Industrial Medicine

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THE relationship of certain diseases and injuries to occupation has been recognized for hundreds and perhaps thousands of years. With the industrial revolution, first in England and later in this country, the frequency, number, and complexity of such medical problems grew tremendously. The advent of workmen's compensation laws early in the 20th century caused many managers of large industrial plants to seek inplant medical services. These were usually provided by a full-time nurse and a part-time or on-call physician.

The most obvious and most costly medical problems were those secondary to trauma. It is not surprising then that the early inplant doctors were almost always general surgeons whose chief function was the repair and rehabilitation of injured workmen.

Economic, humanitarian, and moral considerations led most managements, with the aid of physicians, hygienists, and safety engineers, to seek ways of preventing injury on the job. The success of these efforts is reflected in the striking increase, during the last 50 years, in the industrial worker's average life expectancy. It is now comparable to that of those not so employed, largely as a result of preventing trauma. Except for occasional dramatic revelations, industrial factors leading to chronic medical disabilities were unrecognized until relatively recently.

One may say with certainty today that any job required by industry can be done without harm or injury to the worker. This conclusion is corroborated by the observations of many effective industrial medical departments. Disability secondary to occupation accounts for fewer than 5 percent, and in some instances 1 percent, of all disability cases (*1*). Careful study of disability secondary to occupation in such plants invariably reveals errors in judgment or performance of the injured workman himself or of one or more of his fellow workers. The frequent accumulation of millions of man-hours in industrial plants without a single disabling occupational illness or injury gives credence to the belief that occupational disability can be all but eliminated.

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Growth of Inplant Medical Services

In spite of the marked decrease in the frequency of occupational injury and disease, the number of physicians employed by industry has increased tremendously in the past 15 years.

The growth of industry itself might well account for an increased number of plant doctors even though the need for their services has declined. And although the relative frequency of occupational disease has been decreased, such disease has not been eliminated. Even the remote possibility of occasional disaster in historically hazardous industries causes some managers to maintain a readily available medical staff.

Chiefly, however, the increased number of physicians in industry is the product of new concepts of the possible roles of medical services in industry. For example, some managements have yielded to the organized demand of workers for complete therapeutic inplant medical services at management expense as a fringe benefit in lieu of salary increases. In other instances, varying amounts and kinds of

medical services have been provided in efforts to reduce the cost of sickness absenteeism. Most important are the preventive medical programs designed to supplement the therapeutic medical services already available to the worker in the community. The goal of such preventive industrial medical services is to keep the maximum number of workers on the job performing at optimal levels.

Unfortunately, the average person groups all these varieties of medical activity, and still others, under the single label of "industrial medicine." The physician who carries on any of these activities in an industrial setting is known as an industrial physician. Some refinement of terminology is possible and very desirable.

Industrial and Occupational Medicine

I suggest that the term "industrial medicine" be used to designate that variety of medical practice which deals primarily with the treatment of injury or disease resulting from peculiarities of the working environment and for which the employer assumes a moral and legal responsibility.

Almost all practitioners of medicine are called upon from time to time to treat "industrial cases" and might well be considered, therefore, "industrial physicians." It is impossible to define industrial medicine or surgery in terms of disease entities. Disease or injury occurring as a result of defects in the working environment is in no wise different from that which occurs among persons who have never been employed in industry. A strategically placed roller skate on the cellar stairs may lead to the same injuries as an improperly assembled scaffold on the job. Solvents improperly used to clean the living room carpet may produce the same liver damage and bone marrow depression as when used without proper ventilation in the plant. Proper treatment is the same, and the potentialities for permanent disability or even death are the same. The fact that there is workmen's compensation should not affect the medical care or the end result.

The term "occupational medicine," on the other hand, should be used to designate that variety of medical practice concerned primarily with the prevention and control of both occupational and nonoccupational disease, and not with the treatment of either. Occupational medicine was recently defined as "that branch of medicine which deals with the relationship of man to his occupation, for the purposes of the prevention of disease and injury and the promotion of optimal health, productivity, and social adjustment" (*2*). True occupational medical services are not bargainable fringe benefits. They are essential tools of management for the effective and safe use of workers in industry.

