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DIABETES MELLITUS

A CONTRIBUTION TO ITS EPIDEMIOLOGY BASED CHIEFLY ON MORTALITY STATISTICS *

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INTRODUCTION

Although the term, epidemiology, has in the past been applied generally, if not exclusively, to the study of communicable diseases, so far as concerns their development among groups, or their manner of transmission from the infected or the carrier to the susceptible person, the methods of such investigations can often be employed with advantage in analyzing the causes and distribution of other diseases. The essential and distinctive feature of epidemiology is the study or knowledge of that part of the natural history of a disease which determines its occurrence or distribution quantitatively and qualitatively in groups of persons, particularly as one case of sickness is related to others, by some common factor of age, sex, race, color, occupation, geographical distribution, or determining element in heredity, environment or hygiene, distinct from the study of disease as it affects the life history of the person by modifying the structures and functions of the human body.

A limitation of accuracy in any statements based on mortality statistics must be accepted where the cause of death as given on the death certificate is without support from postmortem examination, or lacks corroboration through positive evidence of etiology as can often be obtained by direct inspection of lesions, with or without operation, or by clinical, microscopic or biologic examination of body tissues, fluids, etc., before death.

* From the Department of Public Health Administration of Columbia University.

* Read before the Association of American Physicians, Atlantic City, May 7, 1924, and before the Section on Preventive and Industrial Medicine and Public Health at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.

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Tuberculosis is usually found to be the chief complicating fatal disease which may obscure the picture of diabetes deaths, but since tuberculosis has been, in general, steadily decreasing as a cause of death during the last fifty years, and diabetes has been increasing over the same period, we can presume that the accuracy in diabetes death rates has been increasing, so far as this factor is concerned.

Where diabetes is given as a primary cause of death, the following diseases have been the chief contributing causes in the order of frequency, as shown in Table 1, for the United States Registration Area of 1917 and for the City of New York in the years 1914 and 1920.

It is of some importance in this connection to recall the fact that it has been a standard practice by the Census Bureau, and by registrars of vital statistics generally throughout this country, to deal with certificates presenting more than one cause of death according to the

TABLE 1.—*Contributory Causes of Death in Diabetes*

	U. S. Registration Area, 1917 *	City of New York	
		1914 †	1920 ‡
Total deaths from diabetes	12,734	979	1,075
All contributing causes	6,080	316	457
Principal contributing causes	(4,480)	(297)	(282)
Gangrene	1,235	...	.....
Bright's disease	951	126	75
Organic heart disease	812	67	84
Cerebral hemorrhage	397	...	.....
Lobar pneumonia	273	15	10
Diseases of the arteries	223	26	40
Furuncle	200	...	.....
Bronchopneumonia	170	23	19
Pulmonary congestion	116	...	.....
Acute nephritis	103	9	7
Apoplexy (embolism and thrombosis)	.....	19	25
Surgical operations	.....	7	14
Diarrhea	.....	5	8

* U. S. Census Bureau Mortality Statistics, 1917.
† Annual Report of the Dept. of Health of the City of New York, 1914, p. 103.
‡ Annual Report of the Dept. of Health of the City of New York, 1920, p. 282.

Index of Joint Causes of Death, U. S. Bureau of the Census, 1914. According to this practice, diabetes takes precedence over all other causes with which it is reported jointly as a contributing cause, except diphtheria, pulmonary tuberculosis and typhoid fever. The error, if error there be in the inclusion of diabetes among the deaths reported from all forms of tuberculosis as a contributing cause, must indeed be small, since of 110,144 deaths from tuberculosis in the Registration Area as reported in the 1918 Census Mortality Report, pages 49 et seq., diabetes appears as a recorded complication in only 365 instances.

There is no wholly reliable way of proving that deaths from diabetes are more or less accurately recognized now than they have been at any time during the last sixty years. It may, however, be accepted as probable that diabetes has shared with other causes of death in the greater accuracy of clinical diagnosis, which is chiefly responsible in

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the United States for a diminution in deaths reported under those categories or titles of the International List which are unsatisfactory, because of their indefiniteness and the inclusion of many unrelated and ill-defined groups, while there has been a corresponding increase in the proportion of all deaths accurately recorded under their proper and reasonably precise titles.

The frequency with which glycosuria is discovered by routine and special examinations of urine in the course of private and institutional medical practice has doubtless increased greatly in the last twenty years, and this, together with the increased frequency of blood sugar determinations, has probably caused a higher proportion of persons to be brought under medical supervision for disturbance of the function of sugar tolerance in recent years than was the case a generation ago.

We should expect that the advances in early detection of mild cases of glycosuria, of high blood sugar content, and of subjectively symptomless diabetes, together with the widespread interest in dietetic adjustment and medical regulation of food habits of such persons, would have the effect of diminishing the ratio of deaths attributable to diabetes rather than of increasing them in the population.

The duration of the disease, its characteristic symptomatology and the frequency with which its advanced stages bring the patient under medical care, all combine to reduce to a minimum those diagnostic errors which would lead to failure of its recognition as the cause of death.

The only substantial fact that may be accepted as lending force to an argument that deaths from diabetes have in the main been recorded with as much or greater accuracy than has been the case in other important causes of death, is the experience of Cabot [1] with the necropsies at the Massachusetts General Hospital, who observed that among the 3,000 necropsy cases studied, there was little evidence of omission of cause, or commission of error in those stated to be due to diabetes mellitus. (Other causes of death in which as high a percentage of accuracy occurred, i. e., 95 per cent., were leukemia, pernicious anemia, diphtheria, puerperal eclampsia, malaria, dementia paralytica and amebic dysentery.)

While the use of insulin may be postponing markedly the deaths of diabetic patients, it has not yet been shown that any permanent improvement in the death rate from this disease can be attributed solely to its use, and even if this favorable result should develop, the influence on death rates among the general population of cities or states in this country can hardly be expected to appear until at least the year 1924.

1. Cabot, Richard C.: Diagnostic Pitfalls Identified During a Study of Three thousand Necropsies, J. A. M. A. **59**:2295 (Dec. 28) 1912.

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Evidence has been offered by the Metropolitan Life Insurance Company [2] to the effect that a reduction in the death rate from diabetes among their industrial policy holders, during the last half of 1923 and the first quarter of 1924, is possibly due to the widespread use of insulin in the last year. In any event, the discovery of insulin can hardly be considered to have introduced any error into the mortality data offered in this paper.

If any particular community differs in the percentages of its population living at the various age groups from the distribution of the population by these age groups in the country as a whole, or in other cities with which death rates are compared, an adjustment of death rates for age is necessary for accuracy. In the case of New York City, whatever change there has been in the years since 1866 in the age grouping can hardly have caused any error of overestimation in the diabetes death rates, for, as a matter of fact, the City of New York in 1920 had a larger percentage of its population under 40 years of age than any city in the United States with a population of 100,000 or over. There is a considerable error in the unadjusted general death rate of the city in the direction of an understatement. Because of the relative youth of its population, the error is likewise one of underestimation to an even greater degree in the specific death rate of diabetes, from the fact, as will be seen from the study of diabetes death rates for various ages, that the rates are much higher in the later decades of life, age groups which are represented in New York City by less than the standard percentage of the population in other cities or in the Registration Area.

If there is any error in drawing conclusions from the changes in the death rates of diabetes in the last sixty years, it is likely to be due to an understatement rather than an exaggeration in the reported deaths from this cause. It is probable that this error was greater in 1866, the first year for which rates are quoted for the city of New York, than in 1923.

It cannot be assumed that increase of deaths necessarily indicates an increase in the incidence of a disease, nor that an increase in the number of cases of a disease diagnosed will necessarily be expressed in an increase of the death rate of a disease, but rather the contrary, owing to the greater probability of successful arresting or curative treatment, as in the case of tuberculosis following earlier and more accurate diagnosis. In other words, the case mortality percentage of a disease which is amenable to curative resources is likely to fall as diagnosis becomes commoner in its early stages. This we may assume to have

2. Statistical Bulletin, New York Metropolitan Life Insurance Co., February, 1924.

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been the case with diabetes, in which such remarkable advances have been made in diagnosis and treatment, during the last twenty years in particular.

The assumption, however, is valid that an increase in the death rate of a disease may be considered as indicating an actual increase in its incidence, during a period of time when clinical diagnosis and treatment have developed progressively in the direction of greater success in recognizing and arresting it in its mild or early stages, and in postponing death in patients whose condition has progressed beyond the possibility of cure.

Among the factors which have been commonly considered by students of diabetes to play any important rôle in its etiology, two, namely, obesity, or disproportionate weight for the age, sex, race and height of the person, and "nervous strain," presumed to exist when life is complicated, full of responsibility and difficult because of keen economic or industrial competition, are not revealed by the death certificate except to the extent that occupation or place of residence reported may imply a life of particular nervous hazard on the part of the deceased. Many questions of etiology receive but little illumination from mortality data unless supported by carefully prepared case histories. Similarly, the hereditary, familial or conjugal factors, if of any force in the causation of diabetes, cannot be satisfactorily studied by the use of general mortality statistics alone, and even when reliable data in a selected experience are offered in support of the theory that inheritance, family or conjugal relationships were of significance in causing diabetes such claims are commonly worthless by reason of the lack of evidence as to the dietary, occupational and other factors in the cases, which are often of more significance than the accidental relationships of birth or marriage.

Mortality data will be presented which it is believed will make clear that a consistent and great actual increase in the diabetes death rate has occurred in New York City between 1866 and 1923, and similarly in many other population groups in recent years. Some of the causative factors will be presented and discussed.

THE INCREASE IN DEATH RATES FROM DIABETES IN RECENT YEARS

A sufficient reason for studying the deaths from diabetes in New York City at this time is the considerable shift in relative importance, numerically, of the leading causes of death which has dropped tuberculosis from first to fourth place and has brought diabetes up to tenth place (Table 2).

Expressed otherwise, we find that while one death from diabetes was recorded in 1866 for each 2,437 deaths from all causes, in the year 1923, one death from diabetes was recorded for each fifty-one deaths from all causes.

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In many of the cities of this country, where notable reduction in deaths from tuberculosis has occurred, we find there is now one death from diabetes for every four or five deaths from tuberculosis.

In the registration area of the United States in the last forty years there has been a change from 2.8 to 16.1 in the death rate from diabetes per 100,000, of population, while the death rate from all causes has

TABLE 2.—*Chief Causes of Death, City of New York, 1923*

Organic heart diseases	14,321
Pneumonia and bronchopneumonia	8,231
Cancer	6,287
Tuberculosis, all forms	5,673
Violent deaths (excluding suicide, including homicide)	4,502
Bright's disease and nephritis	4,367
Congenital debility and malformations	3,723
Diseases of arteries	3,250
Diarrhea under 5 years	1,534
Diabetes	1,360

fallen steadily during this period. There has been a still greater change in the percentage of all deaths represented by those from diabetes; in 1921 the deaths from diabetes represented 1.4 per cent. of all deaths in the Registration Area, while in 1880 deaths from diabetes amounted to but 0.14 per cent. of all deaths in the Registration Area of that date, a change amounting to 900 per cent. of the ratio of 1880.

Of the principal causes of death in the Registration Area of the United States, 1920, diabetes appears in the twelfth place, as will be seen from the specific death rates per 100,000 given in Table 3.

TABLE 3.—*Death Rates per Hundred Thousand of Population from the Chief Causes of Death in the Registration Area of the United States, 1920* *

Organic diseases of heart	141.9
Pneumonia and bronchopneumonia	137.3
Tuberculosis, all forms	114.2
Bright's disease and nephritis	89.4
External causes (violent deaths including suicide and homicide)	88.8
Cancer	83.4
Cerebral hemorrhage	80.9
Influenza	71.0
Congenital debility and malformations	69.9
Diseases of arteries	22.8
Puerperal state	19.2
Diabetes	16.1

* U. S. Census Bureau Mortality Rates, 1910-1920.

That the importance of the increasing mortality from diabetes has long been recognized by the Census Bureau can be seen from the following quotations from the volumes on Mortality Statistics of 1906, 1907 and 1909.

1906. "Among the old Registration States there appears to be a decided tendency to an increase in mortality from this cause. These

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were, in order of highest death rate, Connecticut (18.8), Maine (16.8), Massachusetts (16.1), New York (16.0), Michigan (13.7), New Jersey (12.8), Indiana (11.0).

"While the mortality from this disease is not great, its general increase throughout the country is significant and may be compared with the similar increase shown for cancer, a disease whose age incidence resembles that of diabetes."

1907. "This rate (13.9 per 100,000 for diabetes, 1907) is low as compared with the rates for tuberculosis, cancer, and other important diseases, but the mortality from diabetes is of increasing significance, as being due to a fairly well marked and distinctive type of disease and one likely to show further increase, dependent on the greater number of persons at older ages in the population. The disease is one of later middle life, is intimately dependent on the conditions affecting the nervous system, as well as the nutrition of the person, and may be one of those diseases which the sanitarians of the future will successfully restrict by directing their efforts against unhygienic conditions of living, both mental and physical."

1909. "The relative increase in the death rate from diabetes (45.5 per cent.) was considerably greater than that in the death rate from cancer, but the total number of deaths from this cause was much smaller, and therefore the increase is of less importance numerically."

United States Bureau of the Census: Mortality Rates, 1910-1920, 1923, pp. 87 and 88: "For the Registration States of 1900 the death rates from diabetes show a steady trend upward, the adjusted rate for 1900 being 10.4 per 100,000 population, the rate for 1910 being 16.16, and the rate for 1920 reaching 18.7.

"For both the white and colored in the Registration Area and Registration Cities, and the rural part of the Area, the death rates from diabetes increased generally in the decade: (for the white, from 15.3 to 16.8 in the Registraion Area; from 16.4 to 19.6 in the Registration Cities; and from 13.7 to 14.1 in the rural districts, and for the colored in the respective areas from 7 to 7.9; from 8.3 to 12.7, and from 3.2 to 5.2)."

DEATHS FROM DIABETES IN THE CITY OF NEW YORK FROM 1866 TO 1923

In the years from 1866 to 1923, inclusive, there were recorded by the registrar's office of the Department of Health of the City of New York, 23,254 deaths due to diabetes.

