the microenvironment of the primary care physician's office practice, an expanded role for these physicians will require changes in these external forces. The following sections suggest the types of changes that are required.

Economic Interventions

As described in Chapter 2, there are several powerful economic disincentives to primary care physician involvement in occupational and environmental medicine. These include aspects of the workers' compensation system and the reimbursement of cognitive and preventive services.

The Occupational Safety and Health Act of 1970 created an expert panel to examine, evaluate, and report on workers' compensation—its goals, its effectiveness in achieving the goals, and its remedies for the recognized problem of

variation in coverage among states. The committee believes that a second congressional review of compensation to individuals suffering work-related injuries and illnesses is in order. The committee recommends that a second examination of state and federal workers' compensation systems be undertaken and include specific evaluation of the disincentives they present to primary care practitioners' willingness to consider the role of work in causing or exacerbating a patient's health problem. Consideration should be given to:

1. Ways to prevent unreasonably long delays in payment for medical services (for example, by initial payment from third-party coverage until work relatedness is resolved).

2. Adequate payment for medical services (for example, by consideration of parity of payments with those for similar illnesses reimbursed under third-party systems).

3. Reimbursement for additional demands on physicians' time not usually associated with disease treatment (for example, payment for time preparing reports and preparing findings before workers' compensation commissions).

4. Reduction in unnecessary paperwork (for example, by developing understandable and reasonable nationally standardized illness and injury reporting forms in a manner similar to the use of national standards for the form of state birth and death certificates).

Each workers' compensation program incorporates a statute of limitation for filing claims for occupational illness and injury. Physicians need to know about the various statutes of limitations and other rules in the workers' compensation system that provide and limit access to coverage. The committee recommends that the National Institute for Occupational Safety and Health (NIOSH), with the assistance of federal and state workers' compensation system representatives, develop educational materials for primary care physicians and patients about how the systems operate, including information on statutes of limitations, the general coverage available through these systems, and the process for obtaining reimbursement.

Trends in third-party reimbursement favor enhanced rewards for investment in resources (for example, training), for cognitive services, and for preventive services. These and similar trends are likely to encourage primary care practitioners to prepare themselves and keep abreast of occupational and environmental health concerns. Reimbursement could be transformed into an incentive rather than a disincentive in the system. The committee recommends that the Congress instruct groups that examine this issue, in particular the Physician Prospective Payment Commission, to consider these occupational and environmental health issues in developing recommendations for reform in the reimbursement schemes. Similar recommendations should be conveyed to private groups examining such issues.

Legal Interventions

It is assumed that most primary care physicians want to limit their involvement with the legal system. This is entirely appropriate. For example, physicians can inform patients that they may have legal recourse in their efforts to obtain compensation without the physicians becoming directly involved themselves. The recommendations also assume, however, that primary care physicians have legal duties under common law to provide a reasonable standard of care, and that the standards in the area of occupational and environmental medicine are not fixed, but are and will continue to evolve.

Primary care physicians need resources that will provide them with basic information on their legal obligations vis-a-vis environmental and occupational medicine and with advice on how to better manage their interaction with the legal system. They also need information about the structure of the occupational and environmental health regulatory systems. This resource should include brief descriptions of the relevant agencies and laws, as well as the types of exposure and health effects data collected by and accessible through the agencies. These resources should be especially useful to primary care physicians engaged in occupational or environmental medicine. The committee recommends that appropriate federal agencies, such as the National Institute for Occupational Safety and Health (NIOSH) and the Agency for Toxic Substance and Disease Registry (ATSDR), work with professional societies, local and state medical societies, and malpractice insurance carriers to develop these resources for primary care physicians.

Ethical Interventions

Lack of awareness among primary care physicians about occupational and environmental health factors remains the largest obstacle to their successful recognition, prevention, and treatment (Rosenstock and Hagopian, 1987). As with other areas of medicine, physicians have an ethical obligation to keep as informed as possible and to recognize when their knowledge or experience is insufficient and consultation is needed. Primary care practitioners incur additional ethical obligations when they provide occupational medical services to employers and unions. A variety of potential problems may emerge when physicians care for patients who work for an employer who hired the physician in the first place. As described earlier in this report, issues involving confidentiality, physician autonomy relative to patient care, client expectations, and ability to act on recognized hazards may pose significant problems for physicians. The committee recommends that the appropriate professional medical societies (for example, the American Occupational Medical Association, American Academy of Family Physicians, and American College of Physicians) develop model standards for primary care practitioners who agree to provide routine medical services for employees, such as preemployment or back-to-work examinations. These societies could also work together to develop a standard form that

physicians should provide patients regarding the unique aspects of the physician-patient relationship under the circumstances, to the degree that the relationship differs from that which is normally operative. The committee also recognizes the value of case histories that illustrate the range and complexity of the ethical issues that may arise when primary care practitioners agree to a role different from that which operates when the doctor-patient relationship is otherwise unencumbered. Such case histories should be developed and published in journals most often read by primary care physicians.

Professional Interventions

The practicing physician's personal sense of accomplishment in dealing successfully with an occupational or environmental health problem encountered in private practice can provide a significant incentive for further involvement in and sensitivity to these issues. This may arise from a single positive case experience in which a busy physician diagnoses an occupational problem (such as work-related allergy), contacts the employer to determine the nature of occupational exposure, and brings resolution of the illness and the exposure hazard.

The practitioner's interest and competency in occupational and environmental medicine also will be influenced significantly by his or her contact with other physicians who deal with these aspects of medical practice. After completion of formal training programs, the routine peer professional contacts include hospital and clinic staffs and committees, formal and informal interactions with colleagues, and membership in professional societies and associations. These spheres of influence can exert a strong and readily assimilated positive influence on physicians by recognizing and reinforcing their activities in occupational and environmental medicine.

Primary care physicians belong to two types of professional organizations: those that include members from all specialties, which are generally geographically defined and have broad educational, social, economic, and political objectives and functions (for example, the American Medical Association and state and county medical societies); and those groups defined by a specific specialty or field of medical practice. Examples of the latter include specialty colleges, local and national associations and societies such as the American Academy of Family Physicians, American College of Emergency Physicians, American College of Physicians, American College of Surgeons, and about 150 others. These organizations can be enlisted to help foster the role of their primary care physician members in occupational and environmental medicine. Indeed, several organizations have undertaken this type of activity in the past. The American Academy of Family Physicians and the Society of Teachers of Family Medicine worked with the American Occupational Medical Association to suggest guidelines and curricula for family physicians in occupational health. The American College of Physicians has issued a position paper on the internist's

role in occupational medicine (American College of Physicians, 1984). The committee recommends that these organizations institute or reinvigorate their occupational and environmental health committees, and that these committees actively pursue programs to instruct and assist their primary care physician members in the relevance of occupational and environmental medicine to their clinical practice. These committees should also encourage the inclusion of articles relating to occupational and environmental medicine in their organizations' professional journals.

Organizations made up of occupational and environmental medicine specialists, such as the American Occupational Medical Association, can also be encouraged to interact with primary care physicians and to promote the participation of their members in activities designed for primary care physicians. For example, they can invite and encourage primary care physicians to attend their local meetings, participate in educational programs at local hospitals and clinics, make rosters of specialty consultant resources available to primary care physicians, and prepare articles and case studies for publication in journals read by primary care physicians.

Patient Demand Interventions

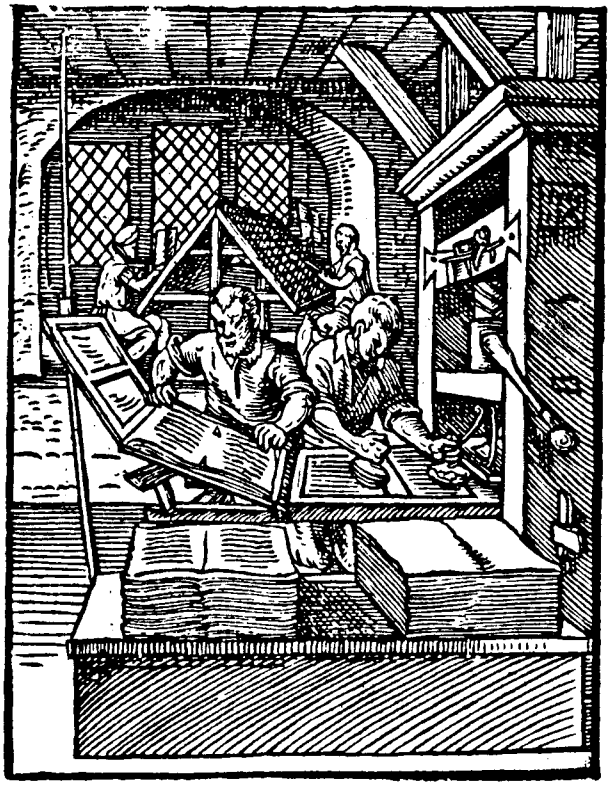
Publicity about numerous health risk factors in the print and broadcast media has stimulated a sharp increase in public awareness of illness prevention measures. As a result, we have seen a significant reduction in cigarette smoking and, to some degree, the consumption of distilled alcoholic beverages. Concern about cholesterol and its relationship to heart disease has altered the diets of millions of Americans. The federal antihypertension program has been a resounding success. These and other health issues receive continued reinforcement in the public's mind as new data are reported in the news on a daily basis.

The general interest in health promotion, together with specific concern about such matters as stress and fitness, has fostered the rise of new growth industries related to health enhancement. Exercise equipment and stress management programs are but two examples. Providers of such equipment and services can be expected to continue to expand their trade with additional promotion which, in turn, keeps disease prevention in the public eye.

The media has also called attention to numerous occupational and environmental health risks. Local newspapers frequently carry stories about asbestos and pesticide and other chemical exposures, as well as accounts of environmental contamination and hazardous waste. One effect of this heightened awareness will likely be felt by primary care physicians whose patients are concerned about these risks and about disease prevention in general. Efforts that stimulate an increasingly informed public to raise such questions in their contacts with physicians are important. Worker and community right-to-know laws will increase the likelihood that physicians will be asked about specific chemical and physical hazards.

Federal agencies responsible for occupational and environmental health should give higher priority to proactively developing accurate information about issues for dissemination to the media, with the goal of informing physicians indirectly through their patients. Information should be disseminated both in the form of tip sheets that outline issues and contact points for the press and through more in-depth features that are suitable for use by newspapers.

Patients can also influence the economic problems associated with poor reimbursement for preventive services. They may be important advocates for broadening coverage through union-management negotiations during collective bargaining. Both union and nonunion workers can lobby their state legislatures for laws that mandate such coverage.



Printers themselves tell me that after they have applied themselves to their task the whole day long and have left the shop they fancy even at night that those letters which are printed on their imagination keep moving to and fro before their eyes for many hours, until their images are blotted out by the forms of other objects.

CHAPTER 4

Recommended Interventions in the Education of Future Physicians

The teaching of environmental and occupational medicine to future primary care physicians needs to be significantly changed at both the undergraduate and graduate levels of medical education (Rest et al., 1983b; Cullen, 1987; Demers et al., 1987; Levy, 1987; Sokas and Cloeren, 1987). Currently, most medical schools provide little or no identified curriculum in this area (Levy, 1985). The teaching of environmental and occupational medicine is important not only for the concepts and factual information that could be conveyed but also for the signal that the teaching of this information sends to students and residents. Medical school education to a large extent defines the boundaries of medical practice. This section focuses on this important aspect of fostering the role of primary care physicians in occupational and environmental medicine. It defines educational objectives, delineates major barriers, and recommends interventions to address these problems.

The committee recognizes that there are problems in inserting new material in the medical curriculum. Medical schools are being called on to devote more time to the expanding scientific base of medical practice, while at the same time they are being asked to expand clinical instruction in geriatrics, nutrition, cancer, and other subjects.

EDUCATION OBJECTIVES FOR UNDERGRADUATE MEDICAL EDUCATION

Undergraduate medical education should lay the foundation for training physicians to incorporate occupational and environmental factors into the etiologic investigation of disease. Because occupational and environmental medicine is largely based on general preventive medicine principles, didactic and clinical training that provides an adequate focus on preventive activities of all types and in relation to all organ systems is key to achieving the minimal competencies identified in this section. This training necessarily includes solid grounding in epidemiology and toxicology and an understanding of the con-

cept of risk and its application to groups and individuals.

