

Diabetes in Industry

Harold Brandaleone, M.D., and Gerald J. Friedman, M.D., New York

The problem of diabetes in industry is of importance for two major reasons: 1. The improved care of the diabetic keeps him alive longer, and permits him to work and lead a productive life. 2. Industrial medicine plays an important role in public health. According to recent statistics of the Metropolitan Life Insurance Company, there are about 250,000 diabetics in the labor force in the United States, and the number is growing from year to year. Industrial medicine can render a service to both the patient and the physician in the diagnosis and supervision of diabetes, and an opportunity is afforded to gather valuable data concerning the disease.

This review has been prepared in an effort to ascertain the present status of the diabetic in industry and the methods by which industrial medicine participates in the practice of preventive medicine. The study was divided into two parts—first, a survey of the employment of diabetics in various unrelated industries; second, the study of a group of diabetics under our supervision in the Third Avenue Transit System of New York.

EMPLOYMENT OF DIABETICS BY 63 COMPANIES

Data were obtained by sending a questionnaire to the medical directors of 348 companies in the United States, its possessions and Canada. (A list of these directors was obtained from the files of the Industrial Medical Association.) All types of industry were represented. The questionnaire was limited in scope in order to insure maximal response. We received 70 replies, but 7 contained inadequate information. In view of the relatively low proportion of replies, it is uncertain that the results are representative. Yet an analysis of the 63 providing suitable data, does give some indication of current practices in a segment of industry.

The total number of employees represented was 780,823. The following industries were included in the survey: sugar cane plants, aircraft, oil, steel, chemical, telephone, textile, railroad, washing machine, rubber,

optical, film, paper, radio and television manufacturing, automobile, tire, can manufacturing, utilities, whisky distillers, transportation, baking and soap.

The incidence of diabetes. In regard to 24 of the 63 companies, the number of diabetics employed was not known. Reports from 39 companies, with 286,622 employees, indicated a total of 1,485 diabetics—an incidence of 0.5 per cent.

Employment policy regarding diabetics. Forty-three of the 63 companies employed known diabetics, 20 did not. Thirty-three companies restricted the diabetic to non-hazardous work; 24 companies had no restriction and 6 companies had no set policy.

Attitude towards veteran employee developing diabetes. Thirty-eight companies permitted an employee who developed diabetes to continue his job, while 24 companies restricted the type of work after diabetes was discovered. One company reported no set policy.

Time lost from work. Sixty of the 63 companies had no available statistics relative to time lost by the diabetic and nondiabetic employees. Three companies reported "the same" time off for both categories.

Calibre of work. Two companies reported that the diabetic performed "better" than the nondiabetic. Forty-four reported the "same" calibre of work in both groups. These reports probably represent opinions rather than accurate evaluations. In 17 companies it was undetermined.

Care of the diabetic. In 4 companies the diabetic was under the care of the company doctor alone. In 36 companies, he was under the care of a private physician. In 22 companies he was under the care of both private and company physicians. One company had no report. Thirty-eight companies performed periodic urine tests; 23 did not and 2 did not report.

EMPLOYMENT OF DIABETICS IN THIRD AVENUE TRANSIT SYSTEM, NEW YORK

An analysis was made of all available information concerning the diabetics in the Third Avenue Transit System from 1947 to 1952. The company maintains a medical department approved by the American College of Surgeons. The major functions performed by this

Address communications to Doctor Brandaleone, Medical Director, Third Avenue Transit Corporation, 2396 Third Avenue, New York 35.

department are (1) pre-employment and periodic examinations; (2) care of illness (when the employee is not under the care of his own private physician) and accident cases; (3) consultation and laboratory services for use of the employees and their physicians. All pre-employment and periodic examinations include a routine urinalysis. When glycosuria is discovered, urine tests are repeated and blood sugar determinations are made. When necessary, a glucose tolerance test is performed.

Data regarding diabetic employees. Of the 3,508 employees (3,252, male and 256 female) there were 40 known diabetics, 39 males and 1 female, an incidence of 1.1 per cent. The age of the diabetics varied from 32 to 68 years and averaged 54.5 years. The age of all employees varied from 19 to 65 years and averaged 46.1 years. The age at onset of diabetes varied from 31 to 65 years and averaged 50.4 years. The average duration of employment prior to the discovery of diabetes was 16.8 years; the maximum was 39 years. Four persons had diabetes of several years duration prior to employment. The duration of employment since discovery of diabetes averaged 3.9 years, varying from 0.5 to 22 years.

