INDUSTRIAL AND OCCUPATIONAL ENVIRONMENT AND HEALTH

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IN 1940, the labor force of the United States included fifty-three million persons, or 40 per cent of the population. This large group of workers is a major group to consider in improving the health status of our population and in providing services for the maintenance of good health. Perhaps the most logical approach in the problem of social medicine is to work with this group, to study the problems of these workers and to build a satisfactory health program. An excellent opportunity is provided to determine the influence of the industrial and occupational environment on health by the study of the physical condition of workers through pre-employment and periodic examinations and of rates of illness and injury and of death. Preventive and treatment services may be integrated.

Industrial plants employ a large proportion of the members of the labor force. These workers report for work each day and it is possible to obtain records of illnesses and injuries. Although the opportunity exists, little progress has been made in the United States in the study of morbidity and mortality statistics of industrial workers. The first step would be to learn the frequency of illness and injury and the death rate of these workers. Such information should be used for the development of complete industrial health programs.

Selected material relating to industrial and occupational environment and health from morbidity and mortality statistics will be used in this discussion. This paper has been divided into three sections; namely, A. Studies of Mortality Statistics, B. Studies of Morbidity Statistics and C. Summary and Recommendations.

A. STUDIES OF MORTALITY STATISTICS

As in every type of health work, we turn first to mortality

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statistics for data regarding the health of workers. Four studies, that of Dublin using industrial policy holders, the English studies, the study of mortality in the United States by Whitney, and Tennessee studies will be mentioned for the purpose of making recommendations for future analyses rather than for detailed report.

1. *Mortality of Industrial Policy Holders.* The occupational mortality experience of insured wage earners has been studied by Dublin (1) and Dublin and Vane (2, 3) for the three-year periods, 1911–1913, 1922–1924, and 1937–1939. They found that the death rates of white male industrial policy holders in the age group, 25–64 years, were higher than the rates for white males in the general population of the United States. Even after elimination for the most part of medical selection by exclusion of the experience of workers insured in the ordinary life insurance department in the last five years, they found that the death rate in 1938 of white males 20 years and over in the industrial department was 44 per cent higher than the rate for all males in the ordinary life insurance department. This excess of 44 per cent for industrial policy holders indicates a health problem of great magnitude in this group.

Because of the lack of information regarding the number of living policy holders in the different occupation groups, Dublin and Vane used the method of proportionate mortality and calculated the standardized relative index of deaths from selected causes of these industrial policy holders, age 15–64 years, for three years, 1937–1939. They were unable to find out whether different occupation groups had higher death rates from all causes than did other groups. Their analysis revealed that relatively high proportions of deaths were due to tuberculosis for occupations with exposure to silica dust; to pneumonia for welders, iron and steel foundry operatives; and to accidents for electric light and power line men, for workers in building trade, for brick and stone masons, lumber men and loggers. This method has been useful in showing occupations with hazards and these data have been extensively used by agencies con-

cerned with improvement of industrial conditions. They do not reveal, however, why the industrial policy holders have a 44 per cent higher mortality than do the ordinary policy holders. The authors recognize the need for further study by saying "Much remains to be done, however, if the death rate of wage earners is to be lowered to approximately that of the non-wage-earning group."

2. *English Studies.* We have to turn to the English for extensive and careful studies of occupational mortality. The Registrar-General of England and Wales publishes decennially occupational mortality for the three years about the census year (4, 5). The latest report (5) deals with the mortality experience in five social classes and various occupations of men, wives of these men (according to husband's occupation) and single women.

Division of the population into these five social classes is an attempt to divide persons in relation to place on social scale, with those of the lowest economic status, in Class V. Nearly half of the eleven million males were in Class III. Standard mortality ratios were used, that is, the ratios of registered to

Table 1. Standardized mortality ratios, all causes, ages 20–65 years, England and Wales,[1] 1921–1923 and 1930–1932.