The undergraduate should be able to elicit basic information about those occupational and environmental factors that may affect an individual's health. Central to this task is learning to perform an occupational and environmental health screening history. The undergraduate should be able to routinely incorporate this history into the traditional health history and have an adequate understanding of the complexity of the work in order to recognize occasions when more specific information is necessary for a full evaluation.

The undergraduate should appreciate the relation between exposure dose and host response. This relation includes recognition of important factors that contribute to exposure dose, including route of absorption, metabolism and degradation, and time-dose characteristics, such as the role of acute versus chronic exposure, in contributing to cumulative dose and latency. An appreciation that most diseases caused by chemical and physical agents are associated with long latent periods from first exposure until disease manifestation reinforces the need for detailed history taking of often remote occupational and environmental exposures.

The undergraduate should know where and how to obtain information sources about occupational and environmental diseases. The undergraduate should be aware of the availability of texts; data bases (such as TOXLINE); and federal, state, and local agencies.

The undergraduate should recognize the special medical, ethical, legal, and economic factors in caring for patients with occupational and environmental diseases. Specifically, this includes an appreciation of workers' compensation and other disability systems, familiarity with institutions and agencies that may play a role in disease prevention, and appreciation of the relevant aspects of the employee-employer relationship.

Educational Objectives for Graduate Medical Education

With the expectation that the undergraduate educational objectives described have been achieved, the overall goal of residency training is to further prepare physicians to recognize, diagnose, and treat occupational and environmental health conditions and risks pertinent to their current and future practice. The knowledge and skills needed for the successful incorporation of occupational and environmental factors into clinical practice will necessarily vary by specialty and subspecialty area. But in *all* fields, postgraduate training should include familiarity and experience with the most prevalent occupational and environmental conditions that will be encountered. For example, in orthopedic training, physicians should appreciate the potential contributions of workplace factors to acute and chronic low back pain, both because workplace factors may be of etiologic importance and because back pain, regardless of causation, may affect the ability of the individual to function at work.

In addition to recognizing the role of work and the environment on health,

the physician in residency should become familiar and comfortable with carrying out the attendant responsibilities of caring for working patients, such as dealing with the workers' compensation system and participating in the assessment of impairment.

Because the committee anticipates that primary care physicians will bear the bulk of responsibility for patients with occupational and environmental disease, the following section specifies educational objectives for graduate training in internal medicine and family practice.

Internal Medicine and Family Practice

The committee believes that the fundamental tool to be mastered at the residency level is the occupational and environmental health history; trainees should learn to take both an occupational and environmental screening history and a more in-depth history directed by the individual's complaints and findings. General toxicologic principles, similar to those learned in pharmacology, should be sufficiently understood that they can be applied to the individual patient. These include knowledge about exposure routes (in the occupational setting, usually dermal or inhalation or both), general mechanisms of action (for example, differences between cellular toxins and carcinogens), latency, and other exposure dose-response and time-response characteristics. At the individual patient level, the primary physician has both legal and medical responsibilities to assess the likelihood that diseases are related to occupational or environmental hazards. The physician must recognize that the degree of certainty brought to such determinations varies for each setting. For example, for legal purposes, a disease is usually considered occupational or environmental if it is more likely than not (51 percent likelihood) that it was caused or aggravated by workplace or environmental exposure.

Listed below are certain criteria that should be considered and understood by trainees in determining the potential work or environmental relatedness of diseases, recognizing that, depending on the circumstances and characterization of the disease process, only some criteria may be met in any individual patient (Levy and Wegman, 1983; Rest et al., 1983b; Rosenstock and Landrigan, 1986). Successful application of these criteria employs skills and knowledge previously identified as objectives for training.

The following are criteria for the work or environmental relatedness of a diagnosis:

1. The symptoms, signs, and laboratory tests are consistent with the diagnosis.

2. The temporal pattern of exposure and disease onset is coherent, that is, exposure precedes disease onset or aggravation.

3. The exposure, if known, was sufficient to cause the disease.
   - Biological monitoring for the assessment of exposure or specific end organ effects, if available, is consistent with dose-response characteristics.

- Epidemiologic data, if available, support the effects at exposures comparable to those experienced by the individual.

4. No other condition or exposure more readily explains the disease.

Residents in internal medicine and family practice should be able to discuss exposure risks with individuals. This will become increasingly important as patients more frequently query their physicians about the potential effects of low-level environmental exposures, or exposures that are established as adverse only at higher occupational exposure levels, if at all. By using the tools of risk assessment, the primary physician will be better able to allay unnecessary fears about trivial risks and explain the relative importance of quantifiable health risks. In this way, physicians can play an important role in explaining and responding to inquiries about occupational and environmental hazards.

Internal medicine and family practice residency programs should teach the specific skills related to care for patients with work-related diseases and injuries. These skills include assessing impairment (loss of bodily function) and disability (impact of impairment on social or work function) and understanding the physician's responsibility in disability programs, including state and federal workers' compensation and Social Security disability.

Finally, as in other areas of clinical medicine, physicians need to learn to appreciate their obligation to keep as informed as possible about occupational and environmental hazards and to recognize when it is in the patient's best interest to seek consultation or referral elsewhere.

Barriers to Teaching Occupational and Environmental Medicine

Curricular change and innovation are difficult to achieve in medical education (Abrahamson, 1978) and a variety of reasons have been cited for this (Ebert, 1981). These include institutional inertia, vested interests, and competition among academic units. These generic barriers are all relevant to efforts to improve the teaching of occupational and environmental health in medical education. There are, however, several additional issues that are especially problematic to preventive medicine in general, and occupational and environmental medicine in particular. These are described in the following section.

Undergraduate Medical Education

The relative lack of teaching time for occupational and environmental health in the undergraduate medical curriculum has been amply documented (Levy, 1985). In order to address this problem, it is necessary to consider how curricular time in medical schools is distributed. Briefly stated, the faculty determines teaching hours and content, and the dean and department chairs determine faculty composition. It is the availability of trained investigators who are capable of attracting research funding support that is the primary determinant of who

will be selected for the faculty, especially in the medical schools that are active in research. In such schools, deans and department chairs are unlikely to select faculty in disciplinary areas for which there is little likelihood of external research funding. Without such funding, the faculty member is not likely to achieve tenure. Further, faculty who are not productive researchers have little likelihood of receiving sufficient respect from their peers to have an impact on the highly competitive world of the medical school curriculum committee.

Thus, the lack of research funding contributes to a shortage of medical school faculty, and this shortage is reflected in the meager curricular offerings in occupational and environmental medicine. Where should such research funds be obtained? At first glance, there would seem to be ample funding sources among federal agencies, including the National Institutes of Health (NIH), the National Institute of Environmental Health Sciences (NIEHS), the National Center for Toxicology Research (NCTR), the Environmental Protection Agency (EPA), and three Centers for Disease Control (CDC) organizations: the National Institute for Occupational Safety and Health (NIOSH), the Center for Environmental Health (CEH), and the Agency for Toxic Substance and Disease Registry (ATSDR). The total Public Health Service (PHS) extramural grants in occupational and environmental health for recent years are shown in Table 5-1. Unfortunately, only the NIEHS has a track record of supporting research at medical schools. The NCTR is almost totally an intramural program. The CEH and ATSDR have taken the traditional CDC view of focusing their efforts in-house or at state health departments, with minimal interaction with academic medical centers. The EPA has made some attempts to fund health-based research in medical schools, primarily through cooperative agreements with those located close to its North Carolina laboratory, and has a peer-reviewed grants program that has been chronically underfunded. In 1986, the EPA awarded $3.4 million in grants and cooperative agreements to medical schools from its close to $200 million extramural research and development budget. The NIOSH has made a specific attempt to fund academic medical centers through its Educational Resource Centers (ERCs). The ERCs are intentionally spread throughout the federal regions and are thus limited to a small percentage of all medical schools. The NIOSH also has a grossly underfunded peer-reviewed grants program now administered through the NIH. In 1986, it had a budget of $6.2 million for extramural grants, of which $3.8 million was received by medical schools.

The NIEHS had an extramural budget of $71.8 million in fiscal year 1986, of which $31 million was received by medical school faculty. The NIEHS has utilized a number of faculty development approaches, including the Research Career Development Award, graduate training programs, and support of mid-career switches, to provide a marked expansion in the full-time faculty in toxicology. Thus, there is a rapidly developing cadre of well-trained and supported academic toxicologists capable of teaching the basic science of toxicol-

TABLE 5-1 Occupational and Environmental Health-Related Extramural Grants and Contracts to Medical Schools by the U.S. Public Health Service as a Percentage of the Total, 1977-1986

Year	Total Amount($)	Amount to Medical Schools($)	Percentage of Total Dollars
Occupational Health			
1986	42,555,038	14,043,422	33.0
1985	43,938,762	17,324,868	39.4
1984	44,099,370	15,421,644	35.0
1983	34,019,319	13,016,781	38.3
1982	31,975,879	12,156,301	38.0
1981	30,665,848	9,927,295	32.4
1980	31,619,924	10,615,248	33.6
1979	25,891,736	7,011,543	27.1
1978	20,368,480	8,395,987	41.2
1977	17,277,265	8,158,765	47.2
TOTALS	322,411,621	116,071,854	
Environmental Health			
1986	135,375,915	60,019,307	44.3
1985	139,369,634	49,952,001	35.8
1984	143,359,856	56,403,239	39.3
1983	125,605,008	46,012,222	36.6
1982	101,252,787	35,640,434	35.2
1981	94,847,977	32,116,504	33.9
1980	94,513,329	32,597,079	34.5
1979	87,625,381	35,626,627	40.7
1978	67,771,260	27,475,957	40.5
1977	52,674,419	22,056,769	41.9
TOTALS	1,042,395,566	397,900,139	

SOURCE: National Institutes of Health. 1977-1986. CRISP Printout, Grants and Contracts. Bethesda, Md.: National Institutes of Health.

ogy to medical students. More recently, the NIEHS has been supporting similar efforts in environmental epidemiology. Unfortunately, however, the public health aspects of environmental health, including human exposure and health effects assessment, have generally not been supported by the NIEHS. Other NIH components, particularly the National Cancer Institute and the National Heart, Lung, and Blood Institute, also have extramural research support in the area of environmental or occupational health.

As a result of the direction of NIH activities, the departmental chair or dean

who is interested in developing occupational and environmental health programs is naturally more inclined to recruit a basic science toxicologist than an academic occupational or environmental health researcher. A well-chosen toxicologist has a much clearer path to academically respectable research funding and an obvious career ladder. This is much less true for even the strongest recruit in occupational medicine. Furthermore, there are far fewer candidates in occupational medicine who have had training specifically aimed at an academic medical school career.

The situation of an inadequate funding base to support academic programs mirrors the problem faced by medical school preventive medicine or public health departments. Most other medical school departments or divisions have a research mission represented at the NIH or a clinical mission considered necessary for a tertiary care medical center. In contrast, there is only marginal support for preventive medicine or public health from the NIH, the rationale being in part the presence of the CDC, another agency of the Department of Health and Human Services that has been given primary responsibility in this area. Unfortunately, the CDC traditionally has spent the bulk of its funding intramurally and has not often turned to academic medical centers to provide the basic information necessary for its mission. Obviously, this is a two-way process. The CDC cannot be faulted for not supporting a preventive medicine public health faculty at medical schools if medical schools do not recruit the faculty who can be responsive to the CDC's needs. The CDC has a cooperative agreement with the Association of Teachers of Preventive Medicine that provides a low level of funding to a few academic preventive medicine departments, but that does not provide basic support for the faculty.

This disparity in support for medical school research between the NIH and the CDC may be more readily resolved for occupational and environmental health than for other areas of preventive medicine. This is because of the existence of the NIEHS and three CDC-related agencies (CEH, NIOSH, and ATSDR), all of which have mandates in the area of occupational or environmental health. Relatively small changes in how these agencies function to achieve their missions would provide the support patterns necessary to ensure the presence of medical school faculty to teach environmental and occupational health. Without such a faculty, no lasting impact on medical school teaching can be expected.

