

PROBLEMS IN OCCUPATIONAL
HEALTH PROGRAMMING

The Benefit-to-Risk Ratio
in Occupational Health

Lewis C. Robbins, MD

In all problem solving one must first define the problem. I should like to propose what I believe the employer sees as his problem, and attempt to define it.

To use Buckminster Fuller's definition, the employer is concerned with the probable recurrence of yesterday's crises. The employer's problem is loss of continuity of employment brought on by diseases and injuries. The working employee is not ill. But the employer knows that he is at risk.

Before the legitimate complaint, there is genesis of disease and injury. Prospective medicine proposes that this risk, and the degree to which it can be reduced, be estimated for each individual. This provides a broader view of medicine, namely, a benefit-to-risk ratio for the well and for the sick.

Prospective medicine uses the benefit-to-risk ratio to improve the employer's chances for continuity of employment among all employees. This differs from today's medicine in that prospective medicine investigates prognosis of the well in addition to the sick.

Some physicians say there is no validity to a discipline that attempts to evaluate the well. But life insurance companies know actuaries can estimate risk, and they have invested a trillion dollars in their estimates. Some say medicine cannot take a prospective view, but many physicians are already providing preventive programs to the well. We would go one step farther in prospective medicine and offer interventions which will reduce the total personal risk. We propose to the employer that prospective medicine is a search for survival advantage, an attempt to reduce risk. The employee health program of the future will seek this survival advantage.

On what foundation was prospective medicine built? There is a common denominator for both curative and prospective medicine, and that common denominator is "risk." The numerator is the "benefit," or reduced risk. The benefit to risk ratio has been called the "survival advantage," which is usually expressed as a ratio, or rate, e.g., "The risk can be reduced by 75%." The employer cannot afford to omit important benefit-to-risk ratios from his health program.

How is the employer to gain better health for employees? Can valid benefit to risk ratios be ordered in such a way as to give all possible survival advantages? In 1970, a group of physicians at the Methodist Hospital of Indiana, acting under a grant from the Indiana State Board of Health, published a manual called, "How to Practice Prospective Medicine." This manual sought to define problems in the well person in terms of the risk of death within ten years. The point is to determine how much this risk can be reduced.

To those who say our present state of knowledge does not permit this precision in the practice of medicine, we say that science has collected the necessary data, and medicine can apply this science in a way that changes the usual course. Health hazard appraisal presents results in terms of changing long term risks in an individual, giving high visibility to the process by means of the health hazard appraisal (HHA) chart. Let us examine this art through the chronology of its development.

In 1947, the Public Health Service (PHS) received a mandate from Congress to begin work on the control of heart disease. Dr. Joseph Mountin chose to initiate a prospective study of heart disease and to include a preventive program that would exploit this and other prospective research. The writer was one of two physicians who were assigned to this study-control effort. The resulting demonstrations became the Framingham and Newton studies. Markers, risk factors, or precursors were identified that placed people at higher risk of coronary heart disease. But were they valid?

As the data from the Framingham study appeared, epidemiologists began to set up studies to confirm them. There was debate, and eventually the question was asked: Shall we go to the profession

and to the public with our findings? Some precursors were validated, others were not.

In addition to the precursors of coronary heart disease, precursors for diseases and injuries began to appear. PHS and the American Cancer Society began to help identify those at high risk. When such an amount of strong evidence had collected, it seemed the medical profession and the public should be informed. PHS did this, and the first major warning was on the cigarette and its relation to lung cancer.

One of the two epidemiologists who reported the cigarette-lung cancer relationship, Dr. Daniel Horn of the American Cancer Society, proposed the term, "survival advantage." The difference between the benefit and the risk can be called an advantage in survival.

The risk factors of cigarettes to lung cancer, cigarettes to coronary heart disease, and alcohol to motor vehicle crashes were recognized as valid precursors that held survival advantage, and scientific societies began to recognize those who were competent in presenting the evidence about precursors and survival advantage.

The Surgeon General of the PHS asked the writer, who was then Chief of the Cancer Control Program (CCP), how he planned to adapt cervical cancer control to medicine. I then began to put together the contributions of those who had pioneered in exploring the natural history of common diseases. Could these several persons, knowing one precursor well, work together to put prevention into practice?

Once the means appeared through resources of the Cancer Control Program to bring the several precursors into a preventive program, a population base was sought for the risk factors. There are three important variables among Americans which affect their risk: age, sex, and race. Harvey Geller of the Cancer Control Program designed tables that gave the 10-year risk of death of individuals in specific age and sex groups by race.

We believed a person's 10-year risk should be examined, so that diseases and injuries could be anticipated in time through the identification of precursors, and their staging, prognosis, and

treatment. What are the premature deaths in one's age group? Just how great, on the average, is the risk of death from major causes, by age, sex and race? These tables became known as the Geller Tables, and they have been used to demonstrate the objectives of health hazard appraisal.