Various occupations were represented among the diabetics: there were 17 bus operators, 10 mechanics, 4 office workers and 9 miscellaneous workers (stockmen, laborers, elevator operators, superintendents. Of the total number of 3,508 employees there were 1,873 operators, 953 mechanics, 336 clerical workers and 346 in miscellaneous jobs.

The diagnosis of diabetes was made by the company medical department in 18 cases, by a private physician in 17 instances, and by other or unknown sources in 5 cases.

Treatment. Eleven employees took insulin regularly, 16 took no insulin and 6 took insulin irregularly. In the remaining cases no data were available.

Applicants with diabetes requiring treatment with insulin were not rejected except for the position of bus operator. For such persons, we recommended employment in other work.

Diabetic control was classified in four categories: good, fair, poor and unknown. A person was considered under good control when he maintained his body weight, had minimal glycosuria, and absence of acetonuria. Fair control was signified by moderate to severe glycosuria, maintenance of body weight, and absence of acetonuria. Poor control was considered when the person lost weight, had severe glycosuria, and intermittent acetonuria.

Seven patients maintained good control, 6 fair and

3 poor. In 24, the status was undetermined. Seven of these 24 are no longer with the company. The remaining 17, or 43 per cent of the total number of diabetics, did not take advantage of the opportunity to cooperate with the medical department.

Ability to work. Twenty-seven employees were able to continue in their jobs. Five were permitted to continue as bus operators when they were not taking insulin. One patient who had pulmonary tuberculosis was unable to work because of his tuberculosis. Five patients were retired on reaching the prescribed age limit. Two resigned for reasons unrelated to diabetes. All of these patients were employed at the time of this study.

Absenteeism. A meticulous study was made of absenteeism in the Third Avenue Transit System for the 9-months period from February to October 1951. Absenteeism was divided into three categories: illness, accident and non-medical. Five of the 40 diabetics were not employed during this period of study, having been pensioned previously. The remaining 35 were compared to the total group and the results are shown in Table 1.

TABLE 1
Number of days absent per employee per year

	Sickness	Accident	Non-medical
Total group	11.81	0.69	7.10
Diabetics	26.2	0.80	4.60

The absence for sickness of the diabetic group requires a word of explanation. Two individuals were absent for long periods of time; one patient with pulmonary tuberculosis was absent the entire 9-months period of study because of tuberculosis and not his diabetes. The other was absent 146 of the 273 days because of an ulcer on the foot. These two patients represent only 6 per cent of the diabetes, but 61 per cent of the number of days absent with illness of the diabetic group.

The time off for illness for the other 33 diabetics (94 per cent of the cases) was 10.8 days per employee per year. This is approximately the same illness absentee rate as for the nondiabetic group (not excluding exceptional chronic cases).

CALIBRE OF WORK

An effort was made to compare the calibre of work, as measured by the accident rate, performed by the diabetic and nondiabetic bus operators.

Thirteen of the 17 diabetic bus operators drove in the New York City routes. The statistics for the diabetic as compared to the total group are shown in Table 2.

TABLE 2

Number of accidents per man in 2-year period from July 1, 1950 to June 30, 1952

	300 Nondiabetic Operators	Diabetic Operators	Number of cases
1st 2 years of driving	5.8		0
3rd year of driving	5.2		0
4th year of driving	5.3	5.6	6
5th year of driving	2.7	3.6	5
6th year of driving	3.3		
7th year of driving	3.2	3.0	<u>2</u>
			13

Although from a statistical viewpoint, the number in the diabetic group is deemed insufficient to permit a conclusion, the data for the diabetic group seem not far removed from the others. Further, both seem to show a sharp decrease in accidents after the fourth year of operation.

DISCUSSION

Industrial medicine can render service to the diabetic in the following ways: (1) the early detection of diabetes through pre-employment and periodic medical examinations; (2) cooperation with the private physician in the care of the disease; (3) cooperation with the personnel department in the proper placement of the diabetic; (4) education of both management and labor in the problems of the diabetic with improvement of labor relations; and (5) collection of statistics for study of diabetes on a large scale.

EARLY DETECTION OF DIABETES

Wilkerson and Krall² found in 1947 that the incidence of diabetes in Oxford, a New England town, was 1.4 per cent of the population tested, including 0.6 per cent in which diabetes had not previously been recognized. In an industrial survey concluded in 1942, Gates⁴ tested 109 selected individuals (believed most likely to have diabetes) among a total of 1800 employees, by means of glucose tolerance tests. There were found to be 20 diabetic persons among the 1800; in 12 of these cases the disease had not been previously diagnosed.

The incidence of unrecognized diabetes in industry depends on a number of factors, including the age distribution of the employee and the type of medical service obtained from the company medical department and independent of the company.