Chart 1 and Table 4 give the story at a glance, and present at the same time a picture of the fall in the general death rate, i. e., the deaths from all causes for each 1,000 of the population, from 36.86 to 11.72 (a difference of 68.2 per cent.); the rise in the specific death rate from

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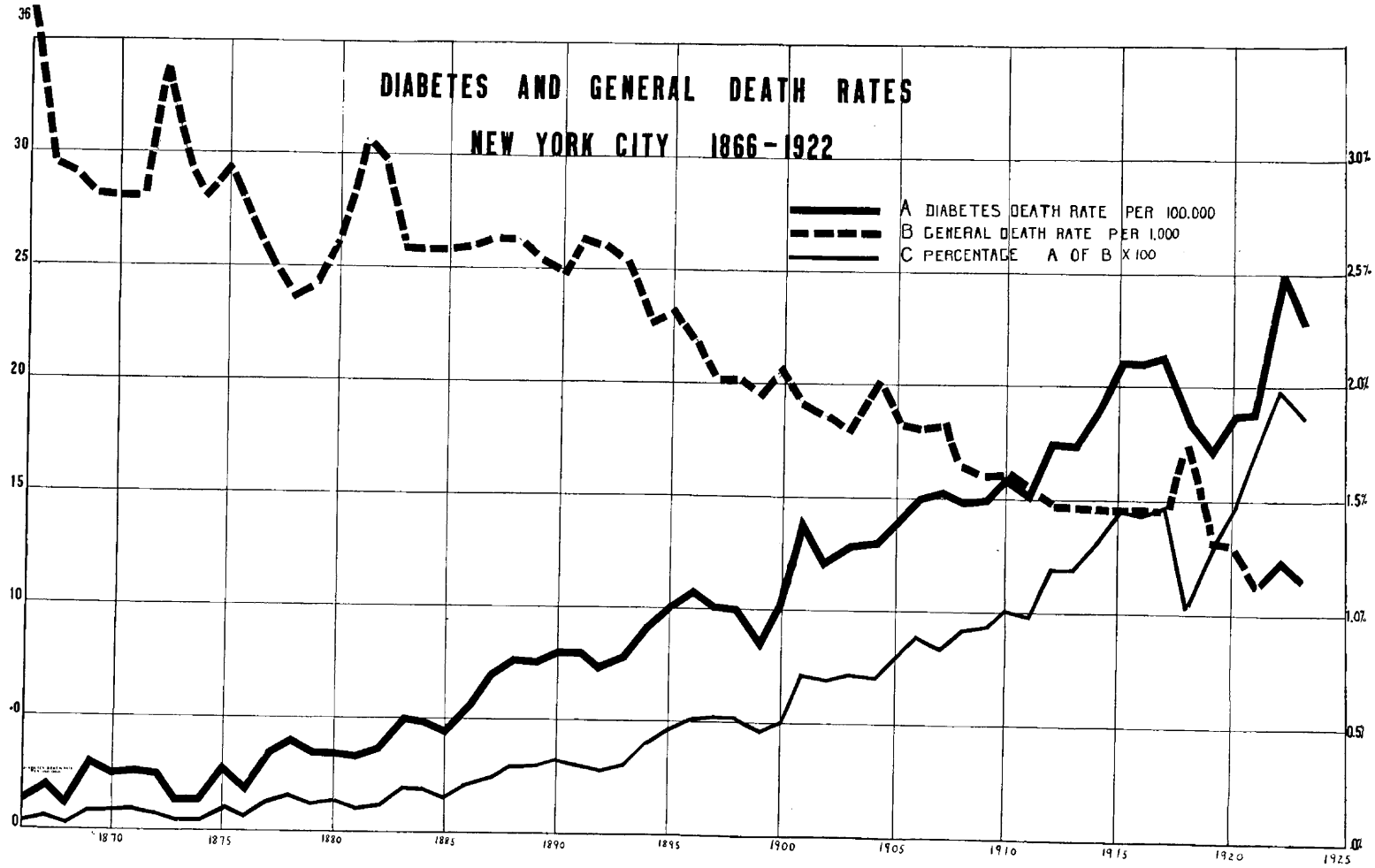


Chart 1.—Death rates from diabetes, and from all causes, New York City, 1866-1923.

diabetes for each 100,000 of the population from 1.5 to 22.9 (a difference of 1,426.7 per cent.), and the change in relation of deaths from diabetes to deaths from all causes, from 0.041 to 1.96 per cent. (a difference of 4,631.9 per cent.).

TABLE 4.—*Deaths and Death Rates, All Causes, and from Diabetes, New York City from 1866 to 1923*

Year	Population	Total Deaths, All Causes	Crude Death Rate per 1,000	Diabetes Deaths			Diabetes Death Rate per 100,000	Percentage, Diabetes Deaths of All Deaths	Age Groups					
									0 to 19		20 to 44		45+	
				Total	Male	Female			M.	F.	M.	F.	M.	F.
1866	769,567	26,567	36.86	11	7	4	1.5	0.041	3	1	1	1	3	2
1867	812,748	23,159	31.89	14	9	5	1.9	0.061	1	1	1	4	7	0
1868	855,929	24,889	29.24	18	4	4	1.1	0.032	0	2	2	2	2	0
1869	899,100	25,167	28.08	22	13	9	3.0	0.088	2	0	6	3	5	6
1870	942,292	27,175	28.80	24	14	10	2.5	0.089	0	0	7	2	7	8
1871	962,210	26,976	28.22	25	16	9	2.6	0.093	3	2	9	2	4	5
1872	982,128	32,647	33.70	25	16	9	2.5	0.077	1	0	4	4	11	5
1873	1,002,046	29,084	29.63	13	7	6	1.3	0.045	0	0	4	1	3	5
1874	1,021,964	28,727	27.89	14	7	7	1.4	0.049	0	0	5	3	2	4
1875	1,041,886	30,709	29.40	31	21	10	2.9	0.101	1	2	9	3	11	5
1876	1,074,824	29,152	27.11	19	8	11	1.7	0.065	1	0	2	6	5	5
1877	1,117,762	26,203	23.66	35	24	11	3.3	0.134	6	1	4	4	14	6
1878	1,150,700	27,008	23.67	42	25	17	4.0	0.156	1	1	9	3	15	13
1879	1,183,638	28,342	24.13	37	21	16	3.4	0.131	2	0	4	7	15	9
1880	1,206,577	31,937	26.42	44	24	20	3.5	0.138	1	3	6	4	17	13
1881	1,246,011	38,624	30.75	43	29	14	3.4	0.111	0	0	12	1	17	13
1882	1,283,870	37,924	29.61	46	29	17	3.7	0.121	3	0	7	7	19	10
1883	1,322,880	24,011	25.81	68	34	34	5.1	0.200	2	2	12	13	20	19
1884	1,363,075	35,034	25.83	68	41	27	4.9	0.194	1	2	10	5	30	20
1885	1,404,401	35,682	25.56	63	35	28	4.5	0.177	1	1	11	6	23	21
1886	1,447,166	37,351	26.00	82	47	35	5.6	0.220	5	4	13	7	29	24
1887	1,491,137	38,933	26.33	105	52	53	7.0	0.270	1	1	7	8	44	44
1888	1,536,444	40,175	26.39	117	61	56	7.6	0.292	5*	4*	10†	8†	46	44
1889	1,566,801	39,679	25.36	118	71	47	7.5	0.297	5*	1*	13†	8†	53	38
1890	1,612,559	40,103	24.87	130	72	58	8.0	0.324	5	3	17	10	50	45
1891	1,659,654	43,659	26.31	130	64	66	8.0	0.298	2	5	10	11	52	50
1892	1,708,124	44,329	25.95	123	66	57	7.2	0.278	6	3	15	14	45	40
1893	1,758,010	44,486	25.30	137	76	61	7.7	0.308	4	3	12	13	60	45
1894	1,809,353	41,175	22.76	166	87	79	9.2	0.403	0	4	22	11	65	64
1895	1,879,195	43,420	23.18	203	95	108	10.0	0.468	3	6	21	17	71	85
1896	1,934,077	41,622	21.84	214	98	116	11.0	0.514	5	1	19	8	74	107
1897	1,990,562	38,877	20.03	202	95	107	10.1	0.520	3	5	21	13	71	89
1898‡	3,438,899	66,294	20.26	345	153	192	10.0	0.521	8	7	37	26	108	159
1899	3,356,722	65,343	19.47	301	148	153	8.4	0.461	10	7	40	17	98	129
1899	3,356,722	65,343	19.47	301	148	152	8.4	0.461	10	7	40	17	98	129
1900	3,446,042	70,872	20.57	357	169	188	10.0	0.503	6	8	38	32	125	148
1901	3,544,079	70,720	19.90	503	269	234	14.0	0.712	9	2	69	37	191	195
1902	3,665,825	68,112	18.58	471	212	259	12.0	0.692	13	10	48	34	151	215
1903	3,781,423	67,864	17.95	488	232	256	12.8	0.721	2	8	57	42	173	206
1904	3,901,023	78,060	20.01	549	233	316	13.0	0.703	11	14	40	50	182	252
1905	4,025,742	73,714	18.31	589	266	323	14.0	0.799	7	11	57	47	202	265
1906	4,166,556	76,203	18.29	652	281	371	15.0	0.856	12	11	49	53	220	307
1907	4,314,237	79,205	18.36	664	251	413	15.3	0.838	13	15	35	53	203	345
1908	4,469,248	73,072	16.35	670	290	380	14.9	0.916	16	7	46	48	228	325
1909	4,632,078	74,105	16.00	696	288	408	15.0	0.939	14	15	48	52	226	341
1910	4,788,009	76,742	16.04	768	320	448	16.0	1.002	8	18	52	65	260	365
1911	4,873,211	75,423	15.48	739	316	423	15.1	0.981	14	10	59	60	243	353
1912	5,961,205	73,008	14.71	870	362	508	17.5	1.192	11	19	59	59	292	430
1913	5,049,199	73,902	14.64	884	366	518	17.5	1.196	16	18	63	52	287	448
1914	5,137,193	74,803	14.56	979	409	570	19.0	1.309	19	20	56	70	334	480
1915	5,225,189	76,193	14.58	1,109	462	647	21.2	1.455	18	21	81	69	363	557
1916	5,313,181	77,801	14.64	1,119	470	649	21.0	1.437	15	14	75	81	380	554
1917	5,401,175	78,575	14.55	1,153	473	680	21.3	1.467	15	14	74	77	384	516
1918	5,489,169	98,119	17.88	1,011	410	601	18.4	1.030	28	18	79	88	308	495
1919	5,577,163	74,433	13.35	955	380	575	17.1	1.284	18	17	71	69	291	489
1920	5,665,157	73,249	12.93	1,075	411	664	18.9	1.468	29	22	58	86	324	556
1921	5,751,859	64,257	11.17	1,120	428	692	19.0	1.74	25	25	82	74	321	593
1922	5,830,738	69,690	11.93	1,448	581	867	25.0	2.08	30	24	82	99	469	744
1923	5,927,617	69,452	11.72	1,360	512	848	22.9	1.96	..	..	..	..	...	...

* Age group for 1888 and 1889, from 0 to 24 years.
† Age group for 1888 and 1889, from 25 to 44 years.
‡ Greater City for all five boroughs 1898 and following

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It will be recalled that the main factors which have brought about the reduction in the general death rate in New York have been the control of the bacterial diseases of the intestinal tract, the diminution in incidence and death rates from the acute communicable diseases of childhood, reduction in tuberculosis and infant mortality, and great improvement in the economic and sanitary standards of housing and food supplies.

In the course of the increase in death rates from diabetes over this long period, there are two periods of sudden and considerable reductions in the rates, followed by even more rapid rises to higher rates than before the fall. The first of these sudden falls and rises coincided with the period of the influenza epidemic from 1898 to 1901, and in all probability represents the effect of this highly fatal infection on persons of the ages chiefly afflicted by diabetes, i. e., those over 40 years of age who suffered particularly in that epidemic. Many persons who would have died of diabetes were carried off by influenza during the years in question.

The halt in the increasing diabetes death rate, which occurred in the years 1916 and 1917, was followed by a sharp drop in 1918, 1919 and 1920, the year 1922 showing the highest rate yet recorded. From experience in other countries, which suffered between 1914 and 1917 from interference and limitation in their food supplies, it seems probable that the halt in the rising diabetes death rate in 1916 and 1917 was related to the voluntary and enforced restrictions in food used, while the great drop which followed for three years was due to the influenza epidemic and the effect it had on all death rates of persons over 45 years of age, even though the heaviest mortality from influenza in this pandemic was in earlier decades of life.

In the face of the records, it is difficult to accept as a probable explanation of increasing diabetes death rates an increase of infectious or febrile diseases.

ANALYSIS BY AGE AND SEX

Developing this general statement of deaths to give those facts which are essential to any complete picture of a disease, we offer an analysis of deaths by age and sex.

In Charts 2, 3 and 4 and Tables 5 to 16 the facts are set forth.

Charts 2 and 3 record graphically by the semilogarithmic and arithmetic methods, respectively, the specific diabetes death rates for three age groups in the years 1866, 1875, 1880, 1895, 1900, 1910 and 1920, for which an enumeration of the city's population provided the number of persons living at each age group. The facts of population and deaths at the different ages for these seven years will be found in Table 5.

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TABLE 5.—*Deaths and Death Rates per Hundred Thousand Population from Diabetes in Selected Age Groups at Census Years, New York City*

	Population			Deaths from Diabetes			Diabetes Death Rates		
Year	0 to 19 Years	20 to 44 Years	45 Years and Over	0 to 19 Years	20 to 44 Years	45 Years and Over	0 to 19 Years	20 to 44 Years	45 Years and Over
1866	319,654	306,339	100,846	4	2	5	1.25	0.65	4.9
1875	442,584	446,812	152,490	3	12	16	0.68	2.68	10.5
1880	495,260	519,391	190,693	4	10	30	0.81	1.93	15.7
1895	690,313	874,355	284,331	9	38	156	1 31	4.36	55.0
1900	1,356,049	1,530,239	545,478	14	70	273	1.03	4.57	50.3
1910	1,825,390	2,145,583	789,108	26	117	625	1.42	5.45	79.2
1920	2,045,984	2,488,415	1,077,844	51	144	880	2.49	5.78	81.7

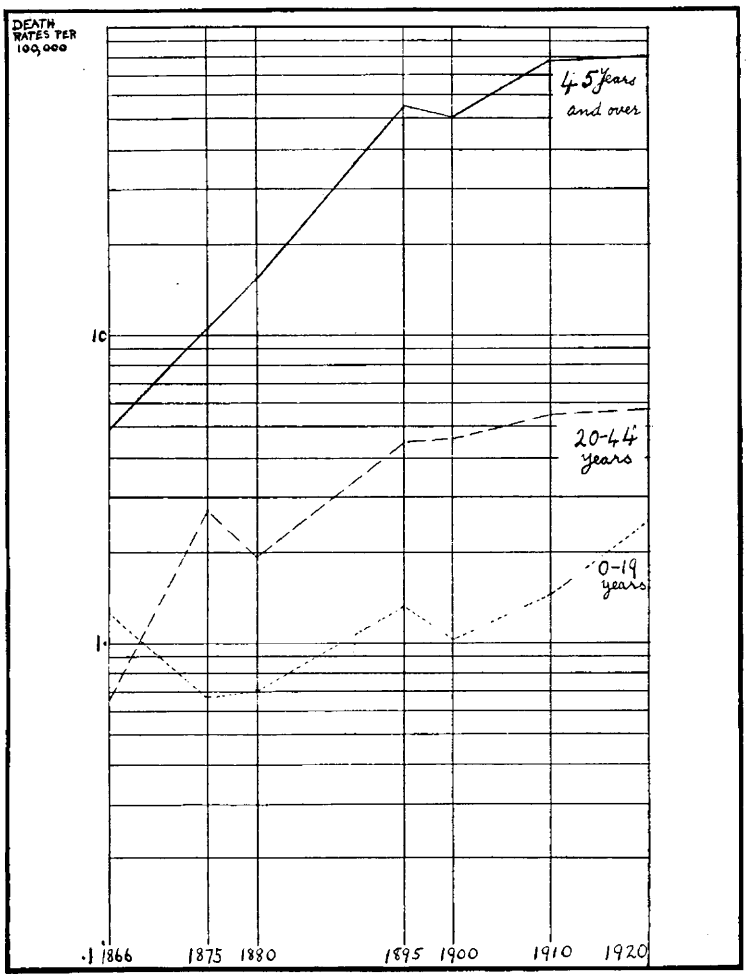


Chart 2.—Death rates from diabetes per hundred thousand population, New York City, by certain age groups at census years (semilogarithmic method).