Physicians in industry may be engaged in industrial medicine, occupational medicine, therapeutic medicine (in competition with the private practitioner), or various combinations of these.

Techniques of Occupational Medicine

For many, industrial and occupational medicine consist of myriads of routine physical examinations and reams of paper work. While both are essential activities in any adequate occupational health program, they are by no means the most basic elements. The peculiar contribution which the physician in industry can make is the maintenance of a safe and healthful working environment. The accepted methodology of public health and environmental medicine provides the framework for the development of safe working practices as well as for proper design and engineering of industrial processes.

The materials used in a given industry or plant, as well as the intermediary and final products, must be known to the plant physician. He must be familiar with the possible health hazards associated with the use of these materials. This physician in industry often knows more about the possible health problems in his particular plant or industry than one can find recorded in the textbooks. He has an obligation to management, the employees, and to the private practitioners of medicine to share his knowledge in the interest of the employee, the consumer, and the general public.

"Working environment" is usually envisioned in terms of fumes, dusts, gases, mists, solvents, noise, radioactivity, radiant heat, and other physical-chemical agents. The working envi-

ronment also includes people—those with buoyant health, the partially disabled, people with personal and social problems or with inadequacies of mentality or emotional adjustment. These workers, as individuals can contribute to a safe and healthful working environment, or they may present a hazard to themselves and to their co-workers. Thus, the employee with tuberculosis or the crane operator with epilepsy can do irreparable harm to his fellow workers. Even a chronic though innocent clash of personalities may be disrupting to the production goal. A sound and comprehensive approach to the working environment involves not only the use of accepted engineering and public health practices but also the practice of good clinical medicine.

A clinical means of providing a safe and healthful working environment is the medical examination program. The basic objectives of such a program should be:

- Elimination of health hazards introduced by virtue of medical defects in the individual employee.
- Early detection of any evidences of health impairment arising from possible inadequacies in the engineering control of health hazards.
- Instruction and guidance of individual workers reporting for examination on proper safeguards to their health so far as occupation is concerned.
- Use of medical information obtained to prevent or control nonoccupational disease.

It is customary to examine the worker (*a*) prior to employment or placement, (*b*) upon return to the job after absences due to injury or illness, (*c*) at appropriate intervals during the course of employment, and (*d*) prior to retirement or other termination of employment.

The preplacement or preemployment examination is almost always a part of the hiring procedure in industry today. There is still a difference of opinion, however, among both managers and physicians in industry regarding the objectives of such examinations. Some insist upon all applicants measuring up to certain minimal standards of physical health. Thus, in some plants an applicant with one or more physical defects, such as an old mitral stenosis or healed tuberculosis lesion, would be automatically excluded from employment. In my opinion this is justified under some circumstances, but usually it is not. Individuals with these or other lesions may be better qualified by training and aptitude to do the available job than other candidates. The medical department should be satisfied if the prospective employee can do the proposed job without hazard to himself or his fellow workers. There is no reasonable basis, however, to assume that such partially disabled persons are more satisfactory workers than those without such defects.

Workers returning to the job after losing time because of sickness or injury should be reevaluated along similar lines. Although such employees should be more useful than the neophyte because of training and experience, they should be able to do their old job in its entirety without contributing a new hazard to the working environment.

The periodic health examination should also be done with full attention to the occupation of the worker. This is equally true whether the employee is subject to the tensions of a boardroom conflict of ideas or the fumes of the lead burner. In either instance, the alert physician in industry will be on the lookout for evidence of uncontrolled or inadequately controlled environmental hazards on the job, as well as any signs that the worker himself is influencing the working environment adversely for his fellow workers.

Some industrial medical departments have segregated the occupational component of the periodic health examination, in the form of the "toxic" examination, an abbreviated periodic examination with attention focused on the job assignment rather than the employee. This approach is wasteful of both doctor's and employee's time, since it necessitates two or more separate visits to the medical department. It assumes that all potential adverse influences of the job on employee health are well documented and easily recognizable physicochemical ones. There is little opportunity or stimulus left to recognize previously unknown environmental influences. The toxic examination focuses the employee's attention unnecessarily on the potential job hazard, stimulating unwarranted anxiety in many instances. Under such circumstances, one may question the justification of doing the periodic examination at all.