One of the advisory physicians on the Cancer Control Program was J. P. Lindsay, Chairman of the Education Commission of the American Academy of General Practice. We discussed with him and others whether this effort, to begin with precursors and to reduce risk, should be developed by public health officers, occupational health physicians, or practicing physicians. Doctor Lindsay believed beginning with practicing physicians would explore a likely source of support, and that the general practitioners were the only ones who hadn't excluded themselves by specialty claims from seeing patients prospectively.

There comes a time when one must advance from discussion to demonstration. Dr. John Hanlon, then chief health officer in Philadelphia and professor of preventive medicine at Temple, was asked to test the appraisal, using the Geller Tables and the valid precursors. A medical student, now Constance Bonbrest, M.D., was assigned as a student employee to the outpatient department of the medical school. During the summer of 1959, 25 appraisals were done, called "health hazard charts". We then looked at the charts and found ways to improve them. The biggest problem was in telling people what we had done, but at least we had a demonstration.

Following the pilot Temple University study, with Doctor Hanlon and others we held a two day discussion of what had been achieved. Our health educator, Cecilia Conrath, said what we were doing was putting prospective studies into practice, and why wasn't that "prospective medicine"? From that moment on, we had no difficulty in telling what it was we were trying to do.

A test of the new term, "Prospective Medicine" aroused interest and enthusiasm among medical students, physicians, and preventive medicine people. Dr. Thomas Peery, who directed the screening of physicians at the annual meetings of the American Medical Association, was approached with the proposal that a demonstration be attempted at George Washington University. He brought in Dr. Joseph F. Sadusk, Jr., who in a few months had organized a

demonstration involving internists, medical students, and a reviewing body of specialists to provide benefit-to-risk ratios. One hundred outpatients received health hazard appraisals, and the program was reported in The Journal of the American Medical Association (1). Here was the modern "Flexner Specialist" contributing to a new medicine.

The Cancer Control Program believed the American Academy of General Practice (AAGP) had the greatest impact on U.S. primary care. Amos Johnson, who later became the President of the American Academy of General Practice, helped to improve professional education in the Academy about cancer and proposed we develop a demonstration to show the family doctor was interested in preventive medicine. With the help of Drs. John Heller and Ulrich Bryner a program was proposed to the AAGP to work with the Cancer Control Program in demonstrating cervical cancer through the general practitioner. Within four years, 1.7 million Pap smears had been taken by 5,000 family doctors, and 10,000 cervical cancers had been diagnosed. This achievement was of help to the Academy in their bid for a new specialty in family practice.

With the family physician showing interest and competence in prospective medicine, more tools for him were sought, and Phillip George, now a surgeon in Miami, joined the Public Health Service to work with the writer on a health hazard appraisal chart. This chart was designed to present the benefit-to-risk ratios of several precursors in such a way that the total personal risk could be determined.

The chart was to be used as a model that would permit a determination of the individual's need for preventive medicine. As it was being developed, the Millis Commission, and coincidentally the Willard Committee, Ravdin, and Witten groups, began to study the integration of medicine into a comprehensive whole through the services of a new kind of practitioner, the primary or family physician.

The epidemiologist had made great contributions to prospective medicine through the work of identifying valid predictors. He did not show, however, how these benefit-to-risk ratios could be used in determining the total personal risk. When actuaries were asked if risk estimates could be made from the grouped data, they

assured us that this was their daily work. Then Norman Gesner took on the job of putting together tables that would combine the average risks by age, sex, and race, according to precursor, stage of precursor, and interventions.

Life insurance companies had broad experience with determination of total personal risks and with changes in risks and precursors. Their method of risk estimate was called the credit-debit system. It consisted largely of adding debits in the form of percentage increases to the age risk. These unique tables developed by Norman Gesner were called the Geller-Gesner Tables.

The health hazard chart came at a time when the computer was coming into its own. Robert Manning, Professor of Medicine at the University of Kansas, was the first to computerize health hazard appraisal (HHA) in 1969. Doctor Manning used the computer to teach medical students how to begin the practice of prospective medicine. Today, two of the best examples of this computerization are the inter-health program in San Diego and the HHA's which are part of the Lifestyle program in The Department of Health and Welfare in Canada. The latter is described in the book "A New Perspective on the Health of Canadians" by Mark Lalonde.

As new developments appear, the directors of medical education in community hospitals must find ways to include them in teaching programs. Jack H. Hall, Director of Medical Education at Methodist Hospital, Indianapolis, developed a teaching program in HHA with the help of a grant from the CCP. The writer joined him as chief of HHA and wrote a manual about the performance of these appraisals. The manual was developed with the help of 12 task forces made up of family doctors at the hospital.

Is there such a role as "precursor specialist"? What is meant by this term is a health worker, preferably a physician, who has specialized in the natural history of a precursor sufficiently to advise authoritatively about its control. The physician generally needs others to help him, for precursors are as varied as alcohol as a factor in motor vehicle crashes and cigarettes in stroke. The physician also is needed to help in the update of the Geller-Gesner Tables and to help build supports for the practice of prospective medicine.

The writer is one of many who knew one precursor well enough to help plan control programs. The precursor specialist deliberately seeks others to help design programs that anticipate disease or injury related to the specific precursor.