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It will be seen that for each of the three age groups (from birth to 19 years, from 20 to 44 years, and 45 years and over) the net result is a marked rise in death rates, greatest among the latter decades of life and least among those of 19 years of age and under. The ratio

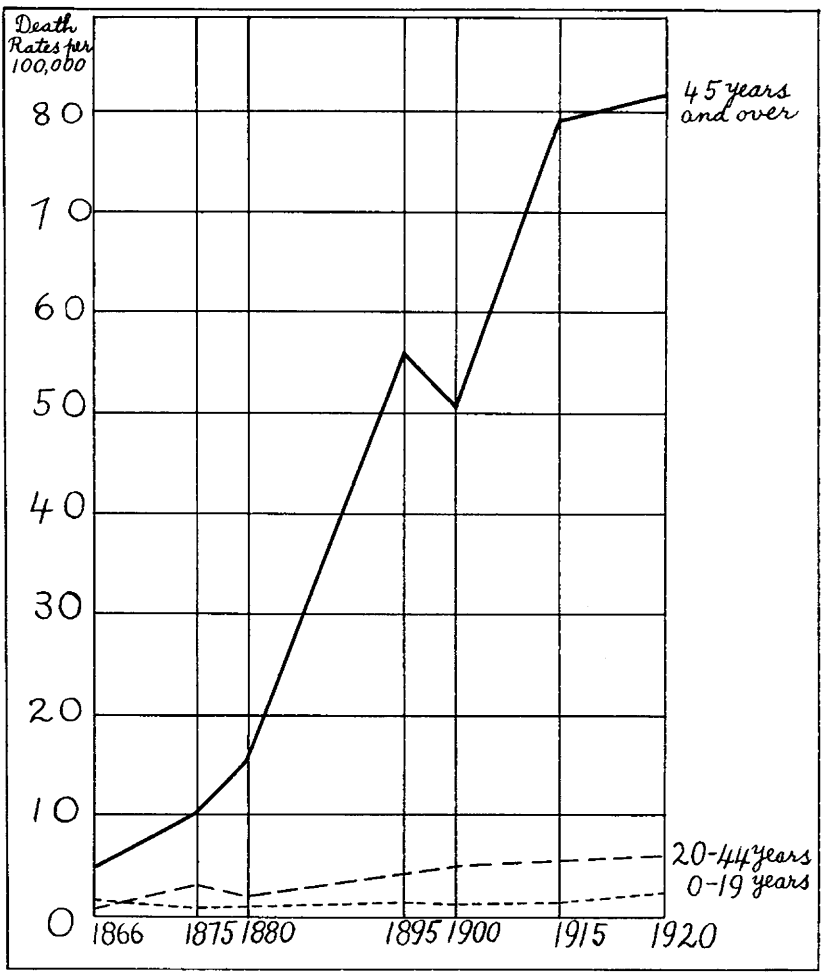


Chart 3.—Death rate from diabetes per hundred thousand population, New York City.

of change is expressed graphically with greater accuracy by the logarithmic Chart 2.

Table 6 presents for these same seven individual census years the evidence of change in the percentages of the population and of diabetes deaths represented in the three chosen age groups, from which it will be seen that in the forty-five years (from 1875 to 1920) the percentage

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TABLE 6.—*Diabetes Deaths Distributed in Selected Age Groups, New York City*

Year	Percentage of All Population Represented in Each Age Group in Census Years			Percentage of All Diabetes Deaths Falling in the Same Age Groups and Years		
	0 to 19 Years	20 to 44 Years	45 Years and Over	0 to 19 Years	20 to 44 Years	45 Years and Over
1875	42.0	42.8	14.6	9.6	38.7	51.7
1880	41.0	43.0	16.0	9.1	22.7	68.2
1895	37.4	47.0	15.0	4.4	18.7	76.9
1900	39.0	45.0	16.0	3.9	19.6	76.5
1910	38.0	45.0	17.0	3.3	15.2	81.5
1920	36.0	44.0	19.0	4.7	13.4	82.0

of the population represented by the youngest age group (19 years and under) fell from 42.0 per cent. in 1875 to 36.0 per cent. in 1920, and that during the same time the percentage of all diabetes deaths occurring in this young group fell from 9.6 to 4.7 per cent. On the other hand,

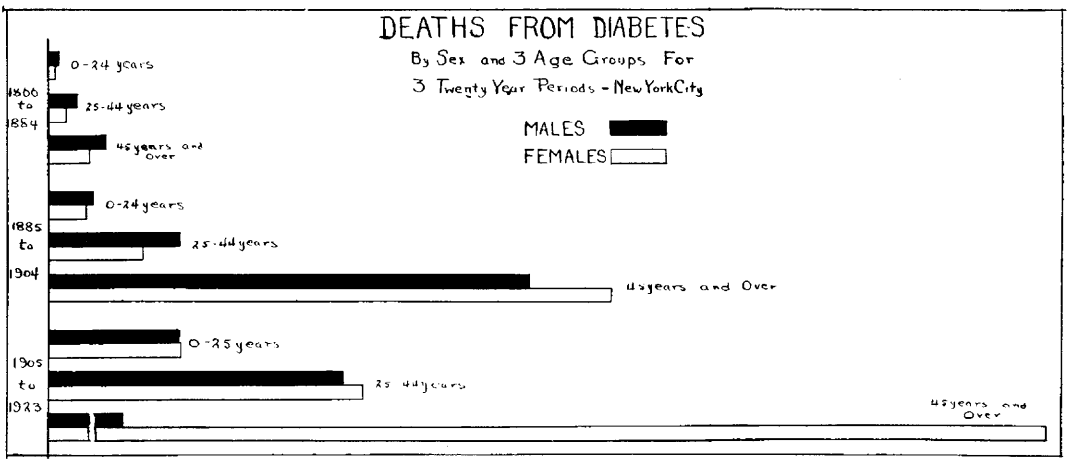


Chart 4.—Deaths from diabetes by sex and three age groups for three twenty year periods, New York City.

TABLE 7.—*Deaths from Diabetes by Sex and Three Age Groups for Three Consecutive Periods of Years, New York City*

Year	0 to 24 Years		25 to 44 Years		45 Years and Over	
	Male	Female	Male	Female	Male	Female
1866 to 1884	39	25	103	68	206	148
1885 to 1904	160	130	464	339	1,711	2,000
1905 to 1923	468	473	1,045	1,118	5,763	8,994

the age group of 45 years and over represented 14.6 per cent. of the entire population in 1875 and 19 per cent. in 1920, during which time the percentage of diabetes deaths occurring at these ages rose from 51.7 to 82 per cent.

Again from a study of Chart 4 and supporting table (Table 7), it will appear that while the deaths of males from diabetes exceeded those

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of females at each of the chosen age groups in the 19 years, from 1866 to 1884, in the period from 1905 to 1923, the deaths of females from this cause outnumbered the males at each age group, and to a greater degree at advancing ages, and out of proportion to changes in the sex distribution of the population. In 1920 the difference in percentages of male and female populations of New York City was only 0.2 per cent.

TABLE 8.—*Percentage of Diabetes Deaths Occurring in Specific Age Groups in New York City, by Periods of Years and Individual Years by Sex, to Show What Percentage of the Diabetes Deaths Occur at Certain Ages, and in Each Sex*

Year	Sex	0 to 19 Years, per Cent.	20 to 44 Years, per Cent.	45 to 64 Years, per Cent.	65 Years and Over, per Cent.
1866 to 1887	Male	7.2	29.9	43.2	19.4
	Female	6.5	26.9	41.8	24.7
	Total	6.9	28.7	42.7	21.7
1890 to 1900	Male	4.62	22.4	46.0	26.9
	Female	4.4	14.5	48.4	32.7
	Total	4.5	18.3	47.1	29.9
1901 to 1917	Male	3.9	17.6	51.2	27.3
	Female	3.1	12.8	51.7	32.4
	Total	3.4	14.8	51.5	30.3
1918	Male	6.8	19.3	48.7	25.1
	Female	2.99	14.6	51.7	30.6
	Total	4.5	16.5	50.6	28.4
1919	Male	4.7	18.7	45.2	31.3
	Female	2.95	12.0	49.0	35.9
	Total	3.6	14.7	47.5	34.2
1920	Male	7.06	14.1	49.2	29.7
	Female	3.3	12.9	50.1	33.8
	Total	4.75	13.4	49.7	32.2
1921	Male	5.8	19.2	49.1	25.9
	Female	3.6	10.7	54.6	31.1
	Total	4.5	13.9	51.8	29.1
1922	Male	5.2	14.1	49.5	31.1
	Female	2.77	11.4	52.7	33.2
	Total	3.7	12.5	51.3	32.4

Table 8 confirms the story of the former tables to the effect that during the last 57 years in New York City, the proportion of all diabetes deaths under 20 years of age has remained about stationary, with the proportion of deaths among males higher in the first 20 years of life. At the ages of 45 years and over, the proportion of all diabetes deaths has increased, and those of females at a greater rate than those of males.

The great increase in specific diabetes death rates by age groups for females after 45 years of age is seen with even more detail in Table 9, although the period for comparison is only the ten years between 1910 and 1920.

It would appear that after the age of 45 among men, the situation in New York City so far as diabetes is concerned had improved, except for the age group 75 years and over.

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TABLE 9.—*Diabetes Death Rates per Hundred Thousand by Sex and Age Groups, 1920 and 1910, New York City*

	Both Sexes		Males		Females	
	1920	1910	1920	1910	1920	1910
All ages: Adjusted.....	17.0	23.9	.....	.....	.....	.....
Crude.....	23.63	18.78	18.41	15.95	28.82	21.60
Under 5.....	1.6	0.6*	1.8	0.8*	1.4*	0.4*
5 to 9.....	3.2	0.9*	4.1	0.9*	2.2	0.9*
10 to 14.....	3.2	1.7	2.8	0.9*	3.6	2.4
15 to 19.....	3.3	2.4	4.1	0.9*	2.6	3.7
20 to 24.....	4.2	2.8	1.6*	2.4	6.4	3.2
25 to 34.....	4.87	4.4	4.6	3.8	5.1	5.1
35 to 44.....	10.2	9.8	8.8	8.4	11.7	11.4
45 to 54.....	46.1	45.3	37.9	39.4	54.8	51.6
55 to 64.....	131.7	128.4	96.3	107.5	167.1	148.4
65 to 75.....	236.7	192.7	178.7	188.0	287.3	196.8
75 and over.....	247.3	220.3	212.1	188.0	272.5	242.9

* Rates for deaths numbering less than five, U. S. Census Bureau Mortality Rates, 1910-1920, p. 526.

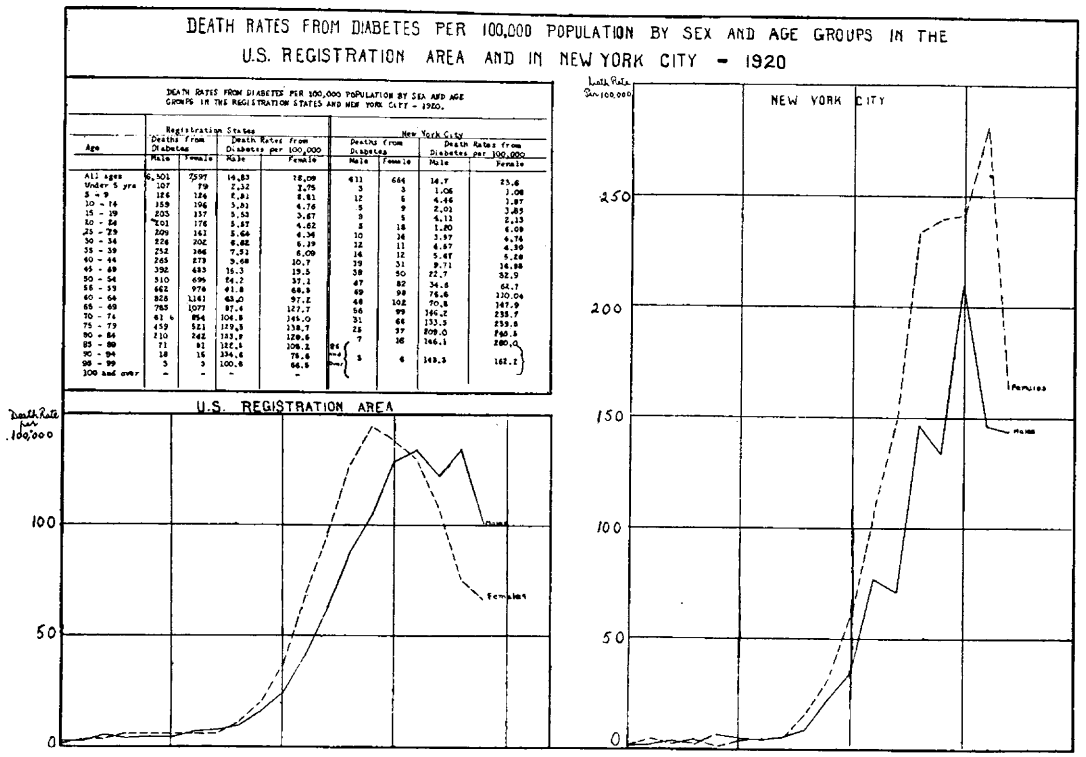


Chart 5.—Deaths from diabetes by sex and five year age groups, New York City.

In Table 10 and Chart 5 where the experience of the Registration States and of New York City is compared by five year age groups for 1920, it is made clear that after the age of 40 women show higher diabetes death rates, except that males in the Registration Area over 80 years of age again take the lead.

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TABLE 10.—*Death Rates From Diabetes per Hundred Thousand Population by Sex and Age Groups in the Registration States and New York City, 1920*

	Registration States				New York City*			
	Deaths from Diabetes		Death Rates from Diabetes per 100,000		Deaths from Diabetes		Death Rates from Diabetes per 100,000	
Age	Male	Female	Male	Female	Male	Female	Male	Female
All ages	6,301	7,597	14.83	18.09	411	664	14.7	23.6
Under 5	107	79	2.32	1.75	3	3	1.06	1.08
5 to 9	126	124	2.81	2.81	12	5	4.46	1.87
10 to 14	159	196	3.81	4.76	5	9	2.01	3.65
15 to 19	203	137	5.53	3.67	9	5	4.11	2.13
20 to 24	201	176	5.57	4.62	3	18	1.20	6.08
25 to 29	209	161	5.64	4.34	10	14	3.57	4.74
30 to 34	226	202	6.62	6.19	12	11	4.57	4.39
35 to 39	252	186	7.51	6.09	14	12	5.67	5.28
40 to 44	265	273	9.68	10.7	19	31	9.71	16.88
45 to 49	392	433	15.3	19.5	38	50	22.7	32.9
50 to 54	510	695	24.2	37.1	47	82	34.6	62.7
55 to 59	662	978	41.8	68.3	69	98	76.6	110.04
60 to 64	828	1,161	63.0	97.2	48	102	70.8	147.9
65 to 69	783	1,077	87.4	127.7	56	99	146.2	233.7
70 to 74	616	854	104.5	145.0	31	66	133.5	239.5
75 to 79	459	521	129.3	138.7	25	37	209.0	240.5
80 to 84	210	242	133.9	129.5	7	16	146.1	280.0
85 to 89	71	81	122.3	108.2	85 yr. and over	3	6	143.3	162.2
90 to 94	18	15	134.6	75.6				
95 to 99	3	3	100.8	66.5				
100 and over	..	..	..	..				