The availability of funds for clinical activities also affects faculty hiring decisions at medical schools. This is particularly true for subspecialties that must be covered for the academic medical center to fulfill its mission as a tertiary care center, for example, in the area of pediatric neurology. Occupational and environmental medicine, while potentially viable economically, are not ordinarily considered a necessary part of the academic tertiary care complex. Further, participating faculty who are in essence full-time clinicians may have less academic impact and influence on curricular processes. Nevertheless, some institutions have established exemplary academically oriented ambulatory clini-

cal operations in occupational and environmental medicine with important service contributions, financial stability, and the offering of a base for both undergraduate and graduate medical education. Examples are in New Haven (Yale University), San Francisco (University of California at San Francisco and the Pacific Medical Center), and Seattle (University of Washington).

Correcting the current lack of academic activity in occupational and environmental medicine will require at least two major policy changes. First, a clear mandate for academic research support in this area must be given to the appropriate federal agencies. Ideally, the NIEHS should broaden its mandate to support a wider range of research. Additional efforts should be made by the EPA, NIOSH, ATSDR, and CEH to look to medical schools for more of the research findings central to their missions.

The second change is for the necessary funding to support the mandate. Existing federal agency budgets cannot be stretched to cover additional responsibilities. NIOSH in particular needs more support to enable it to undertake successfully its mission to support research and faculty development at medical schools. Such funding should primarily be in the form of competitive peer-reviewed research support, which has been successful in providing the advances that have characterized U.S. medicine in recent decades.

It would also be of value to diminish the artificial separation and fragmentation between occupational medicine and environmental medicine. Both occupational medicine and environmental medicine are strongly oriented toward prevention. As defined in Chapter 1, occupational medicine is a broadly based specialty that primarily includes all aspects of the impact of work on health but that also considers the impact of health on the ability of workers to perform their tasks. Environmental medicine focuses predominantly on the effects of chemical and physical agents on human health. Identification and prevention of such effects have become more and more a part of occupational health at the modern workplace. The process of risk assessment, a central part of environmental medicine, is also important for occupational medicine. Hazard identification and dose-response estimation are necessary for exposures in the workplace or the general environment; exposure assessment uses and expands on the tools of classic industrial hygiene to determine exposure outside the work site. Risk characterization and risk communication are important not only in environmental and occupational medicine but also as important tools for the primary care physician in the broader sense.

Workplace and community right-to-know laws are rapidly being promulgated at the federal and state levels (Himmelstein and Frumkin, 1985). Queries from concerned workers and residents will increasingly test the knowledge of physicians. Often, it will be the same chemicals that cause concern both within and beyond the workplace boundaries. The interrelatedness of these two specialties is also apparent when one considers that a classic approach to protecting workers, that of venting material to the outside, puts the community at risk.

Wherever possible, students should learn about occupational and environmental medicine at the same time. There is no need for separate educational processes.

Graduate Medical Education

To a large degree, the same barriers identified above for undergraduate medical education also create deficiencies in primary care and specialty graduate training, and the same solutions apply. Most importantly, the dearth of faculty with specialty interests in occupational and environmental medicine and the inadequate training in these areas of current faculty responsible for educating primary care physicians contribute to the omission of occupational and environmental factors in etiologic investigations of disease. Even the best clinical teachers in residency training programs are likely to omit occupational and environmental conditions from the differential diagnoses of patients on the wards and in the clinics. Role models of the generalist who is comfortable with the medical, legal, ethical, and economic factors of work-related diseases are few and far between. Similarly, there are few specialist teachers available to serve as consultants, further limiting the exposure of residents to concepts necessary to achieve minimal competencies in occupational and environmental health. Compounding these deficiencies is the relative absence of specific clinical and research experiences in occupational and environmental medicine in most residency programs, experiences which could promote interest in pursuing further training for academic or clinical specialty careers in the field. Faculty with expertise in these areas have had no supportive home program, division, or department. Institutional bases for these faculty have arisen on an ad hoc basis.

Incentives for Teaching Occupational and Environmental Medicine

Certain trends may provide incentives to increase graduate training in occupational and environmental medicine. Both medical school and house staff education are increasingly taking place in ambulatory settings. The growth of family medicine departments and divisions of general internal medicine reflects the change. Managed care systems provide incentives to hospital and medical school administrators to broaden the patient care base of the academic medical center. This could include facilities to provide care for people with possible occupational or environmental illnesses. There may be an added incentive to correctly identify health problems as being occupationally related, because these are potentially reimbursable outside the prepaid system through workers' compensation insurance. The increased interest of employers, insurance carriers, and the public in health promotion and disease prevention further favors attention, research, and clinical activities in the workplace, particularly as worksite health promotion programs gain in popularity.

Intervention Strategies

The following section outlines specific intervention strategies designed to achieve the educational objectives discussed above. Faculty training and support for research are critical. Without a major effort to increase research support in the field, an increase in faculty resources will not be likely.

Faculty Training

The number of faculty available to achieve the educational objectives outlined above for undergraduate and graduate medical training is currently inadequate (Association of Teachers of Preventive Medicine, 1986). Interventions to overcome this major barrier include the following :

1. Instituting career development awards to provide salary support and resources to individuals committed to assuming leadership positions in occupational and environmental health in schools of medicine. Awardees could be responsible for promoting and coordinating the education of the schools' students, other trainees, and faculty in the area of occupational and environmental health. Awardees will also have the potential to develop associated clinical and research activities in this field.

Several successful models in other disciplines now exist. These include career development awards in preventive pulmonary medicine, preventive cardiology, and alcohol and drug abuse. Any occupational and environmental medicine awards should require the sponsoring academic institution to demonstrate commitment to continue support for activities in the field beyond the award's duration.

2. Providing opportunities for general internal medicine and family practice medical school faculty to receive additional training in occupational and environmental health. By recognizing the fact that most primary care residency programs will not be able to support full-time trained specialists in this field, funding should also be made available to support individuals with demonstrated clinical and teaching excellence in internal medicine and family practice who seek additional training and experience in occupational and environmental medicine. Such training should be obtained at academic centers with demonstrated excellence in the field.

Guidotti (1984) has suggested that an excellent training program should be able to provide:

- A broadly representative patient population with a heterogeneous mix of work-related disorders, social classes, and occupations.
- Readily available academic support.
- Accessible specialty support for consultation, referral, and teaching.
- Extensive interaction with other occupational health professionals.
- Opportunity for research and scholarly activity.

- A commitment to high-quality care at reasonable cost.

In addition, the committee believes that the academic training center should rigorously adhere to a code of ethics that views the patient as the physician's primary responsibility. The training center should provide ample opportunity for trainees to gain experience in the nonclinical aspects of occupational and environmental medicine.

3. Expanding residency and fellowship training in occupational and environmental medicine. The anticipation of future needs for faculty and clinical specialists in occupational and environmental medicine suggests expanded support for specialty postgraduate training. Currently, this training is supported predominantly through occupational medicine residency programs funded by NIOSH. These positions are limited and are inadequate to meet future needs and do not necessarily prepare individuals for faculty positions with educational responsibilities for primary care physicians. As with other preventive medicine residencies, the lack of a hospital base makes the funding of resident stipends particularly difficult. A number of mechanisms could meet these needs, including the development of fellowship programs for individuals who have completed 3 years of internal medicine or family practice training, as well as support for the development of joint residency programs in internal medicine and family practice with occupational medicine.

4. Exploring the possibility of offering certification of added competence to diplomates in internal medicine and family practice who have advanced training or experience in occupational and environmental medicine. The American Board of Internal Medicine and the American Board of Family Practice, in cooperation with the American Board of Preventive Medicine, should consider this option.

Current specialty certification in occupational medicine is limited to satisfying board eligibility and certifying examination criteria established by the American Board of Preventive Medicine (1982). A recent change in the eligibility requirements requires successful completion of a 2-year training program in an accredited occupational medicine residency program for physicians who graduated from medical school after January 1, 1984 (American Board of Preventive Medicine, 1982). This new requirement further exacerbates the current undersupply of certified specialists in occupational medicine. Moreover, even under former guidelines, the design, structure, and purpose of certification by the American Board of Preventive Medicine do not necessarily encompass the internist or family practitioner who has received additional training or experience in occupational and environmental medicine. In order to recognize such individuals appropriately, which would be useful for viability in academic settings and an acknowledgment of special qualifications in clinical practice, the committee believes that demonstrated expertise in the clinical practice of occupational and environmental medicine and associated disciplines

should be recognized. This recognition could be similar to the recently adopted practice of the American Board of Internal Medicine and the American Board of Family Practice that identifies and recognizes added qualifications in the field of geriatrics for diplomates in internal medicine and family practice who meet eligibility criteria and pass the newly developed certifying examination (Institute of Medicine, 1987). Based on the experience of these efforts, other boards, such as the American Board of Pediatrics, may wish to explore this approach.

Research Opportunities in Environmental and Occupational Medicine

The committee believes that research funding in environmental and occupational medicine is currently inadequate, particularly in support of investigations studying the human health effects of occupational and environmental exposures. Research opportunities are varied; they span the entire field of public health and preventive medicine as well as clinical investigations into the mechanisms, diagnosis, and natural history of resultant diseases. Specific measures to achieve a broadened research funding base include:

- Increasing the extramural budget of CDC and related agencies (ATSDR, CEH, and NIOSH) to develop a substantial peer-reviewed extramural research support program.
- Increasing the budget of NIEHS to allow it to emphasize and foster the public health research aspects of its mission.
- Supporting and stabilizing EPA's extramural competitive research grants program.

Intervention Strategies Specific to Undergraduate Medical Education

The need to enhance the teaching of occupational and environmental medicine at the undergraduate level was described above. The committee recommends several strategies to meet this need:

1. Incorporating occupational and environmental health questions into the National Board of Medical Examiners and Federal Licensing Examination certifying examinations. Board examinations play a major role in defining for students and, to some extent, faculty the need for knowledge in a subject area of medicine. More questions relevant to occupational and environmental medicine should be included in National Board examinations. These questions can and should be spread through a number of board examinations. Examples include questions about lead poisoning in pediatrics, workplace impact on reproductive functions in obstetrics and gynecology, occupational medicine problems in internal medicine, and occupational health problems in preventive medicine. Whenever possible, questions should probe for information about the relationship of toxins to occupational or environmental exposures. For example, for a question in hematology aimed at the causes of erythrocyte basophilic stippling, rather than simply having lead as one of the answers, the answer could be related to work in a battery factory.

2. Modifying the curriculum to address educational objectives. As discussed above, curriculum modification requires the presence of a faculty that is capable of achieving changes in time or content and the provision of high-quality education to sustain the curriculum change. Approximately one-third of U.S. medical schools do not have departments of public health or preventive or community medicine that might otherwise be expected to take the lead in teaching occupational and environmental medicine using their own curriculum time. Teaching efforts at such medical schools must therefore occur through other departments. Among the possible targets for curriculum modifications are the following:

- *Basic science courses.* These courses can easily include or emphasize concepts important to occupational and environmental medicine. For example, the pharmacology course can include basic principles of toxicology; the pathology course can provide information about the effects of chemicals on the organ system; and behavioral sciences courses, which often include information about the stages of life, can discuss the impact of work on behavior and the psychological aspects of working and unemployment on health. Curriculum development efforts to provide and disseminate teaching modules in each of these areas would be of value.
- *Physical diagnosis course.* This course can instruct students in obtaining occupational and environmental histories, and this activity can be reinforced throughout the curriculum.
- *Clinical clerkships.* Learning during clinical clerkships depends to a large extent on the availability of appropriate patients. The frequent location of U.S. medical schools in inner city hospitals tends to act against the availability of patients with readily discernible occupational factors in their disease process. Often, in these patients substance abuse problems associated with poverty and deprivation in inner city areas overwhelm other environmental factors. In such situations, a concerted effort is needed to develop clinical programs that reach out to employed groups of people in order to provide adequate teaching opportunities. This requires faculty who are capable of optimizing available opportunities to develop teaching efforts, despite a relatively limited number of patients.
- *Student clinical assignments.* Introduction of occupational and environmental clinical problems in the students' basic clerkships is desirable. The fourth year in medical school is becoming increasingly structured and could be utilized to examine the special social, legal, ethical, and economic aspects of occupational and environmental medicine. These topics would fit well into a new structure that focuses on broad issues in medical practice such as ethics, health care delivery systems, patient communication, and medical economics. Teaching the various aspects of environmental and occupational medicine could well fit into this new structure.