Social Class	1921–1923	1930–1932			
	Males (Excluding Non-Civilians)	Civilian Males Only	Males (Including Non-Civilians)	Married Women by Class of Husband	Single Women
All Classes	100	99	100	100	100
I Professional, etc.	82	87	90	81	100
II Intermediate between I and III	93	94	94	89	(64)
III Skilled Workers	94	97	97	99	95
IV Intermediate Between III and V	99	101	102	103	102
V Unskilled Workers	121[2]	112	111	113	112
Unoccupied	—	—	135	134	(122)

[1] The Registrar-General's Decennial Supplement, England and Wales, 1931, Part IIa, Occupational Mortality, Table E, page 20.
[2] Corrected figure.

standard deaths. Standard deaths are calculated by applying the general mortality rates of all males, all married women or all single women as the case may be to three times the population of the age groups, 20–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, and summing the products. They represent the deaths which would result in an occupational group if that group was exposed at each age to the standard mortality risks. The standardized mortality ratios for all causes for these five social classes are given in Table 1.

A variation in mortality according to social class from a low ratio for Class I to a high ratio for Class V is noted for males and married women. Such a variation is not apparent for single women.

Although considerable emphasis is placed on this grouping of occupations into social classes, detailed data are given by occupations according to causes of death. Data from this report would be valuable for development of industrial hygiene programs for specific occupational groups.

From these English data, I have tried to learn in which industries workers were experiencing high death rates. To tell the authorities that the professional workers have low and the laborers high death rates does not help them very much in attacking the problem (except, perhaps, indirectly through preventing poverty). The occupations have been grouped into thirty-one occupational units which indicate, to some extent, industrial classification. Laborers and certain other workers, however, have been taken out and placed in "Other and Undefined Workers." The number of workers in these units and the mortality ratios for males are given in Table 2 according to rank of ratios.

In public administration and defense, the unit with highest ratio, the defense workers in Army, Navy, Marines, and Air Force had a standard mortality ratio of 181. The second unit—a large group with over a million workers—had the high ratio of 119, due principally to the large number of laborers. Personal Service had high ratios for inn and hotel keepers, barmen,

waiters, porters, barbers and hair dressers. The next few units show types of industrial workers with high standard mortality ratios and indicate where efforts should be directed in industrial hygiene programs. If laborers and unskilled workers were studied according to industrial groups, a means of attacking their problems by industrial health workers might be provided.

3. *Mortality in United States by Occupations in 1930.* The National Tuberculosis Association appreciated the need in the United States for data relative to health risks of various occu-

Table 2. Standard mortality ratios, all causes, ages 24–65 years in 31 occupational units in order of size, with populations, England and Wales,[1] 1930–1932.

Occupational Unit	Population	Ratios
Public Administration and Defense[2]	297,906	128
Other and Undefined Workers[3]	1,209,140	119
Entertainment and Sport	80,638	115
Personal Service	395,142	115
Bricks, Pottery and Glass	60,201	111
Painters and Decorators	222,679	108
Textile Goods and Articles of Dress	226,952	107
Transport and Communication	1,314,126	107
Mining and Quarrying	824,521	106
Precious Metals and Electro Plate	19,424	106
Textile Workers	258,925	105
Metal Workers	1,132,050	101
Workers in Other Materials	25,329	101
Skin and Leather	38,511	99
Fishermen	23,464	96
Commercial, Finance and Insurance	1,233,244	96
Warehousemen, Storekeepers and Packers	209,453	95
Non-metalliferous Mine and Quarry Products	21,899	94
Stationary Engine Drivers, etc.	143,594	94
Mixed or Undefined Materials	56,323	92
Watches, Clocks, and Instruments	16,724	91
Electrical Apparatus	154,909	90
Food, Drinks and Tobacco	142,969	90
Clerks and Draughtsmen, Typists	661,851	90
Printers and Photographers	122,889	89
Builders, Bricklayers, etc.	622,649	88
Wood and Furniture	400,456	87
Professional	326,403	83
Chemical Processes, etc.	37,024	80
Paper and Cardboard	30,995	79
Agricultural	874,001	73

[1] The Registrar-General's Decennial Supplement, England and Wales, 1931, Part IIa, Occupational Mortality Data from Table I, page 191.
[2] Ratio for Public Administration, 80, for Defense, 181.
[3] Includes general laborers with ratio 119, laborers with ratio 166, other unskilled workers (class of work specified) with ratio 117.

pations for the guidance of industrial health authorities. They published the well-known volume, DEATH RATES BY OCCUPATIONS, based on data of the United States Census Bureau, 1930, edited by Jessamine S. Whitney. Data were used from death certificates of ten states in 1930 comprising 38 per cent of the population.