* The rates calculated on population groups as recorded in 1920, U. S. Census, and deaths from diabetes, as reported by New York City Department of Health.

Table 11, dealing with the population of the Registration States of 1900 for the years 1900, 1910 and 1920, as well as Chart 6 for the years from 1910 to 1920, add more convincing evidence of the predominant and increasing hazard of diabetes among women and particularly among those over 45 years of age.

TABLE 11.—*Death Rates from Diabetes per Hundred Thousand Population in the Registration States, 1910* *

	Both Sexes			Males			Females		
Age	1920	1910	1900	1920	1910	1900	1920	1910	1900
All ages: Adjusted	18.7	16.6	10.4	15.9	15.0	10.8	21.0	17.9	10.1
Crude	20.6	17.6	11.0	17.3	15.8	11.3	23.9	19.5	10.7
Under 5	2.5	2.4	2.1	2.8	2.8	2.3	2.2	2.0	1.8
5 to 9	3.3	3.5	2.4	3.6	3.3	2.2	3.1	3.7	2.5
10 to 14	4.9	4.4	4.2	4.2	4.2	4.1	5.7	4.5	4.4
15 to 19	5.3	5.3	4.5	5.8	4.9	5.6	4.7	5.7	3.5
20 to 24	5.1	4.2	4.0	5.7	4.8	3.8	4.6	3.5	4.1
25 to 34	5.6	5.6	5.0	5.9	5.8	5.3	5.4	5.3	4.8
35 to 44	9.2	9.0	6.8	9.2	9.2	7.8	9.2	8.8	5.8
45 to 54	30.0	27.2	16.4	23.8	25.5	15.5	36.6	29.0	17.3
55 to 64	80.9	75.9	40.4	63.1	63.9	37.6	99.1	88.1	43.1
65 to 74	141.5	117.8	67.2	111.0	103.2	71.1	170.6	131.8	63.5
75 and over	153.1	118.6	68.9	149.2	103.4	88.3	156.3	131.5	51.9

* U. S. Census Bureau Mortality Rates, 1910-1920, p. 87.

Table 12 shows how with advancing life expectancy, and possibly also in parts as a result of improved skill in medical care and earlier detection of the disease, the median age at death of diabetics has been advanced in the Registration States 2.1 years among men and 4.4 years among women in the last twenty years (from 1900 to 1920).

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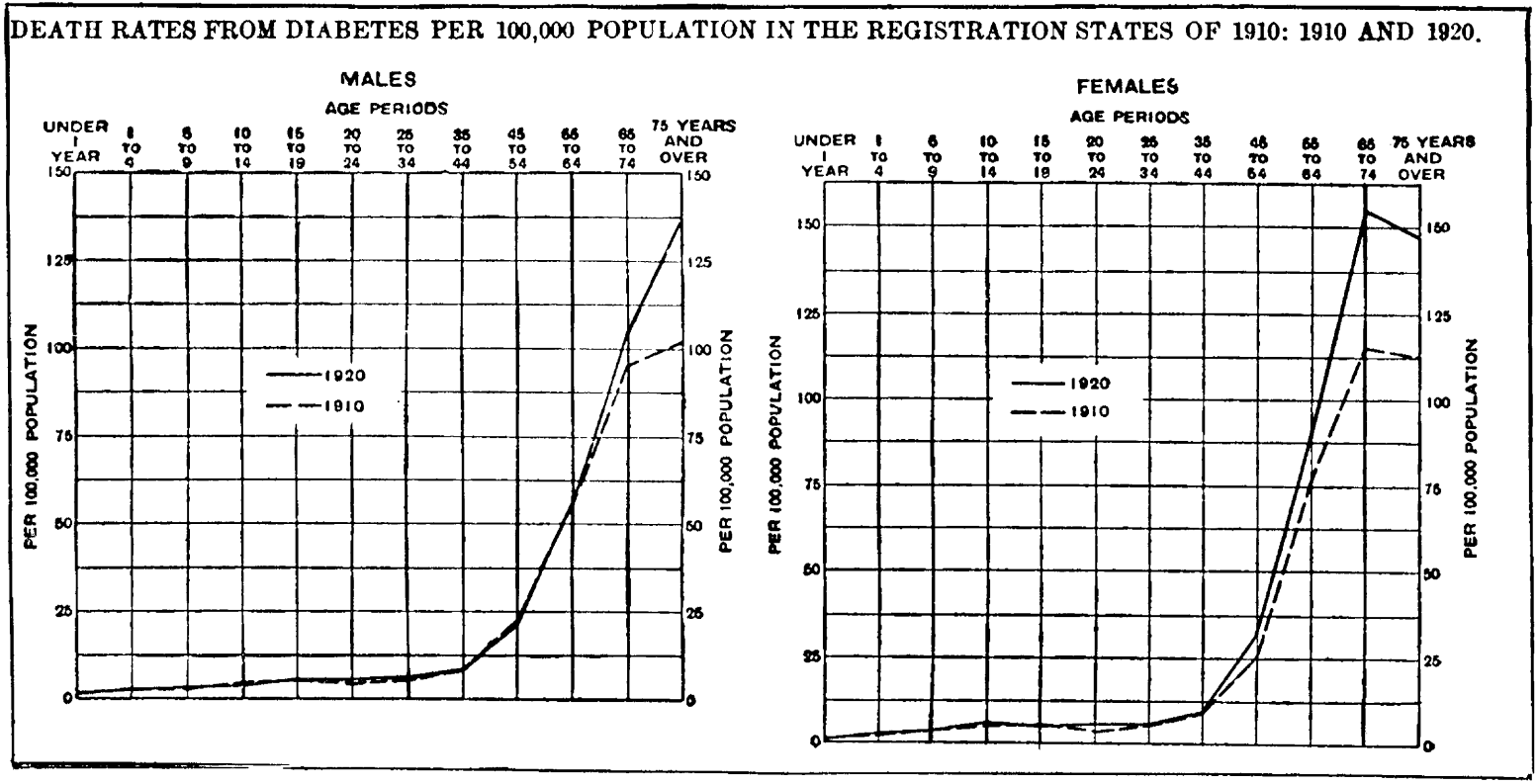


Chart 6.—Death rates from diabetes, by sex, in the registration states of 1910, in 1910 and 1920.

TABLE 12.—*Median Age at Death from Diabetes, by Sex, in the Registration States in 1900, 1910, 1920* *

Year	Both Sexes	Male	Female
1900	57.1	57.4	56.9
1910	59.4	57.9	60.4
1920	60.6	59.5	61.3

* U. S. Census Bureau Mortality Rates, 1910-1920, p. 139.

Averaging the five year experience of the United States for the periods from 1901 to 1905 and from 1911 to 1915 a similar picture is obtained (Table 13), although one which does not show such extreme differences between diabetes death rates of males and those of females, nor such high rates in the later decades of life as have prevailed in New York City.

TABLE 13.—*Death Rates from Diabetes per Hundred Thousand Population by Age Groups and Sex; Annual Averages of 1901-1905, and 1911-1915 in the Registration States of 1900* *

	Both Sexes		Males		Females	
Age	1911-1915	1901-1905	1911-1915	1901-1905	1911-1915	1901-1905
All ages: Adjusted	17.6	12.1	15.7	11.8	19.7	12.3
Crude	19.0	12.7	16.8	12.3	21.3	13.1
Under 5	2.1	2.1	2.2	2.2	1.9	2.0
5 to 9	3.1	3.1	3.0	2.8	3.3	3.4
10 to 14	4.8	4.7	4.2	4.7	5.4	4.7
15 to 19	4.9	3.9	5.1	4.8	4.6	3.0
20 to 24	4.9	3.3	5.6	3.5	4.3	3.1
25 to 34	5.7	5.0	6.1	5.7	5.3	4.3
35 to 44	9.3	7.6	9.2	8.1	9.5	7.1
45 to 54	28.8	19.9	25.4	19.0	32.4	21.0
55 to 64	78.4	50.0	67.2	44.1	89.7	55.9
65 to 74	131.8	80.6	107.6	76.8	154.7	84.3
75 and over	133.0	80.7	123.4	84.8	140.9	77.2

* U. S. Census Bureau Mortality Rates, 1910-1920, p. 87.

The facts before mentioned revealed by mortality statistics are particularly worth bearing in mind, when one recalls the common clinical experience that more men than women are treated for diabetes while more women than men die of this disease, in a standard population unit. This is usually explained by the fact that men more frequently submit themselves to medical examination for insurance and employment purposes, in the interest of the companies concerned or as a measure of health protection for their own sakes.

That changes in death rates from diabetes have been in process in recent years in England, and that important differences prevail between the rates for the two sexes can be readily seen by the following table, taken from the Seventy-Fifth Annual Report of the Registrar-General of England and Wales, Part III, Registration Summary Tables 1901 to 1910, p. 209.

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TABLE 14.—*England and Wales: Annual Mortality from Diabetes Mellitus in Successive Decenniums, 1861-1910 per One Million Living at all Ages*

Year	Males	Females	All Persons
1861-1870	43	21	32
1871-1880	54	28	40
1881-1890	74	46	59
1891-1900	90	64	77
1901-1910	104	84	93

In distinction from the experience related in the foregoing for the United States Registration Area, the latest as well as the earliest decade reported for England and Wales shows a higher death rate from diabetes among males than among females, but it is worth noting that in a period of fifty years the death rate of females has increased in 1910 to four times their rate in 1861, while the 1910 rate for males is only 2.4 times their rate of 1861.

ANALYSIS BY RACE

Next to age and sex, race stock is often found to bear directly on susceptibility to a disease, or determine the fatality rate. Diabetes, often called "Judenkrankheit," because of its frequent occurrence among those of Semitic stock, appears to show at least as marked differences in persons of white and colored races and among people of the various nations who make up our population as have been found in tuberculosis.

TABLE 15.—*Adjusted Death Rates from Diabetes per Hundred Thousand Population According to Country of Birth of Mother**

Country of Birth of Mother	New York State	Pennsylvania	New York City	Chicago	Philadelphia
Ireland	23.8	17.4	26.0	24.8	18.9
Germany (and German Poland)	29.5	21.3	35.3	22.4	20.9
England, Wales and Scotland	19.5	19.2	21.4	....	....
Italy	19.3	9.1	19.7	....	....
United States	15.7	16.4	17.1	19.4	16.2

* U. S. Census Bureau Mortality Rates, 1910-1920, p. 92.

In Table 15 calculations of the Census Bureau are offered, by birth of mother as a basis of race stock, from which it will be seen that in New York City the highest diabetes death rate is found among people of German or Polish stock (preponderantly Jewish). Since the stock other than white, colored or "other" (Chinese, etc.) is not entered on the death certificate, and tabulations have not been made according to religion of the deceased, it is impracticable to use even the most carefully made estimates of Jewish elements in the population of New York City or of other parts of the United States as a wholly reliable basis for calculation of death rates by race from the registrar's records. The deaths from diabetes for the year 1922 in New York City have been

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tabulated according to nativity of the deceased, for foreign born whites and for native born of foreign parentage, but the percentage of Jewish persons among people coming from various countries contributing immigrants in large numbers of the United States varies too widely to permit a calculation with reasonable accuracy of the number of Jews in these two groups, to serve as a basis of racial death rates. Table 16 gives the facts as recorded.

The high death rates of 101 for Germans and seventy-five for Austrians indicate more the racial liability of the Jews from these countries living in New York than any special hazard of other races claiming these countries as their birthplace. In certain groups of

TABLE 16.—*Deaths from Diabetes, New York City; Nativity of Deceased and Rates per Hundred Thousand Population of Different Nationalities (Census 1920)*

	Nativity of Deceased	
Birthplace	Deaths	Death Rate
United States: Negroes	31	70
White	536	15
Ireland	106	52
Germany	196	101
Italy	98	25
Russia	203	42
England	28	39
Austria	95	75
Hungary	29	45
Scotland	11	51
British America	10	40
France	12	52
Roumania	21	55
Poland	16	11
Sweden	14	42
Norway	2	8
Denmark	4	44
Other West Indies	3	34
Greece	2	9
Other foreign	31	28
Total	1,448	24.8

Jewish people it is probably true in New York City that the diabetes death rate among them exceeds their tuberculosis death rate.

We can, however, show a very interesting correlation for both New York City and Boston between the increase in the percentage of Jews in the population over a period of years, and the increase in diabetes death rates for the same years in these two cities, in Table 17.

It certainly would seem to be more than an unrelated coincidence that a city of the United States, with more than half of all the Jews of the country, and at present including Jews to the extent of not less than 29.23 per cent. of its population, has shown in the last thirty years a greater increase in diabetes death rates than any other large city in the country and a percentage increase of rate running closely parallel with the percentage of difference in the Jewish element in the population.

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TABLE 17.—*Death Rates from Diabetes in Relation to Percentage of Jews in Population*

	New York City		Boston	
	Jews in Population,* per Cent.	Diabetes Death Rate per 100,000 Total Population	Jews in Population,† per Cent.	Diabetes Death Rate per 100,000 Total Population†
1890	11.98	8.0	...	....
1897	.....	....	4.3	12.2
1900	17.39	10.0	4.8	13.7
1910	26.28	16.0	8.8	21.4
1913	.....	....	8.9	21.3
1920	29.23	18.9	...	....
Percentage of increase...	144	136	107	74

* American Jewish Year Book, 1923-1924; Greater New York 1920, N. Y. C. 1920 Census Committee, p. 838.
† Morrison: Boston M. & S. J. **175**: 54, 1916.

A valuable piece of evidence as to the special hazard of diabetes among the Jews is to be found in a study by Billings [3] of vital statistics of 60,630 persons in selected Jewish families throughout the United States, among whom he shows that of certain important diseases, diabetes had a much higher rate in Jews than among the general population. The ratios calculated from his records show deaths from diabetes to be seven times as common in Jewish males in 1889 as in males in the general population of 1880, with the corresponding ratio for females of 16 to 1.

Until we have reported by physicians cases of diabetes by age, sex, race and occupation on the occasion of establishing a diagnosis, we shall hardly be able to give much more reliable evidence than this of the exact excess liability of Jews to this disease. Any individual clinical experience, however large, can never be free from a certain accidental selection as to source of patients which cannot be trusted to run parallel with the race distribution in the population of the community. We do not know the extent to which what may be a true racial susceptibility affects the death rate from diabetes among the Jews. Sedentary occupations, unsuitable dietary habits, luxurious living, disinclination to indulge in physical exercise, a marked tendency to obesity in men and women among the Jews, particularly after 45 years of age, may well be more definite etiologic factors in the apparent excess of diabetes death rates among the Semitic people than their race.