Schools with departments or divisions of public health or preventive or community medicine may approach curriculum change differently. The extent

to which the teaching activities described above will be carried out in such departments will depend on the presence of faculty with a specific interest and expertise in occupational and environmental medicine, the number of teaching hours available to the department, and the distribution of these teaching hours within the curriculum. The importance of clinical instruction cannot be underestimated, however.

Intervention Strategies Specific to Graduate Education

In addition to the development of faculty manpower, other interventions should contribute to the accomplishment of the goals previously described above. These include:

1. Expanding clinical training opportunities for residents in internal medicine and family practice. Academically based occupational medicine clinics, designed to provide multidisciplinary training in assessing the impact of occupational and environmental factors on an individual's health problems, should be supported and developed to provide sufficient training opportunities for internal medicine and family practice residents.

2. Identifying occupational and environmental medicine as a component of continuity training in primary care residency programs. Because occupational and environmental medicine is considered a fundamental component of clinical practice involving adult patients, the committee recommends that specialty clinical experiences in occupational and environmental health be considered as an experience for trainees in ambulatory care rotations. The Health Resources and Services Administration (HRSA), which funds primary care training grants, currently excludes ambulatory rotations in occupational medicine from meeting its requirements for substantive time in continuity of care. Recognition of ambulatory occupational medicine as a continuity of care experience in residency programs would help overcome this barrier to resident participation that HRSA imposes.

3. Expanding research opportunities in occupational and environmental medicine for residents in internal medicine and family practice. Research opportunities for internal medicine and family practice residents electing to undertake directed activities in this area are limited. Support for and encouragement of such opportunities in academic settings, industries, unions, and health departments are seen as effective means of expanding these capabilities.

4. Expanding the current residency curricula to incorporate occupational and environmental health issues. There are many ways to incorporate occupational and environmental health issues within internal medicine and family practice training. If faculty are available, formal teaching events in occupational and environmental medicine can be increased. Establishing inpatient consultation services with the active support of faculty with demonstrated expertise is

another method. Finally, occupational and environmental medicine can be identified as a "residency essential" in internal medicine. Essentials of an accredited residency in graduate medical education have been described for family practice and internal medicine. In family practice, both occupational and environmental health are included as necessary components of instruction in the section on community medicine. The committee recommends that the essentials of internal medicine residency training be made explicit to include these same areas, as current essentials now identify only those subspecialty areas traditionally considered part of internal medicine.

5. Expanding the content of occupational and environmental medicine in certifying examinations of the American Board of Internal Medicine and the American Board of Family Practice. Although both certifying board examinations include questions in this area now, neither board reports the capability to identify occupational and environmental questions or provides feedback to examinees and institutions about performance in this area. The committee encourages the expansion of questions in this field and the means to quantify and provide feedback on performance on these questions.

6. Incorporating concepts of occupational health care delivery into those programs teaching practice management. An increasing number of internal medicine and family practice residency training programs include practice management as part of training. Because occupational health care delivery invokes special financial, legal, and ethical considerations, the committee recommends that these aspects of providing occupational health services be addressed in such training.

I have often wondered how so noxious a dust can come from the grain as wholesome as wheat, and I began to suspect that in that dust there must lurk minute worms imperceptible to our senses and that they are set in motion by the sifting and measuring of the grain and broadcast by the air; then they readily adhere to the skin and excite that great heat and itching all over the body.

CHAPTER 5

Summary of Principal Recommendations

The recommendations derived from this study fall into two major categories. First, there are those designed to foster the role of the present-day primary care physicians in the occupational and environmental medical aspects of their practice. Second, there are those designed to enhance the training of future physicians for greater appreciation and abilities in this aspect of medicine. Underlying these are important general considerations that are critical to both endeavors.

RECOMMENDATIONS TO FOSTER THE ROLE OF PRIMARY CARE PHYSICIANS IN PRESENT-DAY PATIENT CARE ACTIVITIES

Disease and impairment problems attributable to environmental or occupational exposures present unusual complexities in clinical medicine. For example, the necessary expertise to assist the practitioner in documenting the etiology is often fragmented and may be unknown to the primary care practitioner.

The committee feels that as a minimum, all primary care physicians should be able to *identify possible occupationally or environmentally induced conditions* and *make the appropriate referrals for follow-up.* In order to carry out this minimum standard of care, physicians must:

- Know some basic principles of occupational and environmental disease, including such concepts as latency and multifactorial etiology.
- Understand their responsibilities within the workers' compensation system.
- Take an appropriate history in those clinical situations in which occupational or environmental diseases are part of the differential diagnosis.
- Be sensitive to the ethical, social, and legal implications of the diagnosis of and intervention for occupational and environmental disease.
- Be alert to opportunities for the prevention of occupational and environmental illness in patients under their care.

• Call known or suspected hazards to the attention of public health agencies or other entities as indicated by the history and information obtained.

Primary care physicians with a special interest in occupational and environmental medicine, or whose practices include a number of patients with those illnesses, may reasonably be expected to do more than the minimum. The committee feels that at least the minimum amount outlined here should be expected of all.

To foster such enhanced activity, the committee recommends several steps.

1. *Improved information sources for the physician are needed.* The most practical way to assist the primary care practitioner to function effectively and knowledgeably when confronted with a patient suspected of having an occupational or environmental disease is to have a *single-access point for necessary clinically pertinent information.* This single-access point should become the central source through which all appropriate clinical and nonclinical services available to the practitioner could be elicited. The development of such an access point for health care providers needs to be designed so that a single telephone call will satisfy the practitioner's need to access the full range of information necessary to address the patient's problem. It might be an extension of the techniques used in the nation's poison control centers and other information systems currently in operation. It is important to note that attempts to achieve this goal will demonstrate that in many situations the desired data are not available from any source. The Institute of Medicine, or some other appropriate coalescing group, in cooperation with the appropriate government agencies, should initiate the efforts to achieve a meeting with the leaders of existing related programs and other information services to initiate the establishment of such a project.

The committee recommends an increase in the scope and availability of *practice-based data handling systems* for occupational and environmental medicine. This includes printed resources, computer-based data and bibliographic systems, and so-called expert systems of data handling in the field. The committee suggests that the National Library of Medicine, which is already involved in such activity, take the lead in future development.

The committee recommends that public health departments or other government agencies regularly make available to practicing physicians periodic reports of *local disease incidence and exposure patterns* for occupational and environmental illness. This would alert and remind the physician of current problems in the community.

The Institute of Medicine, working with the appropriate government agencies on a broad front, should bring *greater dissemination of information on occupational and environmental medicine* to the attention of the practicing physician such as:

• Encourage the publication of articles and reviews in the various journals dealing with general clinical medicine.

- Encourage special publications or bulletins, particularly from health departments, dealing with topics in occupational and environmental medicine.
- Encourage the inclusion of occupational and environmental medicine topics in programs of continuing medical education. The committee feels that courses on occupational and environmental medicine may have limited appeal, but the inclusion of occupational and environmental medical topics in more general courses such as cardiology and rheumatology would reach more physicians.
- Stimulate the development of mechanisms to inform and guide physicians on the nonclinical means of assisting their patients. For example, this could include directing a patient on how to obtain disability assistance or workers' compensation.

2. *Improved availability of clinical consultation services are needed.* There is a striking shortage of *clinically trained specialists in occupational and environmental medicine* to serve as consultants and educators. There are only about 1,000 active board-certified specialists in occupational medicine in the entire country, and the process of certification is difficult for candidates with a predominantly clinical background. Today, these small numbers of board-certified specialists in occupational medicine are mostly employed by industry or academia and are not available to primary care physicians as clinical consultants. Additionally, only one-half of all medical schools have an identifiable faculty member in occupational medicine. Perhaps the shortage could be relieved by a new certification mechanism of special clinical competence in the field, similar to that currently being undertaken in the area of geriatrics. The Institute of Medicine should convene an ad hoc group to explore and initiate means of correcting the national deficiency. Efforts should also be made to increase the number of primary care physicians with some special interest and training in the fields of occupational and environmental medicine, short of full-fledged board-certified consultants.

In addition to individual experts, there is a need for primary care practitioners to have available *referral centers* that can provide comprehensive patient-specific occupational and environmental health services other than those related to the diagnosis and treatment of disease. These include the identification and coordination of services related to the evaluation of disability, facilitation of workers' compensation claims, rehabilitation or job retraining, and the provision of prevention-oriented resources. It is recommended that the Centers for Disease Control (CDC), through the National Institute for Occupational Safety and Health (NIOSH), convene a panel that would include representatives from the Social Security Administration, state workers' compensation programs, and other appropriate social service agencies. This panel would identify effective alternative means to meet this need, such as through targeted support of labor education resource centers and comprehensive occupational health clinics (those which provide nonclinical support services in addition to the basic clinical

services). Consideration of the appropriate distribution and funding of the alternatives should be addressed. The CDC, through the Center for Environmental Health (CEH), should convene a similar panel to identify alternative means to deliver such services to those affected by hazards in the general environment.

3. *Recommended interventions in the health care system to foster the role of the primary care physician are needed.*

- The economic reward system should be improved for the physician dealing with the prevention and treatment of occupational and environmental illnesses. The current procedure-oriented reimbursement system and the emphasis on efficiency of practice is antithetical to the desired emphasis on prevention.
- A new review and appropriate corrective actions should be encouraged in the troublesome aspects of the workers' compensation system. The Occupational Safety and Health Act of 1970 included a specific charge that an expert panel be created to examine, evaluate, and report on workers' compensation, its goals, its effectiveness in achieving the goals, and remedies for the recognized problems in variation in coverage between states. There is general recognition that it is timely and necessary for a general review of the provision by either state or federal compensation systems of adequate compensation to individuals suffering work or environmentally related injuries and illnesses. Such a review should be undertaken to include specific consideration of the disincentives that the majority of workers' compensation programs present primary care practitioners with regard to their willingness to consider the role of work as the cause or a source of exacerbation of disease. Consideration should be given specifically to ways to prevent unreasonably long delays in payment for medical services, adequate payment for medical services, reimbursement for additional demands on physicians' time, and reduction in unnecessary paperwork.
- Steps should be taken to clarify the physician's legal status when handling problems in this field of medicine. The legal obligations of primary care practitioners, when addressing diseases caused by or contributed to by environmental or occupational risk factors, are complex and not well understood. It is recommended that appropriate federal agencies, in association with appropriate professional medical societies, local and state medical societies, and malpractice insurance carriers, provide primary care providers with basic information on their legal obligations.
- Steps should be taken to explore the ethical situation of physicians dealing with workers with occupational health problems or practicing as a representative of industry. Primary care practitioners assume ethical obligations when contracting with business concerns to provide selected patient evaluation services. It is recommended that the appropriate professional medical societies develop model standards for contracts for use when a primary care practitioner agrees to provide routine medical services (for example, preemployment or back-to-

work examinations) to businesses. Physicians should be informed regarding the unique aspects of the physician-patient relationship under these circumstances.

4. *A study to determine the needs and concerns of primary care physicians.* Unfortunately, in formulating these recommendations our limited knowledge about the changing needs and practices of the primary care physician becomes apparent. Due to the paucity of information about the practice patterns and activities of primary care physicians in today's medical scene with respect to occupational and environmental medicine, a broad and systematic survey of the needs and concerns of such physicians is recommended. Although it would be a major undertaking, a description of the contemporary practices and problems of primary care physicians would be most valuable. Such a study could be carried out by the Institute of Medicine and appropriate professional societies with the assistance of concerned government agencies. The survey of these physicians should determine the extent of their present and past practice of occupational and environmental medicine, including preemployment physicals, workplace and union clinics, and so on; barriers associated with the practice of occupational and environmental medicine; their ideas about acceptable and ideal roles of primary care physicians in occupational and environmental medicine; and their needs for continuing medical education in occupational and environmental medicine. It should be part of a broader national concern for the future role of the primary care physician.

Recommendations Related to the Education of Future Physicians

1. There should be a *better representation of occupational and environmental medicine in the medical school curriculum.* In the eyes of the committee, this will not happen without changes in the academic status of occupational and environmental medicine and their representation on the medical school faculty by appropriately trained faculty members.