The relationship of sex distribution of the population to the incidence of diabetes is at present undetermined. Although the mortality statistics show a higher death rate from diabetes for females, the Oxford Study²

reveals almost an equal incidence in the male and female population. Our company employs 3,252 males and 256 females, a ratio of 12.7 to 1. In the United States, the total labor force is 62,416,000¹. Of this total there are 43,334,000 males and 19,082,000 females, a ratio of 2.2 to 1. Our company, therefore, has six times the ratio of male to female employees as the general labor force.

One would expect to find more unrecognized diabetes in a company employing older individuals and with inadequate industrial and private medical care.

The age distribution in our company is higher than that of the general population (Table 3). The average age in our company is 46.08 years. The incidence of diabetes should be greater than in the general population because of this high age composition. Our incidence of 1.14 per cent as compared with that of 1.7 per cent in the Oxford Study² is of even more significance in view of the difference in the age distribution of the two groups, and undoubtedly means that there are still many cases of undiagnosed diabetes in our company.

TABLE 3

Comparison of the age distribution of the employees of the Third Avenue Transit System with the population of Oxford, Mass, and with the population of the U. S.

	Percent in each age group.		
	Third Avenue Transit	Oxford, Mass. ²	United States ³ (1945)
Under 15	0	24.8	25.2
15 to 24	0.3	16.1	17.0
25 to 34	13.4	16.5	16.1
35 to 44	29.0	13.7	14.0
45 to 54	38.0	11.0	11.8
55 to 64	19.3	8.3	8.7
65 to 74	0	6.4	5.0
75 and over	0	3.2	2.2

In our company, the employee is exposed to independent medical care, because he is required to present a doctor's certificate prior to his return to work following an absence of five days or more. In spite of this medical care, our company's medical department still discovered 45 per cent of the diabetics in our employ.

The incidence of diabetes in the survey of other industrial plants was only 0.5 per cent. We doubt that the incidence of diabetes is any greater in our company than in any other industry or in the population at large, but that constant vigilance has resulted in early detection and proper treatment of many undiagnosed diabetics.

Cooperation of employers with the local diabetes associations in conducting intensive case-finding cam-

paigms would be especially valuable in smaller plants, where there is no in-plant medical supervision. Since approximately 75 per cent of the smaller industrial organizations employ part-time physicians for emergency care and first aid⁵ the program could be carried out with the help of these physicians. Routine examinations for all employees seen by these physicians would increase the early detection of diabetes.

COOPERATION WITH PRIVATE PHYSICIANS

The majority of the diabetic employees remain under the care of their private physicians. Dublin and Marks⁶ report success with an informal type of program in which the company offers its facilities which the employee may use according to his desires. The services of the staff physician and the medical laboratory are available to those who wish to use them, but there is no forced supervision. Diabetic employees may have their own doctors take complete responsibility for their treatment if they so desire. In the judgment of company physicians they receive reasonably good cooperation from diabetic employees.

Because of the responsibility to public safety, the medical department of a transit system cannot maintain this informal type of medical supervision; a comprehensive program must be established. It was our hope to establish a rapport with the patient and his private physician by offering the facilities of our laboratory, nutritional service and internists. The desired close relationship was difficult to obtain because the diabetic operator feared the loss of his job if we discovered that he needed insulin. A few of the operators who were taking insulin attempted to hide this fact. As a result, it has become necessary to employ the aid of both labor and management in insuring the proper follow-up.

Diabetics are required to have routine examinations at regular intervals in the company medical department. The care of the patient remains in the hands of the private physician. Reports of our findings and recommendations are submitted to him. If an operator who has been taking insulin can control his diabetes on diet alone, he is permitted to return to bus operation. Those who require insulin regularly are transferred to other positions.

The importance of close cooperation between the private and industrial physician cannot be over emphasized. Together, they can alleviate the fears of the diabetic concerning his employment, while insuring him of proper care. Additional facilities are made available to the private physician, while the industrial

physician benefits by being able to maintain a close follow-up of the employees.

PROPER PLACEMENT OF DIABETIC

The proper placement of the diabetic in industry depends upon cooperation between the industrial physician and the personnel department.

The majority of large industrial organizations will employ a diabetic but place him in a non-hazardous job. When a veteran employee develops diabetes, he retains his job unless it is hazardous to himself or the public. Studies show that the work record of diabetics in industry is generally satisfactory as compared with nondiabetics. In our experience, with the exception of two individuals who had unusual complications, our diabetic employees had the same absentee record as nondiabetics. Dublin and Marks⁶, in a study of 92 known cases of diabetes, showed excellent absence records in 40 per cent, average in 19 per cent and unsatisfactory in only 15 per cent.