Among the many variable factors in the study of the influence of race stock, body weight is one which lends itself to exact measurement. For this purpose we have analyzed the weights of a group of 1,429 male industrial workers, all painters, 1,170 of them Jewish, 259 non-Jewish, where age, height and body weight have been recorded accurately in the course of a careful medical examination. In Table 18 the number of

3. U. S. Census Bulletin, No. 19, Dec. 30, 1890.

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men in each year, aged from 25 to 55, for which we have the largest number of records, is given, with the sum of the pounds of weight above the normal and those below the normal in each age group, using as normal the weights of the Medico-Actuarial Mortality Investigation, 1912. It appears from this tabulation taking all age groups together, that there is an average of 18.1 pounds overweight among the Jewish painters, and 20.5 pounds overweight among non-Jewish, or viewed in

TABLE 18.—*Number of Men Overweight, from Actuarial Mortality Investigation*

	Jews				Non-Jews			
Age	Number Over-weight	Total Pounds Over-weight	Number Under-weight	Total Pounds Under-weight	Number Over-weight	Number Pounds Over-weight	Number Under-weight	Total Pounds Under-weight
25	11	207	3	32	4	36	2	15
26	9	120	6	64	1	23	4	58
27	20	351	10	60	4	116	1	18
28	22	364	10	100	4	69	5	47
29	28	480	27	267	5	80	2	14
30	30	513	16	180	5	68	1	18
31	20	356	11	96	5	52	1	10
32	30	485	20	154	5	95	3	24
33	24	485	15	142	5	160	4	32
34	39	711	21	213	8	142	2	26
35	35	680	17	146	5	121	2	8
36	26	479	24	238	8	190	2	23
37	34	574	23	206	3	60	2	14
38	32	680	27	220	4	44	4	40
39	25	574	21	277	6	110	4	88
40	34	663	25	232	7	197	6	149
41	20	456	10	97	2	29	1	18
42	26	366	24	318	2	40	13	213
43	19	397	14	217	3	35	6	96
44	11	118	11	156	6	114	2	31
45	15	337	9	116	4	38	4	65
46	16	285	10	117	5	90	2	17
47	11	282	5	76	3	62	4	53
48	13	153	8	126	4	101	3	38
49	11	167	11	107	1	17	4	47
50	10	191	9	87	3	91	2	60
51	5	95	3	51	2	105	2	25
52	6	91	3	36	2	76	4	25
53	2	13	4	74	..	...	1	15
54	4	61	2	13	2	50	2	38
55	2	28	5	95	1	38	..	..
Total	590	10,702	404	4,313	119	2,449	95	1,325

Average number of pounds overweight: Jews, 18.1; non-Jews, 20.5.
Average number of pounds underweight: Jews, 10.6; non-Jews, 13.9.
Percentage of men overwieght: Jews, 58; non-Jews, 54.
Percentage of men underweight: Jews, 40; non-Jews, 43.

another form, 58 per cent. of the Jews are overweight and 54 per cent. of the non-Jewish. That is, the overweight is not peculiar to the men of Jewish race in this group. Further study of similar records is required before definite conclusions can be reached. Occupation and economic state rather than race would seem from this to be the determining factors in overweight among men.

In a study of 3,100 men and women working in the needle trades (96.7 per cent. of the males and 88.8 per cent. of the females being

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Jews), Schereschewsky [4] et al. give data from which the following general statement may be made, namely, that the males in this employed group differ on the average hardly at all in weight, for age and height, from men of the same specifications as found by the Medico-Actuarial Investigation, while the women among the garment workers are, on the average, taking into account age and height, ten pounds heavier than women of similar specifications in the country at large.

Davenport,[5] in the conclusions of his monograph on Body Build and its Inheritance, says "There are geographical differences in build; the heavy build of northern peoples may be due to a physiologic reaction or, in part, to a selective survival of the fleshier individuals or strains.

"The diseases associated with very slender and slender build are: tuberculosis, pneumonia, "nervousness," melancholia. The disease associated with the very fleshy or fleshy build are: diabetes, nephritis and dropsy, apoplexy, and arteriosclerosis and paralysis accompanying it, also numerous diseases of the alimentary tract."

At the other end of the scale of rates from those for the Jewish race, apparently are the negroes, and for these we have a reasonably accurate basis of their population, while among them, owing partly to economic reasons, and partly to lack of education, medical services are apt to be less prompt and less efficient than with other groups of our communities.

The diabetes death rate among negroes is everywhere lower than among the whites of the same region, but it is noticeable that their rate is higher in the cities of the Registration Area and in New York City than in rural areas (Table 19). The difference between rates among the colored and those of the white portion of the population is less in cities than in the rural areas and less in 1920 than in 1910.

In most of the states where rates are reported for white and colored, those for the whites are higher than those for the colored, the most striking contrast being for Florida, with a rate of 11.6 for the white and 3.6 for the colored.[6]

It is not perhaps irrelevant to recall that the highest tuberculosis death rates in the cities of the United States have commonly been found among the negroes and the lowest among the Jews. In diabetes the reverse seems to be the case.

Concepcion,[7] in commenting on the mildness of diabetes among the Filipinos and Japanese where the disease is much more common among

4. Schereschewsky: The Health of Garment Workers, Bull. 71 U. S. P. H. Service, 1915.

5. Davenport: Carnegie Institution of Washington, 1923, December, p. 152, et seq.

6. U. S. Census Bureau Mortality Rates, 1910-1920, p. 89.

7. Concepcion, I.: Incidence of Diabetes Mellitus Among Filipinos, J. Philippine Island M. A. **2**:57 (March) 1922.

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TABLE 19.—*Death Rates from Diabetes per Hundred Thousand Population in Registration States, by Race, 1920 and 1910*

Area and Year	Death Rates from Diabetes per 100,000 Estimated Population*			Percentage of Rate for Colored Less Than That for White
	Total	White	Colored	
Registration Area				
1920†	16.1	16.8	7.9	52.9
1910	14.9	15.3	7.0	54.2
Registration States ‡				
1920	16.2	16.9	8.0	52.6
1910	15.2	15.5	7.1	54.1
Cities in Registration States ‡				
1920	19.4	19.7	13.6	30.9
1910	16.8	17.1	9.7	43.2
Rural Sections of Registration States				
1920	13.1	14.1	5.2	63.1
1910	13.5	13.7	3.2	76.6
Registration Cities in Registration States				
1920	11.4	12.8	7.0	45.3
1910	12.6	13.4	6.9	48.5
All Registration Cities ‡				
1920	19.1	19.6	12.7	35.2
1910	16.0	16.4	8.3	49.3
New York City	22.9	23.2	13.7	40.9

* Population estimated by arithmetic method to July of each year based on Federal census of April 15, 1910, and Jan. 1, 1920.
† Exclusive of Hawaii.
‡ Includes District of Columbia.

the males of the population than among the females, suggests that the orientals, particularly the Chinese, stand nervous shock better than occidental races and further that the excessive activity of the latter peoples predisposes to their higher diabetes death rates.

However, he offers little but opinion to support any such thesis and then calls attention to the largely carbohydrate diet of the Filipinos as justifying the expectation of a high diabetes rate among them, without relating the character of the diet to its total caloric content or the estimated need of calories per capita per day under the conditions of occupation, temperature and clothing which prevail among these people.

OCCUPATION

Of the 493 deaths from diabetes in 1922 in New York City for which occupation was recorded, the order of frequency by occupation, as well, as the facts for these by age and sex of the deceased, is given in Table 20.

Due to the fact that the record of deaths from diabetes by occupations in New York City is not uniform with the enumeration of the population by occupations as recorded by the federal census, any calculation of the specific death rates for certain occupational groups is of doubtful reliability and very crude. Tables 20 and 21 present all the information which seems to have any value for the city of New York, so far as death rates for diabetes in various occupational groups is concerned.

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The term merchant, which heads the list of occupations with the largest number of deaths, includes all variety of proprietors of merchandizing stores, a great majority of whom in New York City are Jews.

The very crudity of the information in this field of mortality statistics for any community or state of the United States is sufficient

TABLE 20.—*Deaths from Diabetes by Occupation, Sex and Age, New York City, 1922*

Occupation	Total	Sex		Age				
		Male	Female	15 to 24	25 to 34	35 to 44	45 to 64	65 and Over
Merchants	72	70	2	..	..	5	37	30
Clerical	56	46	10	8	7	5	28	8
Laborers	46	46	..	1	3	4	26	12
Personal service	45	30	15	1	3	5	27	9
Clothing workers	42	37	5	1	1	3	28	9
Other trades	40	35	5	4	5	1	19	11
Salesmen	30	29	1	1	1	2	16	10
Railway and boats	15	15	..	1	..	4	7	3
Carpenters	12	12	..	..	2	1	5	4
Newspaper writers	11	11	..	1	1	5	3	1
All building work	9	9	..	..	..	2	6	1
Bartenders	9	9	..	1	..	2	3	3
Bakers	9	9	..	1	1	1	5	1
Teachers	9	3	6	..	..	1	4	4
Printers	8	7	1	..	..	1	4	3
Shoemakers	7	7	..	..	..	..	5	2
Painters	6	6	..	..	1	..	5	..
Clergymen	6	6	..	..	..	..	4	2
Peddlers	5	5	..	..	..	1	2	2
Policemen	5	5	..	..	..	2	2	1
Chauffeurs	5	5	..	..	1	3	..	1
Butchers	5	5	..	..	..	..	2	3
Cigarmakers	5	2	3	1	..	..	4	..
Mechanics	5	5	..	..	..	..	5	..
Managers	4	3	1	..	..	..	3	1
Physicians	4	4	..	..	..	..	3	1
Plumbers	3	3	..	..	..	..	1	2
Bankers	3	3	..	..	..	..	..	3
Undertakers	2	2	..	..	..	..	1	1
Trained nurses	2	..	2	..	..	1	..	1
Lawyers	2	2	..	..	..	..	2	..
Civil employees	2	1	1	..	..	..	1	1
Machinists	2	2	..	..	..	1	1	..
Furriers	2	2	..	..	..	1	1	..
Blacksmiths	1	1	..	..	..	..	1	..
Electrician	1	1	..	..	..	1	..	..
Fireman	1	1	..	..	..	..	1	..
Letter carrier	1	1	..	..	..	..	1	..
Civil engineer	1	1	..	..	..	..	1	..
Street cleaner	..	..	..	..	..	..	..	..
Totals	493	441	52	21	26	52	264	130
Total diabetes deaths recorded in 1922	1,448	581	867					

This does not include thirty-five deaths under 15 nor the deaths of women where occupation was given as that of housewife or other than as specified in the list above (815), nor of 140 men whose occupation was given as other than as specified in list.

reason for calling attention to the few reasonably adequate sources of information on this subject, in the literature of other countries.

The most reliable information is to be found in the supplement to the seventy-fifth Annual Report of the Registrar-General of England and Wales, Part IV, Mortality of Men in Certain Occupations. This report of the registrar's office deals with 132 specified occupations for males, among whom those occupied and retired of all ages from 25 to

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65 years, inclusive, were enumerated in the census and among whom deaths have been tabulated by standard causes. Among thirty-one of these occupations or occupational groups the number of deaths from diabetes in all the males of all 132 occupations are represented in the deaths in the thirty-one occupation groups chosen for reporting here.

In Chart 7 will be found arranged in order the comparative mortality figures as calculated in the Registrar's report, those of the thirty-one occupations selected because of showing fifty or more deaths from

TABLE 21.—*Death Rates from Diabetes in the Chief Reported Occupations, New York City, 1922*

Occupation	Number Reported U. S. Census		Estimated Round Numbers		Diabetes Deaths		Death Rate from Diabetes per 100,000	
	Male	Female	Male	Female	Male	Female	Male	Female
Merchants	.....	.....	.....	.....	70	2	..	..
Clerical	137,283	68.949	140.000	70.000	46	10	33	14
Laborers	.....	.....	.....	.....	46	..	..	..
Personal service (entire class)	149,623	156,667	150,000	158,000	30	15	20	9
Laborers, domestic and personal service	1,515	.....	1,600	.....	..	..	..	..
Clothing workers (semi-skilled operators in clothing industries)	67,865	67,817	68,000	68,000	37	5	56	7
Salesmen (in stores)	87,658	.....	90,000	.....	29	1	32	..
Railway and boats	.....	.....	.....	.....	15	..	..	..
Transportation (entire class)	218,368	.....	220,000	.....	..	..	..	..
Carpenters	42,478	.....	44,000	.....	12	..	27	..
Newspaper writers	.....	.....	.....	.....	11	..	..	..
Editors and reporters	3,364	.....	4,000	.....	..	..	..	..
All building work								
Laborers	22,959	.....	24,000	.....	..	..	..	..
Semiskilled operators	1,292	.....	1,300	.....	..	..	..	..
Apprentices to bldg. tr.	5,076	.....	6,000	.....	..	..	..	..
Bartenders	5,406	.....	5,000	.....	9	..	180	..
Bakers	15,510	.....	16,000	.....	9	..	56	..
Teachers (school)	6,048	27,546	7,000	28,000	3	6	43	21
Printers	8,094	5,428	9,000	6,000	7	1	78	17
Shoemakers	8,062	.....	9,000	.....	7	..	78	..
Painters	25,439	.....	26,000	.....	6	..	23	..
Clergymen	4,037	.....	5,000	.....	6	..	120	..
Peddlers	.....	.....	.....	.....	5	..	..	..
Policemen	11,725	.....	12,000	.....	5	..	52	..
Chauffeurs	49,185	.....	50.000	.....	5	..	10	..
Butchers (in slaughter houses)	1,627	.....	1,700	.....	5	..	..	..
Cigarmakers	7,463	6,012	8,000	7,000	2	3	25	43
Physicians	9,449	.....	10,000	.....	4	..	40	..

diabetes in the three year period, as well as the mortality figure for all males of the population of England and Wales for from 25 to 65 years of age, and for all occupied and retired males of these countries to serve as a level above and below which there are striking variations in mortality figures. Those listed as farmers, etc., do not include agricultural laborers, but constitute the category of farm owners and operators who are not only better off financially but, on the average, about twenty years older than the agricultural laborers who show a maximum number at the age of 25, while the farmers are most numerous at 45.

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The agricultural laborers show the lowest age grouping of all the occupations listed.

The category, railway guards, etc., is exclusive of engine drivers who constitute a small and highly selected class.

The category, coach, omnibus service, etc., is exclusive of motor drivers and chauffeurs.

It will be noted that those occupations which in the main receive relatively low return for their labor, and in which a very considerable amount of bodily exercise is necessary, have a mortality figure at or

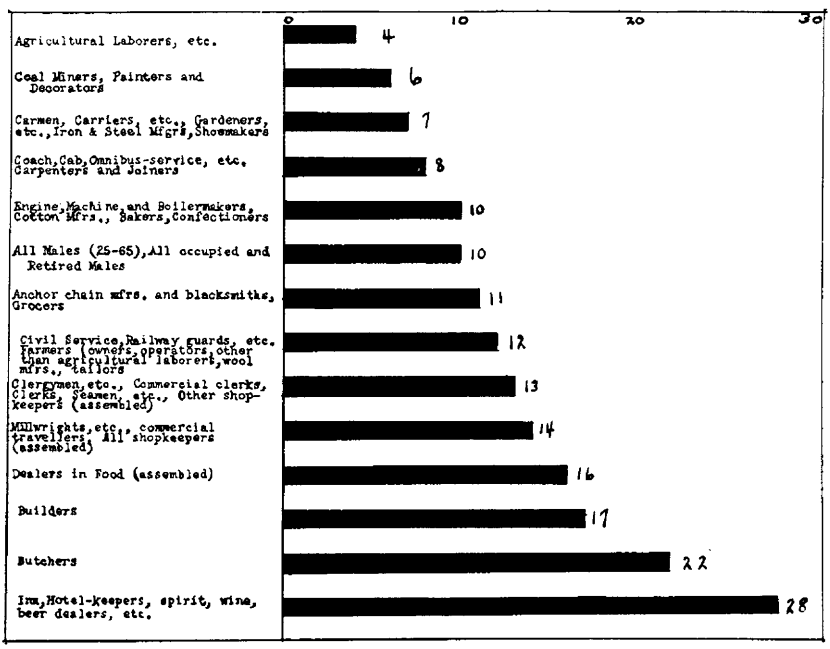


Chart 7.—Comparative mortality figures for diabetes of men between the ages of 25 to 65 years, in certain occupations in England and Wales, 1910-1912; figures to right of columns death rate per hundred thousand.

below the figure for all males of the same ages, whereas most of the occupations showing a higher mortality figure do not require much physical exertion and are relatively better paid.