If occupational and environmental medicine are to be properly represented in the clinical years of medical education, adjustments must be made in many schools to make it part of the mainstream of clinical medicine. It should be a vital part of the traditional clinical assignments of students. As preventive medicine is usually taught during the years that students learn clinical medicine, it is necessary that departments of clinical medicine include occupational and environmental medicine as part of their third- and fourth-year teaching programs. By whatever sponsorship, students should have active clinical experience in occupational and environmental medicine.

Noting that only 50 percent of medical schools have an identifiable faculty member listed as being primarily concerned with occupational medicine, efforts should be made to enable all medical schools to have at least one such faculty member. Mechanisms should be mobilized for the creation of such *new academic*

faculty with academic credentials in teaching and research. For example, the establishment of more career development awards similar to those that have been successful in other disciplines in medicine should be undertaken in this field. In addition, the committee recommends the establishment of mechanisms and resources for current faculty to gain additional training in occupational and environmental medicine and the applicable basic sciences.

2. If occupational and environmental medicine are to prosper in academia, *a vigorous research program is required.* Review of the support of occupational and environmental medical research in the academic environment as described in this report indicates that too little research support is directed to this cause by the agencies involved. Government funding agencies should receive increases in monies for extramural funding. This should be aimed at allowing the National Institute of Environmental Health Sciences (NIEHS) to broaden its mandate to support environmental health sciences, in addition to toxicology, and providing the NIOSH and other pertinent CDC components (Agency for Toxic Substance and Disease Registry, CEH) with a genuine extramural research program capable of enlisting American medical schools in the CDC's environmental and occupational health mission. Such an approach would enhance faculty numbers and help achieve the desired goals of better teaching to yield a better-informed physician in the future and produce more specialists and faculty in the field and the much needed clinical consultants across the country.

3. *Residency programs directed toward the production of general physicians in both internal medicine and family practice should be adjusted to provide more active clinical experience in occupational and environmental medicine.* They should also contain instruction in topics such as epidemiology and risk assessment.

Additional opportunities for the pursuit of specialized residency and fellowship training in occupational and environmental medicine should be established, with encouragement to participate in research activities.

All educational efforts in occupational and environmental medicine should emphasize the physician's role in disease prevention and health promotion.

General Recommendations

1. Many of the proposals resulting from this study have a broad base in medical practice, medical education, and the functions of a number of government agencies. Assignment of responsibility for the pursuit of the recommendations to a single agency or group is often not appropriate. To ensure continued concern and activity, the committee recommends that the Institute of Medicine, in conjunction with representatives of government and private agencies, maintain an ongoing program to pursue these goals in the years to come.

2. In an effort to achieve a greater recognition of the important academic and clinical roles of occupational and environmental medicine, steps should be

taken to encourage greater representation of these areas in the examinations of the various national and state boards for certification and licensure. This should include family medicine, internal medicine, pediatrics, and obstetrics/gynecology.

3. Finally, the committee hopes that pursuit of these various recommendations would have an enhancing effect on the place of occupational and environmental medicine in the world of health care.

Occupational medicine is a long established and recognized medical specialty. Since its roots have traditionally been in prevention, it is often not viewed as a mainstream component of clinical medicine, not only in practice but in medical education and research as well. Occupational medicine, for example, may not be represented in a medical student's clinical assignments. The steps recommended in this report should strengthen the position of occupational medicine as a vital component of clinical medicine. In contrast, *environmental medicine* does not have a structure of clinical specialists, professional societies, specialty journals, and so on. Recognition as a clinical specialty area by medicine and the public is missing. The recommendations from this study, to be pursued by the Institute of Medicine and other agencies, should accelerate the evolution of environmental medicine into a viable, recognized, and accepted subspecialty of medicine. The committee sees merit in these subjects being taught and evolving clinically together rather than being strictly separated.

To sum up: Men in the learned professions should bend themselves to the pursuit of wisdom, but let them set some limit to their praiseworthy tutelage, nor should they become so entirely absorbed in cultivating the mind as to neglect the care of the body; let them preserve the equipoise of their team, so that mind and body, in trusty comradeship, like guest and host, may serve one another and not take turns in wearing each other down.

CHAPTER 6

Concluding Remarks

The committee has addressed its task with enthusiasm and concludes this report with optimism not for a quick fix but for a number of steps that can enhance the occupational and environmental aspects of medical practice.

Fostering the role of the primary care physician in the practice of occupational and environmental medicine, especially its preventive aspects, is not a simple matter. Too often, it has been dismissed with a call for more education and more attention to occupational history taking. Taken together, it was assumed that these steps would solve the problem. Not so. Attaining optimal clinical practice by the primary care physician in this field of medicine is fraught with multiple problems. These include deficiencies in the primary care physician's basic perception of occupational and environmental medicine, their limited place in general clinical practice, and their low visibility in the medical education process. The data base for the clinical practice of occupational and environmental medicine is frequently available only with difficulty to the practicing physician. It is often in the hands of government agencies, is much fragmented between and within occupation and environment, and is not organized for an easy interface with the practicing physician. The type of practice activity emerging from occupational and environmental medicine demands much time, currently at such a premium in primary care practice, with a low financial reward. These factors compound the increasingly recognized physician dissatisfaction with the sharp discrepancy in personal reward between the non-procedure-oriented primary care practice and the procedure-oriented specialty. Despite these constraints, the committee feels that there is a mosaic of feasible steps that could enhance this area of medical practice considerably, with greater satisfaction for physician and patient alike. Complete resolution of some of the issues would require a more sweeping overhaul of the structure of medical practice.

One is tempted to base an appeal for more attention to occupational and environmental medicine by the primary care physician on numbers, yet calcu-

lations yield paradoxical results. With the entire population of this country exposed in one way or another to environmental hazards and as many as 70 percent of the adults having the additional exposure of a workplace, one might expect that the incidence of morbidity would be great. Unfortunately, as noted in this report, accurate figures are not available. On the other hand, when calculated with the best available figures in the context of a primary care physician's daily practice, only a limited number of encounters might be expected each month, unless one includes an extensive list of possible exposures for almost all patients. These figures do not attract the attention of the busy physician who encounters so many more frequent and demanding problems.

The average primary care physician does not consider occupational and environmental medicine part of the mainstream of clinical medicine. Occupational medicine is considered a rather arcane subspecialty of practice, largely in the hands of physicians trained in preventive medicine. In medical education, it is not a highly visible part of the student's clinical experience or a resident physician's rotational program through clinical specialties. Environmental medicine appears even more nebulous to the physician, with no visible structure as a medical specialty, no specialists, and few textbooks or journals. A physician's information about environmental medicine comes mainly from the news media or from patients, frequently in the form of frustrating questions for which there are no readily available answers. Compared with cardiology or hematology, it is difficult to find a clinical consultant in the community who can deal with occupational or environmental problems. The need for readily available clinical consultants is impressive to the committee.

The committee recognizes the limited presence of occupational and environmental medicine in most medical school educational programs. The startlingly few identifiable curricular hours continue, despite vigorous efforts over the past decade by the National Institute of Occupational Safety and Health, the Health Resources and Services Administration, and others that have had only minimal impact. A major reason is the lack of faculty with expertise in occupational or environmental medicine or sufficient peer recognition to successfully compete for time in a medical school curriculum committee. On the other hand, one must consider the plight of medical education. Medical schools are being called on to devote more time to a wide variety of clinically oriented topics including geriatrics, nutrition, cancer, and the medical humanities. At the same time, there has been an almost explosive increase in knowledge of the scientific base of medicine to be taught in the preclinical years. As a result, the medical curriculum has become overstuffed to a degree that appalls educators and that may deter students from entering medicine as a career. In his presidential address at the annual meeting of the Association of American Medical Colleges in 1987, Dr. Edward Stemmler, Dean of the University of Pennsylvania School of Medicine, indicated that the trade-off decision between the amount of basic science and new clinical material to include in the curriculum is a major question

facing medical educators. While the fate of occupational and environmental medicine in medical education is entwined in these considerations, without trained faculty there will be no opportunity to teach the subject.

Many recommendations of this report relate to the practical realities of office practice; some call for basic and systemic changes. In many areas of medical practice, there is the strong and widespread belief that physicians should spend more time and effort on disease prevention and health promotion. Although highly desirable in concept, the practice patterns of today's physicians must emphasize efficiency and cost containment, leaving little time for preventive efforts. The procedure-based reimbursement system gives little economic reward for time spent on prevention. These are issues of great importance in medicine today, and they will not likely be addressed in the field of occupational and environmental medicine alone.

Finally, meetings with several groups of practicing physicians have emphasized the reality of a rapidly changing scene of primary care. Complex new factors of regulation and economics are molding the way physicians practice medicine. The physicians still wish, however, to provide their patients with the best that medical science has to offer. The committee is optimistic that the steps recommended here will aid in achieving that goal.

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Appendixes

APPENDIX A
Abstracts of Commissioned Papers

THE ROLE OF THE PRIMARY CARE PHYSICIAN IN LEGAL ASPECTS OF OCCUPATIONAL HEALTH

Nicholas A. Ashford

This paper has two purposes. The first is to describe the nature and extent of the *legal obligations* of the primary care physician that are related to occupational health. The second is to discuss the *opportunities* for the primary care physician to assist both the worker and his or her employer in preventing or minimizing exposure to occupational health hazards and to assist the worker in obtaining compensation for occupational disease.

The first purpose is primarily related to the discovery, reporting, and treatment of occupational disease. In a small minority of states, there is a statutory duty imposed upon all physicians to report an occupational disease to the public health authorities. There is no similar federal statutory requirement. There are additional duties, recognized in the common law (i.e., law developed through court cases), arising from medical practice. Failure to properly execute these duties could leave the physician liable in a negligence suit for malpractice. The duties imposed on a primary care physician acting as an individual's personal physician may be different from duties that arise when the medical practice is related to an individual's employment, (i.e., preemployment physical examinations, periodic physical examinations, or examinations undertaken for the purposes of medical removal, workers' compensation, or a third party lawsuit in tort). Duties to discover and report occupational disease are discussed at length in this paper. Referral to other specialists is a key element in contributing to the discharge of both the legal and ethical responsibilities of the primary care physician.

The second purpose of this paper focuses more on prevention and compensation. Federal and state laws empower and enable the individual worker (and/or his or her union) to utilize legal machinery to reduce the incidence and severity of occupational disease. This includes legislation for the control of toxic substances, right-to-know laws, antidiscrimination laws, and the worker's right to refuse hazardous work. Through a variety of laws, manufacturers and employers are directed to disclose or provide access to information regarding toxic substance exposure and the subsequent health effects to workers, to unions in their capacity as worker representatives, and to government agencies charged with the protection of the public health. The underlying rationale for these directives is the assumption that this transfer of information will prompt activity that will improve worker health.

The primary care physician can play a vital role that goes beyond diagnosis and the direct provision of medical care. It is important for the physician to understand both the legal obligations of the employer and the employer's permissible uses of medical data. A number of federal agencies such as the Occupational Safety and Health Administration, the National Institute for Occupational Safety and Health, the Environmental Protection Agency, and the National Labor Relations Board offer means and mechanisms to prevent occupational disease. These are discussed at length. It is hoped that this paper will provide guidance to the primary care physician who cares for people who work.

Surveillance of Occupational Disease: Strategies for Improving Physician Recognition and Reporting

Edward L. Baker

Modern systems for the surveillance of disease and injury have three components: data collection, data analysis, and a capacity for response. In the recent past, surveillance of occupational disease and injury has focused primarily on developing techniques for data gathering and data analysis, with relatively little attention given to response. Future efforts at surveillance of occupational disease and injury should be motivated by attempts to collect data in a way that will lead directly to action-oriented intervention for the prevention of these conditions.

Unfortunately, in the minds of many public health professionals, surveillance systems are viewed as passive, imprecise, and ponderous systems designed to collect information of uncertain utility. To achieve a broader involvement of occupational health professionals in the surveillance of occupational disorders, systems must be developed that are intrinsically active and precise and that allow for a rapid response to the emerging trends of illness and injury.