Perhaps the rates most frequently quoted from this report are those for tuberculosis of the respiratory system. As an example of the results of this study, the standardized death rates from all causes and from tuberculosis of the respiratory system by social-economic status are presented in Table 3.

The standardized death rates for males 15–64 years by social-economic status show wide variations similar to those of the standardized death ratios in England and Wales.

Although these data leave little doubt that the rates are higher in the semi-skilled and unskilled workers, the analysis of data without subdivision for white and negro workers raises a question regarding the influence of race. In the United States death rates from all causes and from tuberculosis are higher in the colored population than in the white population and a

Table 3. Standardized death rates from all causes and from tuberculosis of the respiratory system for gainfully occupied males in selected occupations, 15–64 years of age, ten states, according to social-economic class,[1] 1930.

SOCIAL-ECONOMIC CLASS	ALL CAUSES RATE PER 1,000 POPULATION	TUBERCULOSIS OF THE RESPIRATORY SYSTEM (RATE PER 100,000 POPULATION)
ALL IN SELECTED OCCUPATIONS	9.1	87.5
Professional Men	6.7	26.2
Proprietors, Managers and Officials	7.9	43.2
Clerks and Kindred Workers	7.8	65.8
Agricultural Workers	6.2	46.5
Skilled Workers and Foremen	8.3	72.1
Semi-skilled Workers	10.1	102.1
Unskilled Workers	14.5	184.9

[1] Whitney, J. S.: DEATH RATES BY OCCUPATIONS Selected Data from Table 8, page 32.

higher proportion of the colored population is of the semi-skilled or unskilled class. These data have been valuable in showing variations by occupations and indicate the need for further studies in the United States. For such analyses, division of the material by color would be helpful. The difficulties in obtaining accurate data, and in relating data from death certificates, are brought out in this study. This should serve as a beginning and efforts should be made to obtain satisfactory data on death certificates and population schedules for study of mortality. Sufficient population data should be provided for use in analyses.

4. *Mortality in Tennessee by Occupation and Industry.* Labor and other interested groups have asked the Tennessee Department of Public Health for data regarding death rates by occupation, such as those prepared by Whitney. Because of these requests and because of establishment of an industrial hygiene service which had a director who wished to know the health problem in industrial groups, occupation and industry on death certificates have been coded, using the classifications of the United States Bureau of the Census (7). Although, because of movement of population and growth of industry, the period of time was unsatisfactory for the study of mortality, a start was needed. Many factors will have to be considered in interpretation of the data. If this work serves for improvement and extension of such mortality studies, it will have served a worthwhile purpose.

One of the difficulties encountered in analysis is the lack of census data by age and occupation for the white and non-white population of Tennessee. This is a serious problem, as death rates corrected for age for white and colored males and females are needed for understanding death rates by occupation groups. Probably this lack of data was the reason such rates were not prepared by Whitney. Since totals are available, estimates have been made. It is recognized that recent changes in the population have not been taken into account in these estimates; however, the removal of physically fit young men for the Armed

Services probably does not affect appreciably these death rates. The standardized death rates from all causes and from tuberculosis for white males, using occupational groups, for three years, 1944–1946, are presented in Table 4.

Although these death rates were considerably lower than those for 1930 published by the National Tuberculosis Association, in general the same type of variation was noted with lower tuberculosis death rates for the professional workers than for the laborers. The differences in the rates, however, were not as great.

Another method of studying the data for knowledge of industrial health problems seems advisable. In our studies of absenteeism and work with industrial plants, knowledge of illness and death rates according to industrial classifications would be helpful. For example, do employees of glass companies, meat-packing plants, hosiery mills, have high or low rates? Directors of these plants wish to know the experience in other industrial plants of the same type. Also, in small plants, employees have more than one occupation and even work in different departments. For studies of absenteeism in small plants, we have not been able to study illness rates by occupations because of difficulty in getting accurate data. Rates have been calculated by departments. If it is impossible to obtain

Table 4. Standardized death rates from all causes and from tuberculosis for white males 15–64 years of age by occupational group, Tennessee, 1944–1946.