The following are 24 precursors selected for their major importance in the practice of prospective medicine:

- Cigarettes to coronary heart disease
- High blood pressure to coronary heart disease
- High cholesterol to coronary heart disease
- Sedentary life to coronary heart disease
- Diabetes to coronary heart disease
- Obesity to coronary heart disease
- High blood pressure to hypertensive heart disease
- High blood pressure to stroke
- Cigarettes to lung cancer
- Cigarettes to bronchitis-emphysema
- No seat belt to motor vehicle crash injury
- Alcohol to motor vehicle injury
- Miles traveled to motor vehicle crash
- Alcohol to cirrhosis
- Depression to suicide
- Positive cytology to cancer of the cervix
- Carrying weapon to homicide
- Arrest record to homicide
- Rheumatic fever to rheumatic heart disease
- History of colonic polyp to cancer of colon-rectum
- Occult blood in stool to colon-rectum cancer
- Family history to breast cancer
- Dominant nodule (lump) to breast cancer
- Mammography (cancer image) to breast cancer

How does all this relate to occupational health? The employee is a patient who has a vantage point that no one else has, for he can say, "I'm the only one who knows when my shoe pinches." Since workers should see the world as largely indifferent or hostile to their welfare, they must assume responsibility for their acts, and understand that they can contribute to long and useful life expectancies.

The medical profession teaches the patient very little about the anticipation of major causes of death and disability, risk precursors, and their relationship to the natural history of disease and appropriate intervention. Medicine must help develop guidance programs for the patient that are commensurate with its mission: the preservation of youthful and useful function. The several hundred thousand patients using HHA have almost universally found it helpful.

One of the recurring questions in occupational health is whether to take over the responsibility for providing medical care to the employee. Most programs reluctantly conclude, several times a year, to continue to play a supporting role to the family doctor. There is a way to play this role with both the employer and the family doctor as the beneficiary. HHA is designed to provide to the physician all possible patient information. It can provide continuity to the employer in significant problems. The family doctor can be offered a data base that will give his patient the best advantage, whether the diagnosis is of a precursor or of a disease. Here is a way for occupational health to win with every patient: perform a HHA and then help the patient enter into a risk reduction program based upon specific health education.

Information about HHA and prospective medicine is available from the Methodist Hospital, Indianapolis, Indiana 46202.

SUMMARY

Prospective medicine has been summarized best by William P. Richardson, M.D., a past president of the American College of Preventive Medicine:

"In its early days health hazard appraisal was, somewhat disparagingly, called a 'numbers game.' It is indeed a 'numbers game' in the highest and best sense of that term. So also are curative medicine and public health, each of which measures its success by its benefit to risk ratio. In curative medicine the risk is the deaths from a particular disease or injury which can be expected without treatment, and the benefit is the number by which these expected deaths

are reduced by appropriate treatment. In public health the risk is defined in terms of deaths in a population which has been followed prospectively, and the benefit is the reduction in deaths brought about by a specified intervention, i.e., purification of a water supply or pasteurization of milk.

"It is obvious that both of these approaches have achieved great successes, but both have also been limited by the way in which they have been practiced. Curative medicine begins with the sick individual and seeks to reduce his risk, his chances of dying from his disease. Public health begins with the group and seeks to reduce deaths by interventions directed at the group or community. Both approaches fail to take account of the role of the individual in determining his own health.

"Health hazard appraisal transcends these limitations of both medicine and public health: of medicine by starting with the individual while he is well, and of public health by recognizing the individual as the ultimate decision-maker, and focusing on what he can do to enhance the chances of his own survival. It defines the risk as the chance of the individual's dying over the next ten years, based on the mortality experience for his age-sex-race group. The benefit is the increased chance of survival he can bring about by changes in life-style, to eliminate or reduce the risk of overt disease and death posed by specific precursors of disease.

"The benefit to risk ratio for both curative medicine and public health are basically determined by professional prognoses and decisions made on behalf of the individual or group. The benefit to risk ratio in health hazard appraisal is determined by decisions the individual himself makes.

"In short, health hazard appraisal broadens medicine's 'numbers game' to include as the R (risk in the B/R ratio, precursors of disease in the well individual, and as the B (benefit) the survival advantage from measures of intervention for

which the individual must assume responsibility. Guidance as to the appropriate measures and the decision to assume this responsibility must necessarily be based on sound scientific information provided in terms which the individual can understand and which will motivate him to make the necessary changes in habits and life-style.

"We have done a very poor job of providing such information and motivation to the individual. The educational effort it will require is an awesome one which challenges the best efforts of practitioners of curative medicine, public health and health hazard appraisal alike."

REFERENCES

1. Sadusk, J. F. and L. C. Robbins. 1968. Proposal for health-hazard appraisal in comprehensive health care. JAMA 203:1108-1112.

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OCCUPATIONAL SAFETY AND HEALTH SYMPOSIA 1977

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

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Division of Technical Services
Cincinnati, Ohio 45226

June 1978

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NIOSH Project Officer: Loren L. Hatch, DO, PhD
Principal Investigators: Theodore C. Doege, M.D.,
Robert H. Wheeler, M.S.

Contract #210-77-0088

DHEW (NIOSH) Publication No. 78-169