In accomplishing such a transition, the ultimate goal is to develop a surveillance system that has the capacity to respond to changes in workplace hazards and to provide data that direct the efforts of health professionals to intervene in the workplace. Furthermore, the usefulness of the surveillance system should be immediately apparent to occupational health professionals who contribute data to the system. Unfortunately, many surveillance systems fail through an inability to demonstrate that data are used to direct intervention efforts. At present, the National Institute for Occupational Safety and Health (NIOSH) is involved in an intense effort to improve existing surveillance systems, to develop new approaches to identify occupational illness, and to monitor trends of disease and injury. To be successful, such development must derive from a cooperative effort of all those who will ultimately be responsible for surveillance programs.

Although many states have laws that require health providers to report cases of occupational illness and injury, most do not maintain a comprehensive system

that actively identifies and targets potential sources of case reports and then responds to such reports. To address this need, NIOSH proposes to establish a Sentinel Event Notification System for Occupational Risk (SENSOR) that will utilize targeted sources of sentinel providers to recognize and report selected occupational disorders to a state surveilance center in the state health department.

Incentives to Diagnose, Treat, and Report Occupational and Environmental Disease

Leslie I. Boden

The extent of the involvement of primary care physicians in the control of occupational diseases depends on the incentives they face and the costs they may incur. Incentives are increases in payments for medical services. Costs include reductions in income, payment delays, extra paperwork, impacts on the physician-patient relationship of the treating physician's role in determining work restrictions, and involvement in legal disputes.

Impact on Physician Income. When cost controls are tighter under workers' compensation, fee-for-service providers face a loss in income when treating workers for occupational injuries or illnesses. Prepaid plans have an incentive to identify claims as occupational, although this incentive may have a small impact on provider behavior. Of these impacts, the most important is probably the very low workers' compensation fee scale. Unlike the typical medical insurance policy, workers' compensation has no deductibles or coinsurance. As a consequence, where workers have a free choice of physician, workers' compensation increases the demand for medical services. However, this is probably not an important incentive.

Payment Delays. Medical care providers who report an illness as occupational may receive no payments from any source if the claim is contested. This may result in payment delays of one to three years after the initial diagnosis.

Paperwork. Most workers' compensation jurisdictions require physicians to spend more time on paperwork than is required by first-party insurers.

The Gatekeeper Function. When treating workers with occupational diseases, physicians may find themselves in the middle of a dispute between the worker and the employer, disrupting the physician-patient relationship and making diagnosis and treatment more difficult.

Direct Involvement in Legal Disputes. In some occupational disease claims, the treating physician may be summoned to testify about these issues, an occurrence that many find anxiety-provoking or humiliating. This experience often interferes with the physician-patient relationship.

Recommendations.

1. Workers' compensation fee schedules should not pay considerably less for medical services than first-party medical insurance.

2. When liability for a workers' compensation claim is contested, first-party insurers should be required to pay for covered services and be reimbursed by the insurer or self-insured employer if the claim is eventually paid.

3. Only the minimum necessary paperwork should be required of treating physicians. The required forms should be as easy as possible to fill out.

4. When there are disputes between worker and employer, the treating physicians should not play the role of gatekeeper.

5. To the extent feasible, primary care physicians should be insulated from the workers' compensation litigation process.

The Challenge of Teaching Occupational and Environmental Medicine in Internal Medicine Residencies

Mark R. Cullen

A simple survey of residencies demonstrates that the teaching of occupational and environmental medicine (OEM) to medical residents is inadequate; both faculty and elective opportunities are scant, based on data from the Division of General Medicine chiefs. Previous approaches to the problem have emphasized strategies for directing *more* attention to the field. In this paper, which examines the problem in the context of imminent changes in the way residents are trained, the focus is directed more specifically at the *content.*

The basis for this emphasis on content is the recognition that large societal and medical economic forces will, in and of themselves, increase the attention paid to OEM. There are five discernible forces pushing in this direction: patient demands for OEM services are growing, and consumer power is at an all-time high in a competitive health market; regulatory and legal pressures are leading employers to provide more OEM service; business is cutting back on in-house medical departments; health care financing dictates that hospitals more aggressively market service to insured, healthy workers rather than the poor, sick, and elderly on whom residents have historically trained; and expanded prepaid health delivery provides a new incentive for recognition of (cost assignable) disease from occupational and environmental sources.

Unfortunately, these same forces that guarantee OEM more visibility may lead to involvement of residents in delivery of routine, cost-effective screening, and primary care services that serve primarily institutional needs. Such activities are intellectually stultifying and unlikely to increase the capability of residents to recognize and treat occupational and environmental disease. Further, the resident in such contractual settings is unlikely to develop therapeutic relationships with worker patients that resemble the internist's future role in the care of patients who work.

The alternative is the now proliferating academic OEM clinic model, where individually referred patients with suspect problems are diagnosed and man-

aged. These clinics offer a highly desirable mix of experiences for the resident. Problems, however, include the very high cost of such clinics and their still great scarcity. Thus, some middle alternatives between the inevitable and the ideal are described.

Curriculum Approaches to the Teaching of Occupational Medicine in Family Practice Residencies

Raymond Y. Demers, Anne Cunningham, and Martin J. Hogan

The positive and negative influences of the work environment on human health are obvious to the trained observer. However, the interrelationship between work and health often goes unnoticed or unappreciated by many primary care physicians. If occupational medicine skills are to be integrated into community-based practices, they first must be taught and learned during the time of residency education. The occupational and environmental history is the foundational tool for discovering the influence of occupation or environment on the patient. This paper discusses the benefits of and barriers to incorporating occupational history information into routine patient care and suggests ways to change family practice residency curricula to include more occupational medicine content.

Incorporating occupational medicine content into clinical practice has benefits and barriers. Benefits include the gathering of additional information relevant to the diagnosis and management of disease, and the ability to offer a unique service that generates additional revenue and that remains in compliance with laws that require the reporting of occupational disease. Barriers also exist. The occupational history requires an additional time investment in patient care, and many practitioners have little training in occupational medicine. Other physicians do not seek involvement in the unfamiliar legal system. Most importantly, few physicians have ongoing cues to incorporating new behaviors in occupational medicine into their clinical practice. Programs that seek to change physician behavior in occupational medicine must emphasize the benefits of change and seek to minimize barriers.

Changing residency curricula to include occupational medicine content requires establishing relevant curricular objectives, designating appropriate teaching strategies, and evaluating the learning needs and outcomes of residents. Curricular objectives address behavioral assessment of the resident. Sample curricular objectives would state that each resident must obtain and record occupational histories on at least half of all adult patients, and attend at least two industrial site visits per year. Teaching opportunities can either integrate the occupational medicine content into existing educational activities (morning report, bedside rounds, clinical wrap-up sessions, grand rounds, and core curriculum activities) or be developed as special educational programs (in-

dustrial site visits, participation in employee health services, providing continuity of care for emergency room referrals for occupationally related illness or injury, and acquiring Material Safety Data Sheets for selected patients). These changes in curriculum activities should be evaluated by an initial needs assessment and formative assessment, followed by a summative evaluation inquiry to assess behavioral and knowledge changes.

Current Status and Trends in Reimbursement of Occupational Health Services for Workers

Frank Goldsmith

Primary care physicians continue to be a major ingredient in the delivery of health care. The ever present diagnostic issue persists. Once they have diagnosed occupationally related illnesses, diseases, and injuries, these physicians encounter particularly difficult patient care and administrative problems. The problems are not the treatment; often the medical issues involved are very similar to those of nonoccupational disorders. The problems stem from the payment mechanism for the delivery of the service and the potential disagreement over the work relatedness of the cause of the problem.

If the condition is job-related, regular health insurance cannot be used for payment. The system of workers' compensation must be used. To any primary care physician this throws up a flag and a general reluctance to treat the patient. Physicians not familiar with workers' compensation quickly find out why they should think twice before entering "that world" which includes:

1. Fee schedules for medical services that are well below reasonable and customary charges (at least in a number of states).

2. Long wait for payment of services, especially when the compensation claim is contested by the employer's insurance carrier. For contested injury claims the wait could be 1 year; for occupational diseases the wait could be well over 2.5 years.

3. The worry about being interrogated by the attorney and physician for the injured worker's employer's insurance carrier as to the work relatedness of the medical condition for chronic conditions such as heart, back, hernia, and similar conditions, but especially for illnesses and diseases.

4. If the injured worker is receiving workers' compensation, the employer or the employer's insurance carrier will be making phone calls to the physician urging that the worker be judged to be ready to work at his or her previous job or to be able to work at a light-duty job.

A brief description of the worker's compensation system, the economic policy field in which workers' compensation reforms are debated, experience of other countries' social insurance systems, and related issues are also addressed.

Altering Physicians' Behavior Patterns and Skills Through Education

Warren A. Heffron

It is my hypothesis that it is possible to alter physicians' behaviors and to increase physicians' knowledge and skills through education. If physicians are to learn through educational methodologies, it is important that they have educational learning skills as well as the ability to determine what is needed to be learned. It is also important that education should be actively sought by the learner. Plato wrote "education under compulsion has no hold on the mind," while a more recent author stated "what is learned with pleasure is learned full measure."

Specialty societies can be effective in enhancing positive attitudes and behaviors. The American Academy of Family Physicians has set forward as a positive goal that all family physicians should not only be initially competent in their medical skills but should continue to grow professionally during their career. This change has led to creation of new residency programs. Currently one will need to have graduated from a residency as well as have appropriate continuing education documented in order to be a member of the Academy. The Academy has effectively modified its members' skills and attitudes through educational processes.

If change is to be instituted it is important that education take place early in the education of medical students and is best incorporated as a part of the medical school curriculum. Some of the earliest attempts to upgrade the medical skills of general practitioners were not successful because they were largely based in county hospitals and there were no family practice role models present in medical schools nor was this a significant part of the medical school curriculum. It only became successful when an academic movement in family medicine was established and role models were placed on medical schools, strong departments created, and medical students were positively affected and influenced to enter this specialty.

Attitudes and behaviors can be taught to students, residents, and physicians in practice but need to be reinforced if these behaviors are to be continued. There have been multiple studies in the literature indicating that the behaviors of physicians can be modified. However, if reinforcement is not a part of the learning experience, physicians' behaviors and attitudes soon revert to what they were before the education intervention. It is therefore important to have the initial educational experience followed up with the reinforcement educational experience.

Attitudes and behaviors learned in medical school can enhance career choice insofar as primary care specialists are concerned. Medical schools throughout the world have developed different alternative educational experiences that are designed to influence the choice of medical students into primary care. It has been the experience at the University of New Mexico that programs with primary care role models can indeed influence medical students to enter these specialties.

Defining the Extent of Occupational Risk

Patricia A. Honchar

A need for estimates of the risk of occupational illness and injury exists in various areas of occupational health, and most directly in relation to public health prevention activities. Unfortunately, the data needed to define the extent of occupational risk are not always available and often difficult to obtain. Information about the occurrence of a particular condition in a defined population is required, in conjunction with knowledge and evaluation of past and/or current workplace hazards or exposures that relate to the condition. Some data like these are available in the descriptions of the 10 leading work-related diseases and injuries as developed by the National Institute for Occupational Safety and Health, although a great deal of variation exists in the derivation and completeness of the numbers. Differences in the nature of the occupational conditions and degree of work attributability contribute substantially to the variation in the data available to define risk. For example, while reasonable estimates of the prevalence of silicosia in workers in high-risk activities are available along with exposure estimates, the risk of neurotoxic disorders remains in question. Data available to define risk also are affected by problems in the clinical recognition of occupational etiologies and the appropriate diagnosis of occupational disease.

For the primary care or other practitioner, estimates of risk and exposure at the local and community level may be more practical and useful. A physician with knowledge of the major local industries in which his or her patients are likely to be employed, and the hazardous exposures experienced by the patients, is more likely to ask appropriate questions and capture occupationally related diagnoses.

Prevention and Detection of Occupationally Related Diseases by Primary Care Physicians: Developing the Paradigm

Thomas E. Kottke

Occupational hazards are a significant burden for American workers, and primary care physicians are a potential resource for prevention and early detection of occupationally related diseases. A number of attributes will have to be developed if primary care physicians are to become an effective resource: knowledge of patient need for service, skills to deliver the service, practice organization to support the delivery of the service, perceived patient demand for the service, belief that delivering the service is a professionally legitimate activity, adequate return to the practice for the investment in providing the service, perceived effectiveness of the service, commitment to providing the service, and confidence to provide the service.