When the same basic data are presented by the Registrar in what he alludes to as social classes, which are really broad general groups by industries or occupations, not by relative incomes, the mortality figures in Table 23 are found [8] expressed in death rates per hundred thousand.

8. Supplement to the Seventy-Fifth Annual Report of the Registrar-General for England and Wales, Part IV.

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TABLE 22.—*Comparative Mortality Figures for Diabetes, Occupied and Retired Males Aged from 25 to 65 Years, by Social Classes, England and Wales, 1910-1921*

I	Upper and middle classes	14
II	Intermediate, excluding unoccupied	14
III	Skilled workmen	9
IV	Intermediate	8
V	Unskilled workmen	8
VI	Textile workers	11
VII	Miners	6
VIII	Agricultural laborers *	4

* Most of these are in a young age group.

The best information on this subject for French experience is presented by Bertillon [9] in his paper on Mortality and the Causes of Death According to Occupation, from which the following is quoted:

Diabetes is very common among the following occupational groups:

1. In the learned professions, especially among lawyers and doctors. Pharmacists and clergymen have lower, though high rates. Lastly, teachers, architects and musicians have average rates.
2. Occupations exposed to alcoholism; inkeepers, brewers and maltsters.
3. Butchers.
4. Certain other professions (dyers, commercial travelers, commercial clerks, railway clerks).

On the other hand, diabetes is very uncommon in the following occupational groups:

1. Coachmen and drivers, notwithstanding they are proverbial drunkards.
2. Hand laborers of all kinds, such as dock laborers, porters, general laborers, although drunkenness is very common among them.
3. Railway workmen (workers on the road bed; guards, porters), but railway clerks and also engineers and firemen rise to or above the average.
4. Persons engaged in agriculture (except farm tenants, who are less favored than domestic servants on the farm), gardeners and farm laborers.
5. Several other manual occupations carried on in the open air (masons, shipbuilders).
6. Miners and quarrymen (except lead miners).

We find only average or insignificant figures in the metal working and textile industries, sedentary occupations, and those pursued on the water.

In the main, the French experience supports the report of the Registrar-General of England, to the effect that those occupations which involve hard manual and bodily labor show low diabetes death rates.

Various writers [10] have expressed themseleves to the effect that occupations involving nervous strain and worry show high prevalence of diabetes.

I am inclined to agree with Kober and Hayhurst (Industrial Health, 1924, p. 972) that such an inference is doubtful, especially when lacking any control information as to race, weight, height, age and dietary

9. Transactions of the Fifteenth International Congress on Hygiene and Demography **1**, Part II, pp. 364-366, 1912.

10. Thompson, W. G.: Occupational Diseases, p. 151. Dublin, L. I.: Causes of Death by Occupation, U. S. Dept. of Labor Bull. 207, 1917.

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habits of persons supposed to be suffering a nervous strain because of their occupations. The question of first importance is, whether such persons are not overeating and underexercising, a hygienic sin, particularly common among people of sedentary, highly skilled trade or professional occupations.

Among employees of the B. F. Goodrich Company, rubber manufacturing establishment,[11] and among the steel workers in a Pennsylvania city [12] diabetes for the ages and sexes of the groups concerned does not exceed its incidence in the general population.

Hoogslag [13] says of his 250 cases (ages from 10 to 79) that occupation was an unmistakable factor, in that conditions of work favoring corpulence favored diabetes. "Captains of passenger steamers are peculiarly predisposed, as they have to preside at meals and get little exercise. Lipogenous diabetes is found almost exclusively among the well to do. Diabetes among the thin is found in the rich and poor alike, in children and especially in brain workers and in those with much responsibility."

MARITAL STATE

The marital state of the deceased (single, married, widowed, divorced) in those over 15 years of age, sometimes coincides with distinct differences in death rates, and in Table 23 the death rates by sex for the four usual categories are shown for the city of New York for the year 1922.

TABLE 23.—*Death Rates from Diabetes per Hundred Thousand Population Over 15 Years of Age by Marital State and Sex, New York City, 1922*

	Both Sexes			Male			Female		
Marital State	Population 15 Years and Over	Deaths from Diabetes	Death Rate from Diabetes per 100,000	Population 15 Years and Over	Deaths from Diabetes	Death Rate from Diabetes per 100,000	Population 15 Years and Over	Deaths from Diabetes	Death Rate from Diabetes per 100,000
Single	1,472,967	138	9.4	784,924	73	9.3	688,043	65	9.4
Married	2,328,900	805	34.6	1,178,867	379	32.2	1,150,033	426	37.1
Widowed	342,215	463	13.5	81,432	106	13.0	260,783	357	13.6
Divorced	11,420	7	61.3	4,436	4	90.1	6,984	3	42.9
Not reported	16,993	...	....	12,997	...	....	3,996	...	....
Totals	4,172,495	1,413	33.8	2,062,656	562	27.2	2,109,839	851	40.3

Since we have not the ages of the persons whose deaths are here tabulated by marital state, speculation is idle as to the causative factors in these differences, and where the rates are astonishingly high, as among the divorced, the numbers of deaths, four for males and three

11. U. S. P. H. Report No. 50, **37**:3083 (Dec. 15) 1922.
12. U. S. P. H. Report No. 53, **35**, Dec. 31, 1920.
13. Hoogslag, W.: Nederlandsch. Tijdschr. v. Geneesk. **2**:1934 (Oct. 28) 1922.

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for females, are too small to justify any discussion. It may be that among divorced persons self-indulgence and the financial means to satisfy it are commoner than among other groups of the adult population.

SEASONAL VARIATION

The seasonal variation in the death rates of diabetes follows very closely the curve so generally observed in the cities and states of the northeastern United States for deaths from diseases of the respiratory

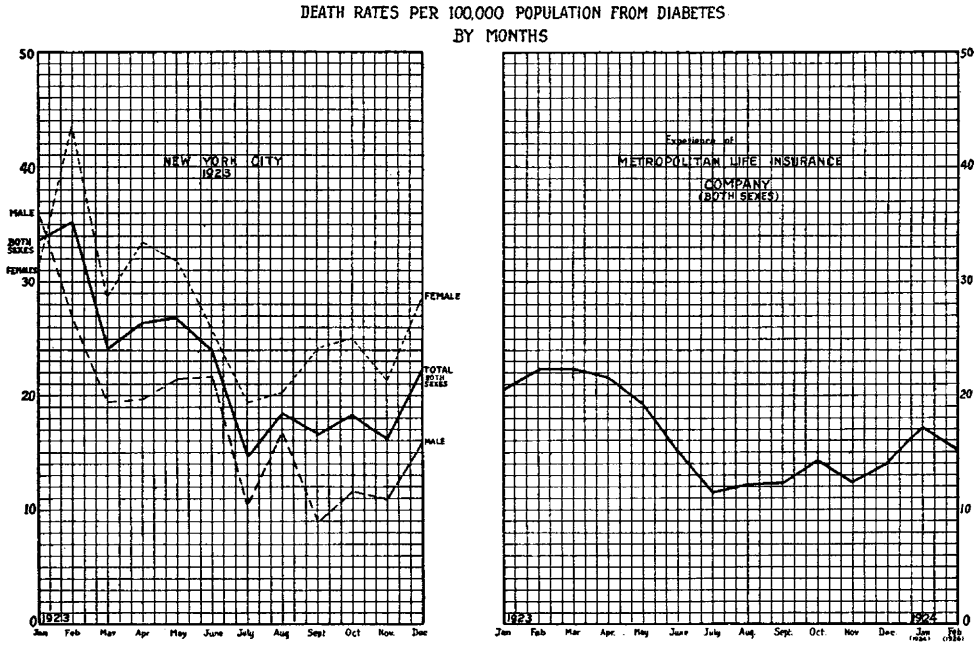


Chart 8.—Seasonal variation in death rates from diabetes

tract. Diabetes shows its highest death rates from January to May and its lowest rate in July among both men and women, in the population of New York City (1923), and among the industrial policy holders of the Metropolitan Life Insurance Company (for 1923, and two months of 1924) as can be seen in Chart 8 and Table 24.

While the intercurrent affections which have a similar seasonal variation in distribution may be wholly responsible for the month of death of diabetic patients, the temperature of the months in which the climate of New York imposes the smaller demands or burden on the heat production or food intake of the body may be the reason for the low death rate, regardless of the lower incidence of respiratory tract

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TABLE 24.—*Deaths and Death Rates per Hundred Thousand Population from Diabetes by Months, 1923*

Months, 1923	New York City						Industrial Experience Metropolitan Life Ins. Co.	
	Deaths			Death Rates				
	Total	Male	Female	Total	Male	Female	Deaths	Death Rates
January	169	91	78	33.5	36.1	30.9	230	20.3
February	160	61	99	35.2	26.8	43.6	229	22.3
March	121	49	72	24.1	19.4	28.6	256	22.3
April	129	48	81	26.4	19.6	33.5	243	21.6
May	134	54	80	26.7	21.4	31.8	226	19.2
June	116	53	63	23.8	21.6	25.8	173	15.1
July	74	26	48	14.6	10.3	19.4	137	11.5
August	93	42	51	18.4	16.8	20.3	145	12.1
September	81	22	59	16.6	9.0	24.2	143	12.2
October	92	29	63	18.2	11.6	25.0	174	14.3
November	79	27	52	16.1	11.4	21.4	149	12.5
December	112	40	72	22.2	15.9	28.6	174	14.1
Total (1923)	1,360	512	848	22.9	17.1	28.3	2,279	16.1
1924								
January							213	17.2
February							178	15.2

infections so usual between June and November. That there is a distinct seasonal liability to death among diabetic patients in the winter months cannot be doubted, whatever may be the cause.

GEOGRAPHICAL DISTRIBUTION

If we compare the death rates from diabetes in New York City with rates for the same years in other large cities of the United States we find not only wide variation in the rates in the several cities for any one year, but remarkable differences in the percentage of increase in the rates over a period of twenty-one years as recorded in Table 25.

TABLE 25.—*Death Rates from Diabetes per Hundred Thousand Population in Twenty Large Cities of the United States*

Cities	1900	1905	1910	1915	1920	1921	Average of Rates 1900-21	Per Cent. of Increase 1900-21
Baltimore	8.2	11.6	18.0	17.8	20.6	22.1	10.8	169
Boston	15.2	17.3	20.8	27.1	24.2	19.8	19.9	30
Buffalo	12.8	16.7	18.1	23.7	23.5	22.3	19.0	74
Camden	4.0	6.0	14.7	9.4	14.5	20.1	10.7	402
Chicago	6.7	11.4	15.8	17.6	20.4	20.3	14.4	203
Cleveland	4.4	7.6	13.3	16.5	17.2	17.1	12.2	288
Denver	12.7	12.3	11.7	18.2	19.7	15.6	14.3	23
Indianapolis	11.8	11.6	18.7	20.4	19.5	19.0	15.2	61
Kansas City, Mo.	4.3	8.9	11.2	15.6	13.4	18.7	11.2	335
Los Angeles	11.7	11.6	14.5	19.3	16.8	23.4	15.8	100
Minneapolis	6.4	15.3	10.6	17.4	23.1	20.9	13.5	226
Newark	13.4	12.7	21.8	20.3	22.7	18.4	17.4	37
New Haven	17.6	17.3	18.6	20.8	27.4	28.1	20.6	59
New Orleans	3.5	6.4	8.5	15.6	15.7	19.8	11.1	465
New York	11.4	16.4	18.7	24.1	23.4	24.1	18.7	111
Paterson	6.7	11.7	24.6	23.6	20.5	24.0	15.7	258
Philadelphia	8.4	13.9	16.1	18.7	18.1	19.1	14.7	127
San Francisco	14.3	19.2	21.7	25.2	21.9	25.0	21.1	75
St. Louis	5.7	10.4	12.9	18.7	16.1	21.1	13.9	270
Washington	7.5	15.4	16.5	18.5	15.1	17.4	15.3	132

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The cities which have had death rates from diabetes of over ten per 100,000 of population throughout the twenty-one years (from 1900 to 1921) show uniformly a lower percentage of increase in rate than do the cities which in 1920 had rates below ten, only Los Angeles and New York showing increases of 100 per cent. or over among the high rate cities, the others showing percentages of increases of 127 to 465 per cent.

TABLE 26.—*Death Rates from Diabetes per Hundred Thousand Population by States*

Average Rates 1900-1921		Rate 1921	
New Hampshire	20.2	New Hampshire	29.0
Vermont	20.1	Maine	26.0
Nebraska	20.1	Vermont	24.7
Oregon	19.2	New York	23.4
Rhode Island	18.7	Connecticut	22.2
New York	18.4	Oregon	21.2
Connecticut	18.4	California	20.3
Maine	18.4	Massachusetts	20.2
Massachusetts	18.1	New Jersey	19.7
Illinois	17.1	Rhode Island	19.7
California	16.6	Nebraska	19.5
Kansas	16.2	Minnesota	18.1
Ohio	15.8	Illinois	18.0
Wisconsin	15.4	Ohio	18.0
New Jersey	14.8	Wisconsin	17.5
Minnesota	14.8	Pennsylvania	17.3
Michigan	14.2	Maryland	17.1
Pennsylvania	13.9	Michigan	16.5
Missouri	13.8	Indiana	16.3
Maryland	13.6	Missouri	15.9
Indiana	13.4	Kansas	15.6
Washington	13.2	Washington	15.1
Utah	12.7	Delaware	14.6
Delaware	12.2	Colorado	14.3
Montana	11.4	Utah	14.3
Colorado	11.1	Florida	10.4
Virginia	8.9	Virginia	10.1
Florida	8.8	Montana	9.9
Kentucky	8.1	Louisiana	9.4
South Dakota	7.8	Kentucky	8.7
Louisiana	7.5	North Carolina	7.5
North Carolina	7.5	South Carolina	7.3
Tennessee	6.5	Tennessee	6.1
South Carolina	6.1	Mississippi	5.8
Mississippi	5.5	South Dakota not reported	
United States	14.29	United States	16.8

There is shown a tendency to greater uniformity of rates among these large cities at the 1921 higher rates than was the case in 1900. In 1900 only nine of the twenty cities had a diabetes death rate of over ten per 100,000 population, four having rates between three and five and no city a rate as high as eighteen. In 1921 all twenty cities showed rates of at least ten and five cities had rates of over eighteen per 100,000 of population.

The variation of death rates from diabetes among the thirty-five registration states during the years 1900 to 1921 and for the year 1921, arranged in order of descending rate, is seen in Table 26 and the graphic representation of these differences in 1921 in Chart 9.