Occupational Group	All Causes Rate per 1,000 Population	Tuberculosis Rate per 100,000 Population
Total	6.4	61.8
Professional	6.2	26.3
Proprietors, Managers and Officials	9.2	33.9
Clerks and Kindred Workers	6.3	51.3
Farmers	4.3	56.6
Craftsmen	7.8	68.0
Operatives	10.8	93.6
Service Workers including Defense	(17.5)	(108.0)
Laborers	7.3	91.7

accurate occupation data in such studies for which data are supplied by personnel and medical departments, it seems unlikely that data from death certificates and census reports would be accurate. It is granted that, for large industrial plants, managers would be interested in data by occupation. In Tennessee in 1939, of the 2,289 manufacturing establishments, only 33, or 1.4 per cent, had more than 500 employees. These large plants had only 29.3 per cent of the employees in manufacturing industries. In the United States, the comparable percentages were 1.2 and 35.4. Thus, it is primarily with small industrial plants that a health program could best be directed. Just as we think first of total death rates of a county or city, before breaking them down by districts of the county or wards of the city, similarly we should think first of the illness and death rates of industrial plants before obtaining finer subdivisions.

The Census Bureau has recognized the increased importance of industrial statistics and has enlarged its tabulations. Fortunately, census data are available for the white and non-white populations employed and seeking work in industrial classifications.

An attempt has been made to study mortality in Tennessee according to industrial classification of the Bureau of the Census as well as occupational groups. Since the numbers of deaths in some of the groups were small, standardized death ratios, as used in the Report of the Registrar-General of England and Wales, seem preferable to standardized death rates for the study of mortality in industrial groups. In Table 5 the observed and expected deaths and their ratios are given for broad industrial groups for the same three-year period.

For the major groups, the observed and expected deaths appear to agree within reasonable limits. A slight excess was noted in a few groups which included occupations with high standardized death rates. Subdivision of the manufacturing industries into the various industrial classifications as chemical and allied products, stone, clay, and glass products; iron, steel, and their

products; etc., would be of tremendous value to our industrial hygiene service.

Although this method seems satisfactory and the results have practical value, there are difficulties to be overcome in bringing together such data from the census and from death certificates. One difficulty is evident from the comparison of observed and expected deaths for those with no occupation or industry, that is, the unemployed. An industrial classification in the census was given for only employed workers and experienced workers seeking work or 79 per cent of the white males 15–64 years of age. At the time of the census, 5 per cent were on public emergency work, 1 per cent were new workers seeking work and 15 per cent were not in the labor force. In these unemployed

Table 5. Observed and expected deaths[1] from all causes and from tuberculosis for white males 15–64 years of age according to industrial classification, Tennessee, 1944–1946.

Industrial Classification	All Causes			Tuberculosis		
	Observed	Expected	Ratio	Observed	Expected	Ratio
Total Deaths	14,334	14,334	1.00	1,453	1,453	1.00
Agriculture, Forestry and Fishing	3,879	4,977	.78	478	478	1.00
Mining	263	251	1.05	33	29	1.14
Construction	1,024	874	1.17	97	92	1.05
Manufacturing	1,695	1,763	.96	168	211	.80
Transportation, Conservation and Public Utilities	998	858	1.16	72	88	.82
Trade	1,508	1,499	1.01	98	162	.60
Personal Services	254	209	1.22	28	22	1.27
Professional and Related Services	382	415	.92	13	43	.30
Government (including Defense)	1,120	397	[a]	64	41	[a]
Other	459	481	.95	45	52	.87
Not Classifiable	1,716	171	[a]	216	20	[a]
No Occupation or Industry Stated	1,038	2,439	[a]	141	215	[a]

[1] Expected deaths have been obtained by applying the age specific death rates for white males for the three years, 1944–1946, to the estimated population of white males employed and seeking work in the industrial classifications.