If a primary care paradigm that includes the prevention and treatment of occupational diseases is to be developed, a cadre of committed physicians will need to be recruited to address these issues and develop practice models. By developing the Preventive Cardiology Academic Award program, the National Heart, Lung, and Blood Institute has recruited a cadre of physicians committed to developing a paradigm of physicians offering preventive cardiology services. Individuals with institutional support compete for 5-year awards to develop preventive cardiology curricula and intervention models in their medical schools. The applicant must devote 50 percent of his or her time to the award, and the average award is about $100,000 per year. The success of the award is documented by the recent announcement of a Preventive Pulmonary Academic Award and a Transfusion Medicine Academic Award by the same agency. It is suggested that a similar paradigm development program be considered for occupational medicine by primary care physicians.

Occupational and Environmental Health Content of Internal Medicine and Family Medicine Journals

Steven Lerman and Bernard D. Goldstein

The objective of this ongoing study is to determine the extent to which occupational and environmental medicine content is present in journals read by a large percentage of physicians in the fields of internal medicine and family medicine. The basic premise of our approach is that the boundaries of the clinical responsibilities for a practitioner tend to be defined by the contents of the journals written for the practitioner's field. Chosen for this purpose have been the *Annals of Internal Medicine*, the *Archives of Internal Medicine*, the *American Family Practitioner*, and the *Journal of Family Practice*. For the purposes of this study, occupational medicine has been defined rather broadly and environmental medicine rather narrowly.

Analysis of 369 articles, case reports, editorials, and reviews in the two internal medicine journals revealed that 9 (2.4 percent) had primary occupational or environmental content and an additional 9 (2.4 percent) had some minor component, for example, mention of the role of sunlight in the causation of malignant melanoma. When case histories were presented, only 7.4 percent listed the occupation. A similar analysis of 491 items in the two family medicine journals showed that 28 (5.7 percent) had primary occupational or environmental content, and an additional 9 had some minor component identified. Of the far fewer case histories presented in family medicine journals, 23.0 percent listed the occupation. We observed numerous instances in which, despite a clear potential for an occupational or environmental causation, there was no mention of such causes in the discussion of the case nor was the occupation listed.

Of note is the most common occupation considered in the published

material, that of health care workers. Similarly, in the few instances that occupation is listed as part of a case history, it is very often a nurse, physician, or other health care worker. This may reflect opportunity. It may also reflect some degree of a self-centered view of the potential for occupation-induced disease.

We recommend that editors make an effort to increase the extent to which editorials, reviews, and other features that they tend to control have occupational and environmental content. In general, such material lags behind the amount of accepted articles and case material published in their journals. This should signal the willingness to accept for review original publications in these areas and thereby increase the likelihood of attracting such manuscripts. Furthermore, reviewers and editors should begin insisting on a listing of the occupation in all case histories. This can often be done with 1 or 2 words in the first line of what is often a 500- to 1,000-word case history.

Improving Medical School Education in Occupational Health: What Should We Try to Do and How Should We Try to Do It?

Barry S. Levy

All practicing physicians have a need to better understand the relationship between health and work and to adequately recognize, diagnose, treat, and prevent work-related illnesses and injuries. Training needs to take place at all levels of education. Surveys have indicated that, while improving, medical school education in occupational health is inadequate.

In order to improve medical school education in occupational health, three areas, in the author's opinion, should be focused upon: taking and interpreting an occupational history; identifying and instituting preventive measures for both the patient as well as other workers who may face similar risks; and appreciating the context of work and actual working conditions of individual patients. Training in these three areas should begin in medical school and be continued in more depth in residency and continuing education programs.

I believe that three words are key in guiding implementation of this proposal: mainstreaming, cooperation, and reality. Occupational health teaching should be done in the context of what students perceive as mainstream medicine, and this teaching needs to be done in almost all clinical departments as well as some basic science departments. Faculty member cooperation within and among departments is essential to facilitate this. Students need to have real-world contact with patients with work-related medical problems, as well as with the working conditions and workplaces that cause or contribute to occupational medical problems.

Finally, teaching should focus on work-related disease and its recognition and prevention, and *not* emphasize so-called health promotion and life-style-related programs in the workplace. The precious little time for occupational health should focus on work-related medical problems.

New Information Technologies for Medical Practice

Daniel R. Masys

The rapid pace of discovery in the life sciences is reflected in a growing flood of information published in the biomedical literature. The last 10 years have seen a doubling of the journal articles indexed by the term OCCUPATIONAL DISEASE in the MEDLINE data base, from 11,220 in 1977 to a cumulative total of 24,759 by the end of 1986. With nearly 2,000 new articles per year being published in this subject area alone, and the entire MEDLINE file growing at over 320,000 new entries per year, it is not surprising that the primary care practitioner is unable to maintain a comprehensive and current understanding of the diagnosis and therapy in specialized disease areas such as occupational and environmental health.

A number of new information technologies have arrived in the marketplace within the past 5 years that have the potential to substantially enhance the problem-solving strategies of health care professionals. These technologies include increasingly powerful and inexpensive personal computers, mass information storage devices such as magnetic and optical disks, and affordable digital telecommunications for online access to biomedical data base systems. There are currently three types of electronic information resources that are useful in clinical problem solving: bibliographic search systems, factual data bases, and artificial intelligence or expert systems.

Bibliographic search systems are the best known and most widely used currently; MEDLINE is searched over 3 million times per year by online users around the world. Computerized bibliographic systems are an indispensable aid in locating publications, but provide only a pointer to information that is physically located elsewhere, or at best provide an abstract of the publication's content.

Factual data bases differ from bibliographic data bases in that they contain the information sought. Several factual databases are available from the National Library of Medicine's MEDLARS computer: TOXNET, a suite of toxicology and environmental hazard data bases, and the Physician Data Query (PDQ) system of cancer treatment advice. In both bibliographic and factual data bases, searches presume that the user has an awareness of a specific concept or disease; they do not generally instill such awareness in the user. Since lack of awareness of the possibility of occupational and environmental illnesses appears to be a central issue in primary care delivery, such online systems would not be expected to have a major impact in improving outcomes.

Expert systems are those computer programs that embody the knowledge of human experts in goal-directed reasoning processes. A number of prototypes have been constructed, such as the MYCIN antibiotic selection advisor, its successors PUFF (pulmonary disease) and ONCOCIN (oncology) clinical advisory systems, and the diagnostic expert systems CONSIDER, RECONSIDER, and

CADUCEUS (INTERNIST-I). Rules for diagnosing occupational and environmental illness exist in most of the current general purpose expert systems developed for medical diagnosis, and the ability of such systems to methodically and rapidly evaluate hundreds or thousands of candidate diagnoses based on clinical findings offers a new tool for improving the consistency and accuracy of clinical diagnoses. Expert systems are in development and testing stages now, and will be available widely in 5 to 10 years.

Changing Physician Behavior: A Systems-Marketing Approach

Graham W. Ward

A physician is embedded in a complex social system. The actions of a given physician are influenced as much by the forces operating in his or her system as by the knowledge he or she may possess. To modify physician behavior, we must use social marketing to gain the initial interest of the primary care provider in the problem, to persuade the primary care provider to gain the knowledge required for an appropriate response to a problem, and to reinforce the actions the primary care provider must undertake so that they occur regularly on a long-term basis.

Marketing uses interventions arising from target audience needs, wants, and expectations. Three activities are required: defining the problem in marketing terms, developing a strategy based on the problem definition, and exploring some considerations related to implementing the strategy. A key task is segmenting the market, that is, identifying sectors within a population to allow priorities to be set and to permit development of messages tailored for specific groups.

Before a solution can be proposed, one must know why the inappropriate or lack of action exists. Marketers analyze the situation using the four "P's" of marketing: product, place, price, and promotion. Place addresses the question: Are the materials and services needed to solve a problem located properly in the system?

Price is a set of ratios. The first is the ratio of the price to perceived utility. This means there are two opportunities to seek change that reduce costs as a barrier to consumer action. One is to reduce the actual price, for example, by lowering the cost of continuing medical education attendance or records systems. Another is to increase the perceived value so the price does not seem to be so great. The second is the ratio of the value gained in a transaction relative to the value of other foregone transactions— the "opportunity cost."

Promotion has two components, visibility and timing—achieving awareness that an option exists and reinforcing that option at the time the user is making a decision.

Roles. A description of a professional's role must meet two requirements: rationality and specificity. Basic physician education is limited to achieving

expertise in only two functions: critical diagnostic (physiologic abnormality identification) decisions and critical therapeutic (medical intervention) decisions. Planners err by casting physicians in nonmedical roles. A rational approach is, first, to define the skills, knowledge, and experience required for a set of tasks and, only then, to surmise what type of professional or team of professionals best fits the needs of the tasks. Start with a medical role for the M.D.

Specificity. Defining the role of a profession or organization requires a high degree of specificity that is usually best achieved by consensus. Examples of important role questions are: What history items should be probed routinely? What special history items should be probed in what special circumstances? What diagnostic procedures should be routinely part of baseline data? What sentinel events should one watch for? What educational information should be given to patients—routinely and under special circumstances? How and when should communications be established with a patient's company physician? When and to whom should what patients be referred? What knowledge or skills should physicians seek to improve?

APPENDIX B
Biographical Information on Committee Members and Consultants

JOSEPH M. CANNELLA has been the corporate medical director of the Mobil Corporation in New York City since 1980. Previously, from 1969 to 1980, he was the manager of health services for the Xerox Corporation in Rochester, New York. He graduated from the Faculty of Medicine, Queens University, Kingston, Ontario, Canada, in 1961. This was followed by an internship and one year of internal medicine at Hurley Hospital in Flint, Michigan. For 3 years prior to his service in the U.S. Navy Reserve, he worked in family medicine in Watertown, New York. He completed his residency in occupational medicine at Ohio State University with an M.S. in preventive medicine in 1969. He holds certification in occupational medicine by the American Board of Preventive Medicine. A past president of the New York Upstate Occupational Medical Association and New York Occupational Medical Association, he is currently president-elect of the American Occupational Medical Association and a fellow of the American Academy of Occupational Medicine and the American College of Preventive Medicine. He is Clinical Professor of Environmental Medicine at New York University Medical Center.

DAVID S. CITRON was the director of medical education at Charlotte Memorial Hospital and Medical Center and director of the Charlotte Area Health Education Center until his retirement in October 1987. Previously, he was director of the family practice residency at the same institution. He graduated from the University of North Carolina and received the M.D. degree with honors from Washington University, St. Louis. Following internship and residency in internal medicine at Barnes Hospital, he practiced medicine in Charlotte, North Carolina, for 20 years. He is Clinical Professor of Medicine and Family Medicine at the University of North Carolina and is a member of the Institute of Medicine, the executive board of the National Board of Medical Examiners, and the board of directors of the Federation of State Medical Boards.

MOLLY JOEL COYE is the commissioner of health for the state of New Jersey. She has formerly served as a special advisor for health and environment to the governor of New Jersey, as a medical officer with the National Institute for Occupational Safety and Health, as the chief of the Occupational Health Clinic at San Francisco General Hospital, and associate professor of family practice and internal medicine at the University of California, San Francisco. Her research and publications are in the areas of occupational hazards of agricultural work, environmental aspects of pesticide exposure, and occupational health policy. She received graduate degrees in Chinese history from Stanford University and medicine and public health from the Johns Hopkins University.

NEIL J. ELGEE has been a practicing physician in Seattle, Washington, for 30 years, in both general internal medicine and endocrinology. In addition, he works as an active clinical faculty member in the School of Medicine of the University of Washington. Service in various functions of the American College of Physicians preceded his election to the Institute of Medicine in 1978. He received his M.D. degree from the University of Rochester.