Most diabetic workers are over the age of 40 and are valuable employees because of their long service and experience. Retaining them in jobs for which they are trained and in which they are experienced is good management.

Workers who become diabetic seldom need to change their jobs, although in exceptional cases a shift may be desirable because of a change in the diabetic's physical condition. Hurwitz⁷ feels that the degenerative complications of the disease, especially peripheral vascular disease, make the diabetic unusually susceptible to trauma. It is interesting to note that our absentee records show that the time off for industrial accidents was no greater in the diabetic than in the nondiabetic.

A guiding principle in the placement of a diabetic is that he should not be in a position where, as a result of insulin reaction, he would endanger the lives of others as well as his own^{6, 8}. Fowler⁹ recommended that diabetics not be permitted to drive planes, locomotives or buses, or work at heights. However, we permit diabetics who do not require insulin to drive, since we feel that they are not a public hazard. Except where the factor of public and individual safety is concerned and the potential danger of an insulin reaction exists, we feel that a diabetic is capable of doing any job a nondiabetic can do.

EDUCATION

Education of Management. Management must be educated to have a favorable attitude toward the diabetic. Fair treatment of employees with diabetes leads to better

industrial relations. An unfavorable attitude is detrimental in that it leads to attempts at concealment of the disease, discouragement and discontent amongst diabetics; and a higher rate of unemployment.

One of the reasons put forth for the refusal to hire a diabetic is the increased cost of insurance and pension programs. This is refuted by a personal communication from Dr. Harry E. Ungerleider, Director of Medical Research of the Equitable Life Assurance Society, of the United States.

"The companies have not felt it necessary to add one penny to the premium because of the presence of diabetics in the group, and from a sickness and health insurance standpoint, that is, insurance payable either in weekly benefits, hospitalization or medical care, the diabetics have been no problem to us at all. We do employ diabetics as members of our organization and the only restriction we place upon them, of course, is that they must be under the care of a physician. From an ordinary life insurance standpoint, we insure diabetics who are controlled by diet or by insulin. As a matter of fact, we have been taking diabetics for the past twenty-five years if one would look at our formula. All in all, I do not think that diabetes is an insurance problem."

Education of labor. "The American Federation of Labor has a deep interest in the handicapped workers and their employment opportunities and this of course applies to the diabetic." This statement¹⁰ is credited to Mr. Louis Hines, Secretary to the late Mr. William Green, The American Federation of Physically Handicapped, a subdivision of the American Federation of Labor, which is striving towards legislation in behalf of diabetic workers and realizes that some consideration must be given these people in order that their skills should not be lost or they be deprived of earning a livelihood.

Cooperation of labor is essential. They can be of great value in negotiating with diabetic employees in making special provision for transfer from hazardous to non-hazardous jobs. It is a responsibility of labor as well as management to see that a diabetic employee receives proper medical care, thus insuring him of earning his livelihood.

Education of the diabetic employee. The diabetic employee must be taught that his disease, properly cared for, does not pose a problem in industry. He must be taught the necessity of maintaining good medical care, and the importance of close cooperation between his private physician and his company medical department. He must be educated to treat his disease without embar-

assment. His fellow employees should be notified of his disease so that emergency care may be rendered if necessary.

In our company the medical department impresses the diabetic employee with the fact that his record, good or bad, influences the attitude of the company towards all diabetic employees. We also emphasize that there is no need for concealment of the disease, since diabetics are not penalized by loss of their jobs. They may be transferred to other occupations for their own good as well as for public safety.

COLLECTION OF DATA

Industrial medicine can collect vital statistics concerning diabetes. Statistics as to the incidence of the disease, relative time off from work due to illness, and proneness to accidents, can only be obtained if large industrial organizations keep accurate records. Studies as to relative control of the disease and the development of degenerative complications, could be made by alert medical departments having the opportunity of following employees for long periods of time, and by collaboration between the private and industrial physician. A planned program utilizing the available facilities is necessary.

SUMMARY

Data concerning the diabetic in industry have been collected by means of a questionnaire, from 63 companies, representing 780,823 employees. The known incidence of diabetes among 286,662 employees of 39 companies reporting it was 0.5 per cent. Forty-three of the 63 companies employed known diabetics; 20 did not. Thirty-three companies restricted the diabetics to non-hazardous work. Twenty-four companies had no restrictions and 6 had no set policy. Thirty-eight companies permitted an employee who developed diabetes to continue in his job; 24 companies restricted the type of work after diabetes was discovered and one company reported no set policy.