[a] Observed and expected deaths for these classifications are not comparable due to deficiencies in the data and conditions incident to the war.

persons 2,439, or 17 per cent, of the deaths would be expected to occur; however, only 1,038 death certificates, or 7 per cent, were of persons without occupation or industry stated on the certificates. Although this discrepancy may be attributed in part to employment incident to the war and war service, this is not the entire explanation. In 1940, the percentage of death certificates without an occupation or industry stated was approximately the same as in this three-year period. Thus, the data for occupation and industry on the census schedules and on death certificates differ considerably. Another difficulty which is our problem and can be overcome is lack of sufficient data for classification according to industry. There were 1,716 deaths, or 12 per cent of the deaths, with data not satisfactory for industrial classification. For occupations such as laborers it will be necessary to obtain the kind of industry or kind of work. This analysis has a practical value for industrial health work in Tennessee and in other states. Satisfactory statistical data should be and can be provided.

B. Morbidity Statistics

As in all fields of public health, morbidity statistics are preferable to mortality statistics for knowledge of health problems and for use in the prevention of illness and death. Morbidity is used here meaning all illness resulting from disease or injury. Little progress has been made in developing morbidity statistics for large groups of the population. Special studies, such as the Hagerstown Morbidity Studies with reports by Sydenstricker (8), the United States Public Health Service study of 9,000 families with publications by Collins (9), the National Health Survey (10), the Milbank Study of Chronic Diseases in the Eastern Health District of Baltimore (11) were undertaken as special projects and have added considerably to our knowledge of illness rates in the general population.

A practical method of obtaining morbidity statistics for the adult population employed in manufacturing plants is through the study of illnesses causing absence from work. The managers of many plants are concerned with the health problems of their

workers as evidenced by the inauguration of measures for control of occupational diseases and injuries and the establishment of medical departments. Since reporting of cases of occupational disease and injury is required in many states and compensation is usually provided by law, progress is being made in this phase of the program. As the result of the reduction of industrial hazards and prevention of occupational illnesses and injuries, the causes of illness of these workers, that is respiratory and digestive diseases, are the same common causes of illness of persons in the general population. The relative size of illness rates from these causes in a specific industry would be of great value for plant managers and industrial health workers. Without satisfactory data for a relatively large group of industrial workers, there are no standards for comparison of the experience of a plant. How frequently should we expect workers to be sick? How can control programs be developed for prevention of illness and injury? Some progress has been made in the development of such statistical data. Two types of studies, those of absences of eight days and longer and those of one calendar day and longer will be discussed briefly.

1. *Studies of Absences of Eight Days and Longer.* Gafafer of the United States Public Health Service has been releasing quarterly reports of absences from illness and non-industrial injury lasting eight days or longer. Such data are obtained for analysis from periodic reports from sick benefit associations, company relief departments and group insurance plans. This is a large experience (12) averaging in 1946, 221,442 males and 22,112 females. Although during the ten years, 1937–1946, the frequency of sickness and non-industrial injuries increased in both males and females, due to employment of inexperienced and very young employees and of older employees and the loss of young men physically fit for military service, the trend was reversed in 1946. The average annual number of absences of eight days or longer due to sickness and non-industrial injuries in 1946 was 114.5 per 1,000 for males and 248.2 for females. The release of these data currently in Public Health Reports

gives us considerable knowledge of the sickness rates of industrial workers.

2. *Studies of Absences of One Day or Longer.* Since absences of short duration occur frequently and since control measures may be effective in preventing some of these short time absences, the study of all illness and injury causing absence from work of one calendar day or longer is also valuable for knowledge of morbidity of the adult population. A public utility, Boston Edison, has kept careful medical records of its employees dating back to 1913. Information regarding absences of one calendar day or longer includes age, sex, occupation, department, social status, number of calendar and working days lost, diagnosis, etc. Sappington (13) analyzed their experience for the five years, 1918–1922 and recommended at that time the collection and analysis of "comparative data in similar industries, whereby it may be duly ascertained whether any given experience is extraordinary or commonplace." Gafafer (14) has continued the analysis of data for this public utility. Data for the last four years for which they are available by cause (1938–1941) are given in Tables 6 and 7. Comparable data for Tennessee plants for 1944–1947 are given in these tables. Because of differences in classification of causes, it was necessary to group data for presentation of the two experiences.

For knowledge of the industrial health problems in Tennessee, a study of causes of absences of one calendar day or longer was started in 1944, using reports of plants invited to participate. The combined experience of the six plants participating for a year or longer during the four years is presented.