ROBERT A. FRIED is the first holder of the Luther L. Terry Preventive Medicine Fellowship, sponsored by the Association of Teachers of Preventive Medicine. In that capacity he served as the first chief of the Clinical Services Branch of the Office of Disease Prevention and Health Promotion, U.S. Public Health Service. He graduated from the University of Pennsylvania in

1969 with a B.A. degree in psychology and received his M.D. degree in 1976 from Hahnemann University. Before accepting the Terry Fellowship, he was assistant director of the family medicine residency program at Mercy Medical Center, Denver, Colorado. He has long been interested in occupational medicine and has lectured, consulted, and written on the subject.

BERNARD D. GOLDSTEIN is the chairperson of the Department of Environmental and Community Medicine at the University of Medicine and Dentistry of New Jersey (UMDNJ)-Robert Wood Johnson Medical School. He is also director of the Environmental and Occupational Health Sciences Institute and director of the Graduate Program in Public Health, both joint programs between Rutgers University and UMDNJ. Dr. Goldstein is a physician and is board-certified in internal medicine and hematology. He was a faculty member in the Departments of Environmental Medicine and Medicine at New York University Medical Center until 1980, when he went to UMDNJ. From 1983 to 1985 Dr. Goldstein was on leave of absence while serving as assistant administrator for research and development of the U.S. Environmental Protection Agency (EPA). He has been a member and chairman of the Toxicology Study Section of the National Institutes of Health and of EPA's Clean Air Scientific Advisory Committee. Currently, he chairs the Committee on the Biomarkers in Environmental Health Research, National Research Council, National Academy of Sciences. Dr. Goldstein received his B.S. degree from the University of Wisconsin and his M.D. degree from the New York University School of Medicine.

PETER B. HUTT is a partner in the Washington, D.C., law firm of Covington & Burling. He specializes in food and drug law and in the government regulation of health and safety. From 1971 to 1975 he was chief counsel for the Food and Drug Administration. He is a member of the Institute of Medicine and a councilor of the Society for Risk Analysis and serves on a wide variety of academic and scientific advisory boards. He has served on the Advisory Committee to the Director of the National Institutes of Health (NIH), the National Academy of Sciences Committee on Research Training in the Biomedical and Behavioral Sciences, the NIH Advisory Committee to Review the Guidelines for Recombinant DNA Research, and five Office of Technology Assessment advisory panels. He is coauthor (with Dean Richard A. Merrill of the University of Virginia Law School) of *Food and Drug Law: Cases and Materials* (Foundation Press, 1980); serves on several journal editorial boards, including the *Food Drug Cosmetic Law Journal;* and has published numerous papers on food and drug law and health policy. Mr. Hutt received his B.A. degree magna cum laude from Yale University, his LL.B. degree from Harvard University, and his LL.M. degree from New York University under a fellowship from the Food and Drug Law Institute.

GEORGE W. JACKSON is the chief of the Division of Occupational Medicine and director of Employee Occupational Health at Duke University. His interests are primarily in the area of substance abuse in the workplace. He received his undergraduate degree from Allegheny College in 1964 and his M.D. degree in 1968 from Case Western Reserve University. He was a fellow of the National Fund for Medical Education in 1975.

ALAN A. MCLEAN is a clinical associate professor of psychiatry at Cornell University Medical College. Most of his research and publications (including five of his eight books) are concerned with work stress. Since 1985 he has served as a consultant on occupational psychiatry to a number of organizations in both the private and public sectors. From 1957 to 1985 he was associated with the IBM Corporation as chief psychiatric consultant and, subsequently, medical director. He was the president of the American Occupational Medical Association from 1978 to 1979. At the American Medical Association, he was a member of the House of Delegates and the Section Council on Preventive Medicine (which he chaired) from 1977 to 1987. He has also served on advisory committees for the American Psychiatric Association, the World Health Organization, and the International Commission on Occupational Health. He received his

M.D. degree from the State University of New York and a 2-year fellowship in industrial psychiatry at Cornell from the Carnegie Foundation.

CLIFFORD S. MITCHELL is a resident physician in internal medicine at the Francis Scott Key Medical Center in Baltimore. He received his M.D. degree from Case Western Reserve University in 1987. He was twice cochairman of the American Medical Student Association Task Force on Occupational and Environmental Health. From 1982 to 1983 he worked as a consultant in environmental health in Cleveland, Ohio. He received an S.M. degree in technology and policy from the Massachusetts Institute of Technology in 1981 and a B.A. degree in chemistry from Williams College in 1979.

KATHLEEN REST is a Pew Health Policy Fellow at Boston University. Previously, she served on the faculty at the University of Arizona in the Department of Family and Community Medicine, and later at the Medical College of Pennsylvania in the Department of Community and Preventive Medicine where she was the assistant director of the Division of Occupational and Environmental Health. Her experience in occupational and environmental health stems from 6 years of involvement in a federal contract to develop educational materials in occupational health for primary care physicians. She is an active member and officer of the Occupational Health and Safety Section of the American Public Health Association and the Association of Teachers of Preventive Medicine. She has served on a number of advisory groups for labor, academia, and government. Her interests include ethics in occupational and environmental health, workplace screening, worker right-to-know, risk communication, and training health care professionals.

LINDA ROSENSTOCK is associate professor in the Departments of Medicine and Environmental Health at the University of Washington and serves as the director of the Occupational Medicine Program in the Department of Medicine and director of the Occupational Medicine Education and Training Program in the Department of Environmental Health. She received her M.D. and M.P.H. degrees from Johns Hopkins University. Her interests have been in the clinical determinants of occupational disease and the medical, economic, legal, and ethical aspects of providing occupational health services. She is currently a Henry J. Kaiser Family Foundation Faculty Scholar in general internal medicine.

JAMES L. WEEKS is the deputy director for occupational health for the International Union, United Mine Workers of America (UMWA). Prior to working for UMWA, he directed an occupational health program for a local union in Lynn, Massachusetts. His publications concern the epidemiology of occupational disease and injury among rubber workers and coal miners, occupational health and safety policy, and workers' educational materials. He received his B.S. degree in industrial engineering from the University of California, Berkeley, and a Sc.D. degree in occupational health from the Harvard School of Public Health. He is board-certified as an industrial hygienist and is a member of several professional organizations and committees.

DAVID H. WEGMAN is professor and head of the Department of Work Environment in the College of Engineering at the University of Lowell. He is also director of the Work Environment Laboratory in the Center for Productivity Enhancement at the university. Previously, he served as head of the Division of Environmental and Occupational Health Sciences at the University of California at Los Angeles, School of Public Health, and as director of the Occupational Health Program at the Harvard School of Public Health. His research has been directed to the epidemiologic study of occupational cancer and occupational respiratory disease, the development of surveillance programs to identify occupational disease and hazards, and a number of specific epidemiologic studies of outbreaks of suspected occupational disease. He is the author of over 80 articles on occupational health and is coeditor of a basic text for health professionals on recognition and prevention of occupational disease. Dr. Wegman received his B.A. degree

from Swarthmore College, his M.D. degree from Harvard Medical School, and his M.S. degree from the Harvard School of Public Health. He is board-certified in occupational medicine.

STANFORD WESSLER is currently a professor of medicine and the associate dean for Post-Graduate Programs at the New York University School of Medicine. Dr. Wessler was a member of the faculty of the Harvard Medical School from 1946 to 1964, during which time he spent 1 year in the laboratory of Professor Konrad Bloch in the Department of Biological Chemistry at Harvard College. Subsequently, he was the John E. and Adaline Simon Professor of Medicine at the Washington University School of Medicine, St. Louis, and physician-in-chief at the Jewish Hospital of St. Louis from 1964 to 1974. He was director at both institutions of their National Institute of Health Thrombosis Research Centers. Dr. Wessler's research has been concerned with the mechanism of thrombus formation, and he has published widely in this and the related field of vascular diseases. An Alpha Omega Alpha graduate of the New York University School of Medicine, he received his B.A. degree cum laude from Harvard College. Dr. Wessler has been a member of several government scientific committees and on the editorial boards of medical specialty journals, and he is a member of several learned medical societies. He has been a vice president of the American Heart Association, president of the New York State Council on Continuing Medical Education, and a recipient of the James F. Mitchell Award for Heart and Vascular Research and the Award of Merit of the American Heart Association.

APPENDIX C
Glossary

ACRONYMS

AAFP	American Academy of Family Physicians
AAMC	Association of American Medical Colleges
AAOM	American Academy of Occupational Medicine
ABFP	American Board of Family Practice
ABIM	American Board of Internal Medicine
ABMS	American Board of Medical Specialties
ABP	American Board of Pediatrics
ABPM	American Board of Preventive Medicine
ACEP	American College of Emergency Physicians
ACP	American College of Physicians
ACPM	American College of Preventive Medicine
ACS	American College of Surgeons
AMA	American Medical Association
AOMA	American Occupational Medical Association
APhA	American Pharmaceutical Association
ASIM	American Society of Internal Medicine
ATPM	Association of Teachers of Preventive Medicine
ATSDR	Agency for Toxic Substance and Disease Registry
BLS	Bureau of Labor Statistics
B.S.	Bachelor of Science
CCERP	Committee to Coordinate Environmental and Related Programs
CDC	Centers for Disease Control
CEH	Center for Environmental Health
CME	Continuing Medical Education
COSH	Coalitions for Occupational Study and Health
DHEW	Department of Health, Education, and Welfare
DHHS	Department of Health and Human Services
DP	Disease Prevention
EOHSI	Environmental and Occupational Health Sciences Institute
EPA	Environmental Protection Agency
ERC	Educational Resource Center
FDA	Food and Drug Administration
FLEX	Federation Licensing Examination
GMENAC	Graduate Medical Education National Advisory Committee
HHS	Health and Human Services
HMO	Health Maintenance Organization
HP	Health Promotion
HRSA	Health Resources and Services Administration

IOM	Institute of Medicine
LCCME	Liaison Committee on Continuing Medical Education
MD	Medical Doctor
MMWR	Morbidity and Mortality Weekly Report
MPA	Master of Public Administration
MPH	Master of Public Health
M.S.	Master of Science
MSHA	Mine Safety and Health Administration
NAS	National Academy of Sciences
NBME	National Board of Medical Examiners
NCTR	National Center for Toxicological Research
NIEHS	National Institute of Environmental Health Science
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NLM	National Library of Medicine
NRC	National Research Council
OEHH	Occupational and Environmental Health History
OEM	Occupational and Environmental Medicine
OHH	Occupational Health History
OSHA	Occupational Safety and Health Administration
PCP	Primary Care Physician
PHS	Public Health Service
PRA	Physicians Recognition Award
Sc.D.	Doctor of Science
SOEH	Society for Occupational and Environmental Health
SSDI	Social Security Disability Insurance
STFM	Society of Teachers of Family Medicine
WC	Workers' Compensation
WHO	World Health Organization

Data Bases

DXplain is a computer-based diagnostic assistance system developed at the Massachusetts General Hospital Laboratory of Computer Science. The program provides access to a medical diagnosis knowledge base of over 2,000 diseases via a user interface that accepts a description of patient findings and generates a list of disorders having some or all of the characteristics entered. Online access to the program by physicians is provided by the American Medical Association's AMA/NET computer networks.

MEDLINE is the world's largest biomedical bibliographic online search system. Developed and maintained by the National Library of Medicine (NLM), MEDLINE contains over 5 million citations and covers articles appearing in over 3,000 journals, monographs, and other technical publications. MEDLINE is available through direct dial-in access to the NLM, through several private U.S. vendors, and via a network of 15 international centers located around the world.

The Physician Data Query (PDQ) system is an online cancer treatment resource developed and maintained by the National Cancer Institute. It includes concise summaries of the staging, treatment, and prognosis of all major types of human cancer, listings of experimental cancer therapy protocols available nationwide, and directories of physicians and organizations in-

volved in cancer treatment. PDQ is available online from the NLM and from several private data base vendors.

TOXLINE is a specialized online bibliographic file of the NLM that covers the pharmacological, biochemical, physiological, and toxicological effects of drugs and other chemicals. Like MEDLINE, it is available by dial-in access to the NLM computer system.

TOXNET is a collection of factual data base files containing toxicology data. Its component files include the Hazardous Substances Data Bank (HSDB), Chemical Carcinogenesis Research Information System (CCRIS), and Registry of Toxic Effects of Chemical Substances (RTECS). TOXNET is built and maintained by the NLM, and like MEDLINE and TOXLINE, is available for searching via dial-in access over public telecommunications networks.