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Three factors, capable of fairly exact expression which may throw light on the reasons for these variations, are the percentage of population of a state living at 45 years of age or over, in 1920,[14] the expectancy of life for the population of a state calculated for the end of the first

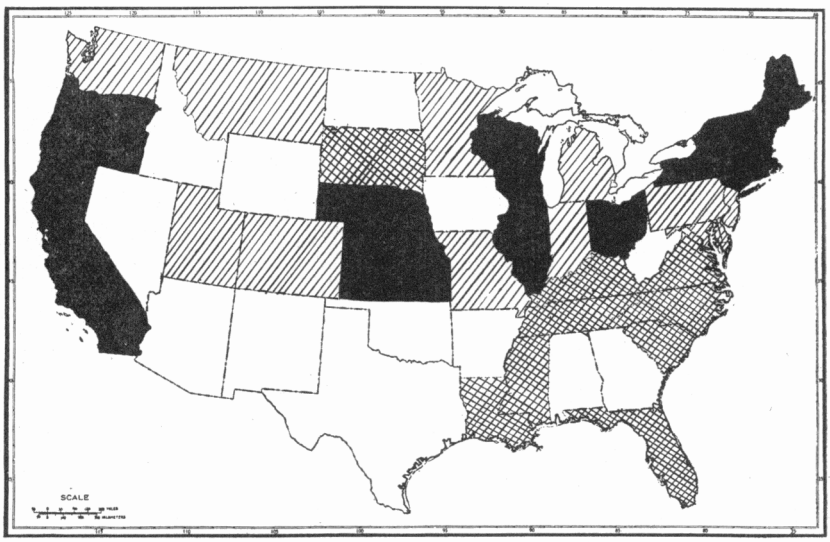


Chart 9.—Average death rates from diabetes, 1900-1921, by states; solid black, average of rates, 1900-1921, over fifteen per hundred thousand; parallel lines, average of rates, 1900-1921, from ten to fifteen per hundred thousand; crossed lines, average of rates, 1900-1921, below ten per hundred thousand, and white, no record.

TABLE 27.—*Percentage of Population Forty-Five Years and Over in United States Registration States, 1920*

	Per Cent.		Per Cent.
Vermont	28.5	Colorado	21.9
New Hampshire	28.5	Michigan	21.7
Maine	28.1	Illinois	21.6
California	26.1	New Jersey	21.1
Indiana	24.8	Pennsylvania	20.9
Oregon	24.4	Minnesota	20.7
Massachusetts	24.2	Nebraska	20.5
Delaware	23.7	Kentucky	19.9
Rhode Island	23.3	Florida	19.4
Ohio	23.2	Tennessee	18.6
Missouri	23.1	Virginia	18.5
Washington	22.7	Montana	18.4
New York	22.5	Utah	16.6
Kansas	22.4	Mississippi	16.3
Maryland	22.3	North Carolina	16.1
Connecticut	22.2	Louisiana	16.1
Wisconsin	22.1	South Carolina	14.4

year of life, in 1920,[15] and the per capita income of the population of a state in 1919.[16]

These facts are presented in Tables 27, 28 and 29.

14. U. S. Bureau of Census Report, **3,** 1920.

15. United States Life Tables, 1921.

16. Income in the United States, 1909-1919, National Bureau Economic Research.

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TABLE 28.—*Per Capita Income of States, 1919*

State	Per Capita Income 1919	Death Rate from Diabetes per 100,000, 1919	State	Per Capita Income 1919	Death Rate from Diabetes per 100,000, 1919
United States	$627	....	New Hampshire	$597	16.0
District of Columbia	884	17.8	Maine	583	20.9
New York	874	21.2	Indiana	581	16.5
Nevada	850	....	Minnesota	581	13.6
California	820	17.3	Wisconsin	557	15.1
Delaware	792	11.3	Texas	538	....
Wyoming	789	....	Missouri	535	13.9
Massachusetts	788	19.5	Oklahoma	534	....
Washington	786	15.4	Vermont	529	24.7
Illinois	765	15.9	Utah	517	11.2
New Jersey	758	17.4	North Dakota	515	....
Rhode Island	720	24.5	Montana	512	10.0
Connecticut	717	19.5	West Virginia	448	....
Oregon	711	21.1	South Carolina	437	6.0
Iowa	706	....	Louisiana	429	6.6
Michigan	704	15.7	Virginia	429	8.4
Nebraska	702	20.7	Florida	420	7.2
Ohio	689	16.3	New Mexico	408	....
Maryland	689	16.2	Georgia	394	....
South Dakota	685	....	Kentucky	392	7.8
Pennsylvania	683	14.5	North Carolina	383	6.2
Arizona	664	....	Arkansas	379	....
Colorado	639	10.8	Tennessee	365	6.6
Idaho	604	....	Mississippi	351	5.0
Kansas	602	15.2	Alabama	345	....

TABLE 29.—*Death Rate from Diabetes by States, Related to Age and Economic Factors*

State	Death Rates from Diabetes		Per Cent. of Population 45 Years and Over	Per Capita Income 1919	Expectancy of Life in First Year, 1920	
	1920	Av. 1900-21			Male	Female
New Hampshire	23.4	20.2	28.5	$597	.....	.....
New York	23.3	18.4	22.5	874	57.13	59.16
Maine	21.8	18.4	28.1	583	.....	.....
Connecticut	21.1	18.4	22.2	717	58.45	60.33
Massachusetts	20.9	18.1	24.2	788	58.93	60.32
Nebraska	20.7	20.1	20.5	702	.....	.....
Rhode Island	20.2	18.7	23.3	720	.....	.....
Vermont	19.6	20.0	28.5	529	.....	.....
Wisconsin	18.7	15.4	22.1	557	62.77	63.55
New Jersey	18.6	14.8	21.1	758	58.02	59.83
Illinois	17.9	17.1	21.6	765	59.19	60.81
Ohio	17.6	15.8	23.2	689	60.11	61.39
Oregon	17.5	19.2	24.4	711	60.73	62.30
Minnesota	17.3	14.8	20.7	581	61.86	62.97
California	17.1	16.6	26.1	820	57.75	61.12
Maryland	17.0	13.6	22.3	689	58.42	59.77
Kansas	16.6	16.2	22.4	602	63.14	63.48
Indiana	16.5	13.4	24.8	581	60.90	60.51
Michigan	16.3	14.2	21.7	704	59.76	59.48
Pennsylvania	16.3	13.9	20.9	683	57.93	59.68
Colorado	14.5	11.1	21.9	629	.....	.....
Washington	13.9	13.2	22.7	786	60.70	62.60
Utah	13.2	12.7	16.6	517	58.77	61.18
Missouri	12.1	13.8	23.1	535	60.32	61.56
Montana	10.8	11.4	18.4	512	.....	.....
Delaware	10.7	12.2	23.7	792	.....	.....
Virginia	9.3	8.9	18.5	429	60.75	61.22
Florida	8.8	8.8	19.4	420	.....	.....
South Dakota	....	7.8	18.0	685	.....	.....
Louisiana	7.8	7.5	16.1	429	.....	.....
North Carolina	7.7	7.5	16.1	383	61.25	60.72
Kentucky	7.5	8.1	19.9	392	60.97	60.05
Tennessee	6.2	6.5	18.6	365	61.54	60.77
South Carolina	6.2	6.1	14.4	437	59.54	60.40
Mississippi	5.8	5.5	16.3	351	.....	.....
United States	16.1†	14.29†	20.8*	627	59.38‡	60.63‡

* Continental United States.
† Registration states.
‡ Aggregate of states listed, 78 per cent. of total population.

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It will be seen that the high rates fall commonly in the states where either high age grouping of the population or high per capita income, or both are present. Where high expectancy of life is recorded for a state (1920) there is commonly a lower diabetes death rate than in states where life expectancy is shorter.

Concepcion [7] gives evidence of an irregular but considerable rise in diabetes mortality rates per 100,000 population in Manila, and relates this in a measure to the increase in per capita sugar consumption expressed in kilograms.

De Langen and Schut [17] say they find in Batavia that diabetes is particularly frequent among the idle rich.

Gajewski [18] reports from the Preuss. Statis. Landesamt. the gradual increase in death rates from diabetes until 1914 up to 9.54 the drop during the war years to 5.9 in 1918, the fall in the rate among

TABLE 30.—*Incidence of Diabetes Mellitus Among Filipinos*

Year	Death Rate from Diabetes per 100,000	Per Capita Sugar Consumption, Kilograms
1910	2.3	3.19
1911	0.9	11.09
1912	3.3	8.15
1913	0.8	17.46
1914	1.7	14.69
1915	2.1	18.18
1916	2.5	3.80
1917	3.8	17.90
1918	2.9	15.23
1919	4.2	26.19
1920	4.1	22.79

the women being greater than among the men, and the rise to 6.59 in 1921. These rates, taken together with original information copied directly from the official records in Berlin, are shown in Table 32, giving the experience for males and females in both urban and rural populations of Prussia for the years from 1906 to 1921.

Gajewski noted that where excess nutrition was prevalent before the war the diabetes death rate was highest, and that this rate fell less where food shortage during the war was slight than where there was serious privation.

The food shortage expressed itself not so much in the lack of sugar and carbohydrates as in lack of fats, which should make one suspect that it is not the quality but the gross quantity of food (calories) that plays the chief part in development of a high diabetes death rate in a community where more food is eaten than is required.

17. De Langen and Schut: Medelingen Borgelijken Genees. Diente in Nederland. Indie. **3**:63, 1918.

18. Gajewski, W.: Zur Sterblickeit au Zuckerkrankheit in Preussen seit 1891 nebst Anhang: die Eigensterblickheit der jüdischen Bevölkerung au Zuckerkrankheit im Jahre 1920., Med-statist. Nachr. **11**, III and IV, 1920.

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TABLE 31.—*Diabetes Death Rates per Hundred Thousand Population in Prussia, by Years, Rural and Urban Distribution and Sex, 1906-1921*

	Urban			Rural			Whole Country		
Year	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes
1906	11.97	8.62	10.28	3.98	2.88	3.42	7.57	5.49	6.52
1907	12.84	8.67	10.73	4.37	3.29	3.83	8.21	5.75	7.06
1908	13.92	9.74	11.83	4.62	3.45	4.03	8.84	6.32	7.56
1909	13.84	9.64	11.67	4.51	3.38	3 95	8.73	6.24	7.44
1910	15.06	10.49	12.74	4.59	3.41	4.01	9.33	6.33	7.98
1911	14.43	10.52	12.42	5.14	3.85	4.49	9.48	7.03	8.23
1912	14.41	10.71	12.51	5.25	4.37	4.82	9.58	7.44	8.48
1913	15.18	10.91	12.75 (13.0)*	5.76	4.67	5.21	10.23	7.69	8.96
1914	16.39	11.91	13.86 (14.1)*	5.97	4.97	5.22	10.97	8.09	9.54
1915	.....	.....	12.1 *	....	....	4.9 *	9.6 *	7.2 *	8.4 *
1916	.....	.....	11.3 *	....	....	4.5 *	8.8 *	6.7 *	7.8 *
1917	11.68	7.88	9.72	5.23	3.98	4.41	8.32	5.68	6.97
1918	.....	.....	8.1 *	....	....	3.9 *	7.3 *	4.7 *	5.9 *
1919	9.93	6.57	8.14	4.77	3.27	3.99	7.23	4.88	6.02
1920	9.87	6.73	8.23	4.63	3.56	4.08	7.21	5.17	6.14
1921	10.27	8.04	9.16	3.93	3.57	3.75	7.22	5.99	6.59

* Rates taken from Gajewski: Zur Sterblickheit an Zucker Krankheit in Preussen.

Through the courtesy of the office of the Surgeon-General of the Army, an interesting set of facts is offered with regard to the ratio of diabetes among drafted men ("Defects Found in Drafted Men") from the various states and regions of the United States. Tables 32, 33, 34, 35, 36 and 37 dealing with drafted men are based on the examination of approximately 2,000,000 of the 2,700,000 selective service men who were entrained for camps, and 549,099 who were rejected by the local boards as physically or mentally unfit for all forms of military service. Of this number 740 were found to have diabetes, and of these 725 were rejected as physically unfit for military service.

TABLE 32.—*Diabetes in Drafted Men*

State	No. of Cases	Ratio per 1,000	State	No. of Cases	Ratio per 1,000
Connecticut	44	1.23	Mississippi	10	0.27
Vermont	6	0.71	Virginia	14	0.25
Oregon	11	0.69	Washington	9	0.25
South Dakota	13	0.63	Minnesota	17	0.24
Maine	11	0.55	Missouri	20	0.23
Wisconsin	35	0.55	Ohio	33	0.23
Iowa	34	0.50	Montana	6	0.22
Arizona	4	0.48	North Dakota	4	0.22
Utah	5	0.42	Pennsylvania	45	0.22
Nebraska	12	0.41	Colorado	4	0.18
Maryland	15	0.40	Indiana	13	0.18
New York	101	0.39	Kansas	7	0.18
California	31	0.38	Idaho	2	0.16
District of Columbia	4	0.35	North Carolina	9	0.16
New Hampshire	3	0.35	Tennessee	9	0.15
Rhode Island	5	0.34	Wyoming	1	0.15
Illinois	57	0.32	Alabama	7	0.14
Massachusetts	29	0.32	Oklahoma	7	0.12
Nevada	1	0.30	Texas	12	0.10
New Jersey	22	0.29	Arkansas	4	0 09
West Virginia	11	0.28	Kentucky	6	0.09
Michigan	27	0.27	Florida	2	0.08
South Carolina	3	0.08	Delaware	..	....
Georgia	4	0.06	New Mexico	..	....
Louisiana	1	0.02	State not specified	10	0.11
Alaska	..	....			
Total				740	0.27

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TABLE 33.—*Diabetes Mellitus Distribution by Urban and Rural Communities*

	Number of Cases	Ratio per 1,000
Urban	315	0.22
Rural	425	0.20
New York City	61	0.43
Boston	6	0.30
Philadelphia	18	0.38
Chicago	31	0.38

TABLE 34.—*Diabetes Mellitus*

Groups	Total Cases	Ratio per 1,000	Groups	Total Cases	Ratio per 1,000
Agricultural, native white, North, 73% plus	48	0.45	Mountain whites	12	0.16
Agricultural, foreign and native white	115	0.39	Indian, sparsely settled	5	0.16
Agricultural, native white, South	63	0.15	Mexican, sparsely settled	5	0.18
Agricultural, negro, 45% plus	23	0.13	Native white, Scotch origin	4	0.07
Eastern, manufacturing	110	0.49	Russian, 10%	4	0.11
Commuters	23	0.31	Scandinavian, 10%	65	0 41
Mining	17	0.18	Finns, 10%	2	0.15
Sparsely settled, 3 or less per square mile	9	0.20	French Canadians, 10% plus	34	0.37
Desert	4	0.33	German and Scandinavian each 10% plus	49	0.50
Maritime	5	0.25	German and Austrian, 20% plus	24	0.24
Mountain	14	0.27	German and Austrian, 15% plus	125	0.36

TABLE 35.—*Diabetes Mellitus, April 1, 1917, to Dec. 31, 1919, Ratio per Thousand per Annum*

	Admissions		Deaths		Discharges		Days Lost	
By Race and Rank	Abs. No.	Rate	Abs. No.	Rate	Abs. No.	Rate	Abs. No.	Noneffective
Total	718	0.17	104	0.03	330	0.08	39.062	0.03
Officers	83	0.40	6	0.03	14	0.07	5,453	0.07
White enlisted	586	0.16	78	0.02	294	0.08	30,875	0.02
Colored enlisted	36	0.13	16	0.06	13	0.05	2,236	0.02
Color not stated	10	....	3	....	8	....	409	....
Native troops	3	0.08	1	0.03	1	0.03	89	0.01
Filipino	1	0.05	0	....	0	....	47	0.01
Hawaiian	1	0.18	0	....	1	0.18	0	....
Porto Rican	1	0.08	1	0.08	0	....	42	0.01
By country where serving:								
United States	501	0.22	73	0.03	264	0.12	23,379	0.03
Europe	196	0.12	28	0.02	59	0.04	14,695	0.02
Other countries	21	....	3	....	7	....	988	....