Table 1. Comparison of age-adjusted death rates of white male employees and annuitants of the Esso Standard Oil Co., ages 20–99, with those reported for the corresponding State

Cause of death	New Jersey		Louisiana	
	Rate for State, 1950	Rate for Esso, 1950–55	Rate for State, 1950	Rate for Esso, 1950–55
All causes [1]	14. 94	12. 77	12 80	11. 10
Primary causes: [2]				
Cardiovascular disease	904	809	732	729
Neoplastic disease	210	260	194	142
Pneumonia	31	30	27	58
Cirrhosis of liver	23	27	17	2
Peptic ulcer	15	14	8	5
Suicide	26	9	22	34
Diabetes mellitus	19	6	12	3
Tuberculosis	39	5	43	5

[1] Per 1,000 population.
[2] Per 100,000 population.

The preretirement or termination examination can also be used as a check on the adequacy of environmental controls, particularly where there is the possibility of a chronic disease with a prolonged "incubation period." It is particularly helpful, however, in the proper administration of company-sponsored insurance programs and workmen's compensation claims. In some instances, it has dramatically prolonged the life of long-service, faithful employees by recognition of asymptomatic, correctible, but life-threatening disease.

Definite contributions to a safe and healthful working environment may be made through careful attention to dispensary and therapeutic activities as well.

The dispensary services provided by industrial medical departments are an invaluable tool in the early recognition of defects in the environmental control program. It is inevitable that dispensary service cares for countless minor nonoccupational ailments, few of which would find their way to the private practitioner's office. Uncared for, these ailments may be costly in terms of overall employee productivity. A satisfactory rule of thumb for the dispensary nurse or physician is to treat any case not involving loss of worktime and apparently amenable to a single therapeutic effort. All other cases may be referred to the family physician.

The alert physician or nurse in the dispensary may identify sources of illness beyond the control of individual workers. The epidemic nature of some complaints may reveal more than the specific nature of the illness. Thus, 10 cases of conjunctivitis or of "nervous indigestion" all coming from a given unit in a plant mean something different to a plant physician than these same 10 cases would mean to 5 or 10 individual practitioners in the community. In such cases the plant physician has a reasonable chance of correcting the basic cause of the epidemic, while the physician outside can only treat the symptoms.

In the treatment of occupational or compensable disease, obviously the minor cases not involving loss of time can be most efficiently cared for by the plant physician. The referral of cases in which worktime will be lost to appropriate private practitioners on a fee-for-service basis has many advantages for all concerned.

The advent of such devices as punchcard recordkeeping and calculators, has simplified the analysis of clinical data obtained in the industrial medical department. Mortality and morbidity data for the employee group and its various segments may be compared with similar data for the population at large. Thus, the physician in industry has another check on the adequacy of engineering controls for known job-related disease. Similarly, the epidemio-

logical approach makes possible the identification of previously unrecognized health problems. To illustrate the use of this technique, I have compiled several tables, the first dealing with death rates (table 1). Since a large percentage of the employees of the Esso Standard Oil Co. work and live in New Jersey and Louisiana, attention is confined to those two States. Even with an employee population of more than 25,000, sizable fluctuations in rate may occur. For this reason, a running average over 5-year periods is used for calculations. It is consoling to both management and employees that the overall death rates for employees are lower than those last reported for the State in which they live. The upward variations observed in several specific disease categories are not statistically significant.

Morbidity data also provide a valuable clue to potential health problems in an employee group. For example, table 2 summarizes all cancer cases occurring among Esso employees and annuitants these past 8 years. The average number of cases over 5-year periods is used to smooth out fluctuations resulting from relatively small samples. Overall rates compare favorably with incidence reported in Public Health Service surveys. Rates for individual organ systems (not shown here) are consistently lower than those reported by the Public Health

Table 2. Incidence of cancer among white male employees and annuitants of the Esso Standard Oil Co.

Disease	Esso employees and annuitants [1]			Expected [2]
	1951–54	1952–55	1952–56	
Total cancer cases	397. 7	395. 2	369. 9	370 58
Total cancer cases except for skin	272. 4	276. 5	259. 5	299. 78

[1] New cases per 100,000 employees per year.