A special study was made of diabetes among 3,252 male and 256 female employees of the Third Avenue Transit System in New York. There were 40 diabetics—39 males and 1 female, representing an incidence of diabetes of 1.1 per cent. The diagnosis was made by the Company Medical Department in 18 cases (45 per cent), by private physicians in 17 cases and by an unknown source in 5 cases. The age of the diabetic employee of this company varied from 32 to 68 years, an average of 54.4 years. The age of all employees varied from 19 to 65, with an average age of 46.1.

Two diabetic employees were absent from work for

many months, one because of tuberculosis, the other because of an ulcer on his foot. The remainder of the diabetics had an illness absentee rate of 10.8 days per year, which is approximately the same as for the nondiabetics. The accident absentee rate was the same in the diabetic and nondiabetic groups. The non-medical absentee record was lower in the diabetic than in the nondiabetic group—4.6 days absent per employee per year as compared to 7.1 for the nondiabetic group. The calibre of the work as measured by accident rate in diabetic and nondiabetic bus operators was the same.

Industrial medicine can offer a great service to diabetes in the early detection, supervision, proper job placement and education of the diabetic in industry. It can play an important role in the furtherance of our knowledge of the disease by the careful collection of data concerning diabetics in industry. Cooperation between the industrial physician and the private physician is essential. Greater vigilance of plant and independent medical care will result in the early detection of many undiagnosed diabetics.

ACKNOWLEDGEMENT

We wish to express our appreciation to Edward Flamm, Research Assistant to the Executive Director; John D. Sureau, Director of Personnel and John J.

Moran, Director of Safety, for the assistance given us in the compilation of data concerning the Third Avenue Transit System.

BIBLIOGRAPHY

- ¹ Bureau of Census, Department of Commerce, personal communication.
- ² Wilkerson, H. L. C., and Krall, L. P.: Diabetes in a New England town. *J. A. M. A.* 135:209-216, Sept. 1947.
- ³ United States Department of Commerce, Bureau of the Census, Population special reports, Series P-47 No. 3, April 1947.
- ⁴ Gates, E. W.: Diagnosis of undetected diabetes: report of a study of a group of 1800 individuals. *Industrial Med.* 11:387-391, Aug. 1942.
- ^{5a} Root, H. F.: Detection of diabetes in industrial workers. *Indust. Med. & Surg.* 19:266-271, June 1950.
- ^{5b} McCahan, J. F.: Medicine and industry-occupational health. *New England J. Med.* 247:470-472, Sept. 25, 1952.
- ⁶ Dublin, L. I., and Marks, H. H.: The diabetic in industry and his employer. *Indust. Med. & Surg.* 19:279-283, June 1950.
- ⁷ Hurwitz, D.: The diabetic in industry. *Nat. Safety News.* 62:94-183, Oct. 1950.
- ⁸ Spear, E. M.: Can the Diabetic Work? *Diabetes Abstracts.* Vol. 6 No. 3, July 1947.
- ⁹ Fowler, A. F.: The diabetic in employment. *Indust. Med. & Surg.* 19:283-285, June 1950.
- ¹⁰ Beardwood, J. T., Jr.: Industry's role in the employment of the diabetic. *Indust. Med. & Surg.* 19:271-275, June 1950.

Objectives of the Clinical Center of the National Institutes of Health

The United States now has a medical research establishment as fine as any in the world. This building, in its unique and original design, supplies the facilities that are essential for the close interworking of clinical and laboratory research scientists which is required by the intricacies of the search for the cause and treatment of diseases such as heart disease, mental illness, cancer and the other killing, crippling, and chronic diseases with which we will be working. The Clinical Center will make possible research of a very high caliber: our real job now begins.

Medical research is an intellectual pursuit. Its success depends entirely on the capability of the individual. If we are to succeed in this great undertaking, we must continue to attract staff of the highest professional qualifications and continue to maintain an environment in which scientific excellence is the major value. We want to create in this building the atmosphere of excitement,

of high expectation and a knowledge of the happiness that can be achieved in serving mankind—the things that are common to all great research institutions.

We want our patients to feel they are our colleagues in research and to experience this same atmosphere. They will receive the best care that medical science can provide. Our moral obligation to do our best to treat the sick is paramount. Clinical studies will go forward within limits set by the welfare of patients. Not only is this a moral imperative—but it is the only way that sound clinical research can be done. These objectives and principles will guide the National Institutes of Health.

From extracts from remarks of the director, National Institutes of Health, at the dedication of the Clinical Center, by William H. Sebrell, Jr., M.D., in *Public Health Reports*, September 1953