From the frequency rates in Table 6 it is noted that, on the average, male employees were absent due to illness and injury in the public utility 0.9 times per year and in Tennessee plants 1.4 times per year. For females, the rates were higher, 1.9 for the public utility and 2.4 for Tennessee plants. A more recent report for the public utility (15) for 1940–1944 gave higher rates, 1.1 for males and 2.1 for females. These rates, however, were lower than those for Tenessee plants.

Disability rates are also available for the public utility and Tennessee plants. The numbers of days of disability per employee are given according to causes in Table 7.

Judged by frequency rates, respiratory and digestive diseases are responsible for a large proportion of illnesses of these workers and indicate fields in which preventive measures are needed. The possible reduction of absences due to influenza through use of vaccine needs to be investigated through carefully controlled studies.

Table 6. Average annual number of absences lasting one day or longer due to illness and injury, per 1,000 workers, by cause, for public utility,[1] 1938–1941, and for Tennessee plants,[2] 1944–1947.

Cause	Public Utility 1938–1941		Tennessee Plants 1944–1947	
	Male	Female	White Male	White Female
Total	919.7	1,851.2	1,413.3	2,429.7
Illness, Total	854.5	1,765.8	1,316.0	2,335.1
Infectious and Parasitic Diseases	10.1	8.1	22.5	28.8
Diseases of Eyes and Ears	12.2	20.7	17.6	32.2
Diseases of Nervous System	20.2	56.1	9.2	20.6
Diseases of Circulatory System	19.1	23.2	17.8	15.9
Diseases of Respiratory System	540.7	946.3	635.7	957.6
Influenza	148.6	169.5	99.7	123.8
Other Respiratory Diseases	392.1	776.8	536.0	833.8
Diseases of Digestive System	153.7	324.4	227.6	362.3
Infected and Impacted Teeth	17.0	37.8	32.2	67.8
Other Digestive Diseases	136.6	286.6	195.4	294.5
Diseases of Genito-Urinary System	11.3	147.2	12.6	338.0
Dysmenorrhea	—	123.6	—	284.5
Other of Genito-Urinary System	11.3	23.6	12.6	53.5
Diseases of the Skin	13.4	21.5	30.6	25.8
All Other Diseases	49.9	88.6	14.4	31.7
Ill-Defined and Unknown Causes	24.0	129.7	327.8	522.1
Injuries, Total	65.3	85.4	97.3	94.6
Industrial	22.4	4.5	29.1	15.8
Nonindustrial	42.8	80.9	68.2	78.8

[1] Data for Public Utility taken from Manual of Industrial Hygiene, chapter 24, by W. M. Gafafer, page 427. Number of person-years of exposure: males, 10,926; females, 2,460.

[2] Number of white males, 10,316 and white females 5,962.

The investigation (16) of absenteeism due to illnesses due to dental diseases in Tennessee is an example of the use which has been made of such data. Although the dental caries rate was relatively low in Tennessee, the absence rates due to dental causes were higher than the comparable ones from the public utility. It was believed that this condition in industrial workers was the result of an accumulation of dental defects without corrections and lack of dental service. The dental service available in Tennessee was found to be limited, with one dentist per 3,932 population. A conference of leaders in industrial

Table 7. Average annual number of days of disability per person due to absences from illness and injury of one day or longer, by cause, for public utility,[1] 1938–1941, and for Tennessee Plants, 1944–1947.

Cause	Public Utility 1938–1941		Tennessee Plants 1944–1947	
	Male	Female	White Male	White Female
Total	8.23	11.91	7.72	12.79
Illness, Total	7.09	10.66	6.91	12.29
Infectious and Parasitic Diseases	0.33	0.17	0.29	0.61
Diseases of Eyes and Ears	0.12	0.15	0.09	0.13
Diseases of Nervous System	0.52	0.55	0.14	0.26
Diseases of Circulatory System	0.79	0.57	0.25	0.41
Diseases of Respiratory System	2.77	4.42	2.98	4.27
Influenza	1.01	1.10	0.73	0.99
Other Respiratory Diseases	1.76	3.32	2.25	3.27
Diseases of Digestive System	1.18	1.51	1.23	1.91
Infected and Impacted Teeth	0.05	0.13	0.14	0.22
Other Digestive Diseases	1.13	1.39	1.08	1.69
Diseases of Genito-Urinary System	0.36	0.79	0.17	1.54
Dysmenorrhea	—	0.29	—	0.57
Other of Genito-Urinary System	0.36	0.49	0.17	0.96
Diseases of Skin	0.15	0.24	0.26	0.18
All Other Diseases	0.76	1.57	0.24	0.74
Ill-Defined and Unknown Causes	0.12	0.69	1.27	2.24
Injuries, Total	1.14	1.25	0.81	0.50
Industrial	0.68	0.04	0.30	0.14
Nonindustrial	0.46	1.21	0.51	0.36