[2] Based on Cancer Illness in Ten Urban Areas of the United States, Cancer Morbidity Series Nos. 3 and 10, Public Health Service, 1951, 1952. Incidence figures for Hodgkin's disease were not included. The incidence data are calculated for a theoretical population with a 35 percent New Orleans population and 65 percent Philadelphians, approximating the geographic distribution of Esso employees.

NOTE: Incidence figures represent 5-year moving means.

Table 3. Comparison of anatomical distribution and cell type of skin cancers among white male Esso employees and the population at large

Site and type of cell	Esso (percent)	Expected (percent)
Cancer site		
Lip	17. 0	[1] 13. 1
Face, head, and neck	64. 6	[1] 70. 1
Extremities and trunk	18. 4	[1] 16. 8
Cell		
Basal	55. 8	[2] 53. 3
Squamous	36. 4	[2] 33. 9
Melanoma	3. 9	[2] 4. 8
Other	3. 9	[2] 8. 0

[1] See footnote to table 2.

[2] Based on Morbidity from Cancer in the United States, Public Health Monograph No. 29, Public Health Service Publication No. 418, 1955.

Service except for skin. The high incidence for skin is attributable to a special interest in this disease. It is well known that skin cancers are rarely ever diagnosed histologically, much less reported in incidence surveys. Fulguration is a common form of treatment. Our data are based on histological examination of all suspicious skin lesions.

These data were used further to examine the anatomical distribution and cell type of more than 200 skin cancers (table 3). There is no evidence of anatomical localization nor preponderance of cell type which might be expected if the lesions were secondary to industrial exposures.

Such gross data may conceal job-related disease, however, unless careful and constant review of job assignments, for example, is carried on simultaneously. Several of my associates have prepared for publication an epidemiological study which reveals an environmental problem not immediately apparent. I refer to the disease as X. While the plantwide incidence of the particular disease was not striking, the incidence among one group of workers was significantly higher than in the population at large or in the remainder of workers in the same plant. Actually, a previously unrecognized hazard did exist. Incidence rates for disease

X among plant groups engaged in the manufacture of Y are as follows:

	Incidence per 100,000
All plant employees	249
All employees engaged in the manufacture of Y	354
All employees engaged in the manufacture of Y with 10 or more years' service	460
Selected employees engaged in the manufacture of Y with 10 or more years' service	1,500
Other employees engaged in the manufacture of Y with 10 or more years' service	247
Males of comparable age in general population	217

Summary

The techniques of occupational medicine, engineering controls, evaluation of the toxicity of materials used or produced, diagnostic examinations, dispensary services, the treatment of compensable illness, and epidemiology, are all directed toward the provision of a safe and healthful working environment. Certain by-products in the realm of nonoccupational disease, such as the occasional dispensary care of minor illness, the early recognition of disease, the provision of health guidance, often seem of great importance to the employee and to management. There is real danger that these by-products may be confused with the basic commodity of occupational medicine. Such confusion must be avoided lest medicine in industry become merely another variety of institutional medicine or a system of medical economics rather than a highly useful and essential medical specialty.

REFERENCES

(*1*) Wade, L.: A "human relations" approach to sickness absenteeism and other employee problems. A. M. A. Arch. Indust. Health 12: 592–608, December 1955.

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Study of Environmental Factors in Atherosclerosis

The relationship between hardening of the arteries in the heart of the human being and his living habits and other environmental factors is under study in a joint project of the New York State Health Department and Albany Medical College. Scheduled for the Albany area, the project is based on a pilot study made in 1956 by Dr. W. G. Beadenkopf, assistant director of the bureau of epidemiology and communicable disease control of the State health department, and by Dr. Assaad Daoud, assistant professor of pathology of Albany Medical College.

The degree of hardening of the arteries is being measured in all adults on whom autopsies are performed at Albany Hospital. For this purpose, Dr. Daoud has developed a standardized technique for measuring the diameter of coronary arteries and the amount of deposits on their interior walls. Following postmortem examinations, Dr. Beadenkopf and his staff are seeking information on the living habits of each person autopsied from clinical records and interviews with family physicians and relatives.

The project, which will include more than 1,600 individuals, is part of an expanded effort of the New York State Health Department to study coronary heart disease in population groups.