[1] Data for Public Utility taken from Manual of Industrial Hygiene, chapter 24, by W. M. Gafafer, page 427.

dentistry, in dental profession, in industrial hygiene, and in public health was held for discussion of this problem. Recommendations were made regarding development of industrial dental health programs.

There are other causes, such as infectious and parasitic diseases, diseases of eyes and ears, diseases of genito-urinary system, which are higher in Tennessee than in the public utility and need further study. The collection and analysis of causes of absences have definite value in determining illness rates and are useful in evaluating the experience of a given plant.

In the field of cancer control it is possible that data regarding causes of illness might reveal that certain industrial environments play a role in the causation of cancer. According to Hueper (17) there are good reasons for assuming that the majority of carcinogenic agents is still unknown, unknown types will be discovered and occupational cancers will become a public health problem of the first order. For learning the effect of the production or handling of carcinogenic agents on the health of workers, study of illness rates for a large employed population would be of value.

Sufficient data are not available for the study of the effect of industrial and occupational environment on health. A large study with such data from many plants and from various sections of the United States would provide morbidity statistics for developing sound preventive and treatment programs for the maintenance of good health of industrial workers.

C. Summary and Recommendations

1. Dublin and Vane's study of mortality of industrial policy holders revealed death rates 44 per cent higher than for ordinary policy holders. The proportions of deaths due to certain causes in certain occupation groups were high, indicating problems. Their work has shown the need for study of death rates from all causes by specific industrial or occupational groups. They recommended the compilation of mortality by causes of workers engaged in different occupations by the National Office of Vital Statistics.

2. The English studies have revealed occupations with high mortality rates and the great variation in mortality by social class. Instead of analysis by social status, a more practical approach to the problem would appear to be through study of mortality ratios for different kinds of industries and occupations within industries. Such data would be valuable for industrial plant managers and medical departments by providing definite information regarding problems.

3. The study of occupational mortality in 1930 in ten states by Whitney has shown the variation by social-economic class and that death rates are high in certain occupational groups. This work should be used as a beginning and ways should be developed whereby data on death certificates can be related to data on population schedules and satisfactory analyses made for the United States.

4. The study of death rates in Tennessee has revealed many problems. Census data for the white and non-white workers were not available by occupation groups by age. The need for developing comparable data for occupations and industries on death certificates and on census schedules was apparent. It is strongly recommended that steps be taken to insure satisfactory studies for the period of the 1950 census, preferably for three years, 1949–1951. A practical approach for providing usable statistical data for industrial health workers is through the preparation of death rates by industrial classifications. Because of the small numbers in age groups, it is suggested that standardized death ratios be considered for use in analysis.

5. Studies of frequency of illness and injury and disability from these causes have been developed, with a large experience for plants with records of absences lasting eight days or longer and with a limited experience for plants with records of absences of one day or longer, such as for a public utility and for Tennessee plants. Analyses of absenteeism are of value for the plants, for industrial health workers and for those concerned with the health of the population. To provide sound morbidity statistics for adult populations, it is recommended that the study of

illnesses and injuries of one day and longer be extended. Standards need to be developed with the same type of analysis, using frequency and disability rates for many plants. A research project—perhaps properly included as one in public health methods—could be undertaken either in the United States Public Health Service or as part of the research of a School of Public Health or by a Foundation for development of satisfactory morbidity statistics and for use of these data for knowledge of the influence of the occupational and industrial environment on health and in improving industrial conditions. It is possible that the excess in mortality of industrial workers can be reduced. Such data are needed for the development of sound health programs for maintenance of good health of industrial workers and for extension to the entire population.

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