There are also presented the ratios of diabetes per 1,000 men per annum among the military personnel during the World War, and among the enlisted personnel of the Army for the decade of 1913 to 1922. The reader must be on his guard against comparing these ratios, which are based on incidence and admissions to sick call, with the death rates per 100,000 of population used very generally through the remainder of this study.

These records are of interest chiefly because of the wide geographic distribution of the basic material and the uniformity of examination, procedure and manner of life of the great mass of the men studied during the army experience. It is a matter of particular interest that the admission rates for diabetes for the ten years from 1913 to 1922

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TABLE 36.—*Admissions, Enlisted Men, Serving in the United States or Europe by States or Nativity; Ratio of Diabetes Mellitus per Thousand per Annum, April 1, 1917, to Dec. 31, 1919*

Alaska	0	....	Nebraska	13	0.30
Alabama	12	0.18	Nevada	2	0.41
Arizona	0	....	New Hampshire	2	0.15
Arkansas	6	0.10	New Jersey	4	0.04
California	8	0.08	New Mexico	1	0.08
Colorado	4	0.12	New York	61	0.18
Connecticut	5	0.11	North Carolina	14	0.21
Delaware	3	0.42	North Dakota	2	0.08
District of Columbia	1	0.06	Ohio	32	0.17
Florida	4	0.13	Oklahoma	4	0.05
Georgia	11	0.14	Oregon	5	0.18
Idaho	1	0.06	Pennsylvania	41	0.15
Illinois	44	0.19	Rhode Island	5	0.29
Indiana	16	0.17	South Carolina	9	0.19
Iowa	16	0.17	South Dakota	4	0.14
Kansas	15	0.25	Tennessee	6	0.08
Kentucky	10	0.14	Texas	15	0.10
Louisiana	10	0.17	Utah	0	....
Maine	1	0.04	Vermont	5	0.50
Maryland	6	0.13	Virginia	20	0.30
Massachusetts	14	0.12	Washington	1	0.02
Michigan	16	0.13	West Virginia	2	0.04
Minnesota	12	0.13	Wisconsin	14	0.15
Mississippi	14	0.29	Wyoming	1	0.09
Missouri	25	0.21	Others	89	....
Montana	2	0.06			
Total				608	0.17

TABLE 37.—*Diabetes Mellitus, U. S. Army, Enlisted Men; Admissions Ratios per Thousand per Annum*

	White				Colored		Native	
	U.S.	P. I.	Hawaii	Panama	U. S.	P. I.	Scouts	P. R.
1913	0.21	0.11	....	1.25	....	....	....	....
1914	0.15	....	....	....	....	....	....	....
1915	0.21	....	....	....	....	....	....	....
1916	0.18	0.19	....	0.29	1.21	....	....	....
1917	0.18	0.11	....	0.25	0.08	....	....	....
1918	0.20	0.18	0.18	0.12	0.16	....	0.17	0.12
1919	0.23	0.26	....	....	0.15	....	....	....
1920	0.16	0.11	....	0.45	....	....	0.14	....
1921	0.10	....	0.15	....	0.32	....	....	....
1922	0.16	....	0.20	0.15	....	....	....	0.37

show such slight variations, while the rates for every city and state of the United States have during the same period increased with great uniformity for males over 20 years of age. Obesity and physical indolence are discouraged by the hygiene and necessities of army life, whether in war or in peace.

DEATH RATES FROM DIABETES IN RELATION TO VARIATION IN PER CAPITA CONSUMPTION OF FOOD, PARTICULARLY SUGAR

That the general dietetic habits of people vary widely as measured in calories, and have changed in the direction of a greater liberality of food intake in recent times, must be admitted if we accept the statements of Taylor, Legendre and others on this subject. According to

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Taylor,[19] the prewar daily per capita consumption of food in Italy was 2,560 calories, in the United Kingdom 2,860, in Germany 3,200 and in the United States 3,650. Legendre [20] estimates that the average per capita daily consumption of food in France has risen from 1,645 calories in 1832 to 2,255 in 1862, and to 3,160 calories in 1912.

Taylor notes with regard to the United States that possibly 10 per cent. of the population consumes over 4,000 calories a day without work requirements to justify this intake, and that of the industrially submerged tenth, perhaps from 5 to 10 per cent. consume less than 2,000 calories a day, and he lays down the general principle that the work of prosperity increases food consumption and the idleness of hard times reduces it.

It is reported by the Bureau of Animal Industry of the U. S. Department of Agriculture that the annual per capita consumption of meat has fallen in the last fifteen years from 179 to 155 pounds, this reduction having been replaced by an increase in the use of cereals, sugar, milk and fruits. In contrast with this change in the United States is the reported annual consumption of 250 pounds of meat per capita in Australia.

Taylor estimates that with our present food habits, which include the annual consumption of about 100 pounds of sugar per capita, we provide 500 calories a day in our average ration of 3,600 calories for all ages from sugar which we not only like particularly but find a cheap food and most effective for workers.

In spite of the probability that with normal conditions of economic life no great expansion occurs in national food consumption expressed in calories as Taylor states, it is, however, probable that among certain racial, economic and age groups prosperity tends to tempt them into food habits which exaggerate the usual discrepancy between the amount of food intake and the quantity needed for their respective heat, growth, repair and work requirements.

One index of the tendency of our people to use larger amounts of food is the record of per capita consumption of sugar, which is offered here not as an explanation of the increased death rates from diabetes in recent years, but more as a sign of the tendency to excesses in the use of foods of all kinds, beyond the needs of persons for foods in proportion to their expenditure of energy at the different ages of life, and in particular in the later decades.

The estimated per capita consumption of sugar per annum over certain years in the United States, Great Britain and France, and the diabetes death rates for the Registration Area of the United States, for

19. Taylor, A. E.: J. of Home Economics **16**:55 (Feb.) 1924; Harvard Economic Rev. **2**:283 (April) 1924.

20. Legendre: Bull. Soc. scient. d'Hyg. **11**:161, 1923.

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Great Britain and for Paris (not available for France), for some of the same years is shown in Chart 10 and in Tables 38, 39 and 40.[21]

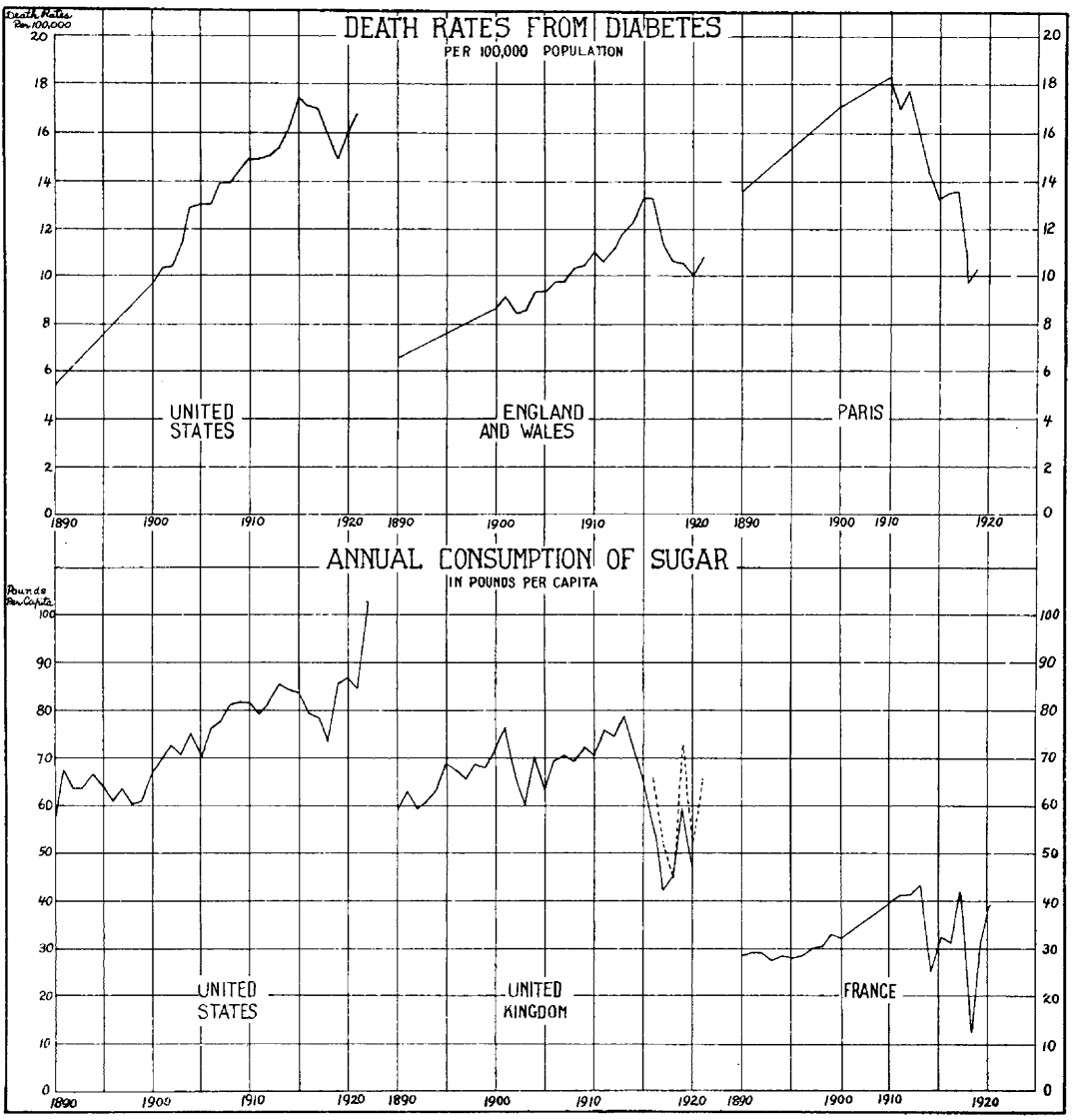


Chart 10.—The estimated per capita consumption for sugar for certain years in the United States, Great Britain and France, and the diabetes death rates for the United States, Great Britain and Paris for the same years.

21. Tables of sugar consumption are based on various government and trade reports, including Yearbook of U. S. Department of Agriculture, General Statistics of France, International Sugar Trade Journal, Concerning Sugar by Palmer, and Licht's reports.

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TABLE 38.—*Sugar Consumption in Relation to the Diabetes Death Rates in United States*

Year	Diabetes Death Rate* per 100,000	Sugar Consumption in Pounds per Capita	Year	Diabetes Death Rate* per 100,000	Sugar Consumption in Pounds per Capita
1890	5.5	54.46	1907	13.9	77.54
1891	....	67.46	1908	13.9	81.17
1892	....	63.76	1909	14.4	81.80
1893	....	63.83	1910	14.9	81.60
1894	....	66.64	1911	14.9	79.20
1895	....	64.23	1912	15.0	81.30
1896	....	60.90	1913	15.3	85.40
1897	....	63.50	1914	16.2	84.29
1898	....	60.30	1915	17.5	83.83
1899	....	61.00	1916	17.1	79.34
1900	9.7	66.60	1917	17.0	78.58
1901	10.3	69.70	1918	15.9	73.36
1902	10.4	72.80	1919	14.9	85.43
1903	11.3	70.90	1920	16.1	86 56
1904	12.9	75.30	1921	16.8	84.47
1905	13.0	70.50	1922	....	103.18
1906	13.0	76.10			

* Diabetes death rates from Joslin. Rate for 1890 is for census year, others for calendar year.

TABLE 39.—*Sugar Consumption in Relation to Diabetes Death Rate in Great Britain*

Year	Diabetes Death Rate* per 100,000	Sugar Consumption in Pounds per Capita	Year	Diabetes Death Rate* per 100 000	Sugar Consumption in Pounds per Capita
1890	6.5	58.89	1906	9.7	69.35
1891	....	63.00	1907	9.7	70.76
1892	....	59.60	1908	10.3	69.49
1893	....	60.88	1909	10.4	72.40
1894	....	63.16	1910	11.0	70.20
1895	....	68.85	1911	10.6	75.93
1896	....	67.07	1912	11.1	74 69
1897	....	65.19	1913	11.8	78.53
1898	....	68.74	1914	12.2	72.36
1899	....	68.42	1915	13.2	65.26
1900	8.6	71.60	1916	13.2	56.38
1901	9.1	76.33	1917	11.3	42.11
1902	8.4	66.47	1918	10 6	45.70
1903	8.5	60.29	1919	10.5	59.64
1904	9.3	70.35	1920	10.0	45.04
1905	9.3	63.34	1921	10.8	.....

* Diabetic rates from Joslin for England and Wales.

TABLE 40.—*Sugar Consumption in Relation to the Diabetes Death Rate in France*

Year	Diabetes Death Rate per 100 000, Paris	Sugar Consumption in Pounds per Capita, France	Year	Diabetes Death Rate per 100 000, Paris	Sugar Consumption in Pounds per Capita, France
1890	13.5	28.9	1910	18.4	40.11
1891	....	29.46	1911	16.9	41.09
1892	....	29.28	1912	17.7	41.48
1893	....	27.80	1913	16.0	43.84
1894	....	28.62	1914	14.3	25.86
1895	....	28.20	1915	13.2	32.83
1896	....	28.80	1916	13.4	31.68
1897	....	30.09	1917	13.5	41.07
1898	....	30.57	1918	9.6	13.28
1899	....	33.34	1919	10.3	31.11
1900	17.0	32.49	1920	....	39.28

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It is apparent that rises and falls in the sugar consumption are followed with fair regularity within a few months by similar rises and falls in the death rates from diabetes, the changes during the period of the World War being particularly striking. If we had the death rate for diabetes of France as we have for the United States and Great Britain we should in all probability find a lower rate than prevailed in the latter countries, as the high rate of Paris is not so high as the rates have been over the same period for New York and London. The Paris rates are used because they are the only ones available for comparison with the sugar consumption of France, since it is the practice of the office of vital statistics of France to include diabetes in a group of general diseases in an abbreviated classification of causes of deaths under thirty-eight titles, instead of publishing by age, sex and cause, reports of deaths for the country as a whole for the 189 titles as is usual in England and the United States.

Riesman [22] after pointing out the fact that urine tests have changed so little in the last twenty to thirty years that greater accuracy in diagnosis of diabetes has probably not occurred during that time, expresses his opinion that the cause of the true increase of diabetes is the greater per capita sugar consumption, coupled with the increase of sedentary habits among most classes of people.

Joslin has given the impression in discussion of the substance of this paper that the increase in the per capita consumption of sugar in the United States can be discounted as a probable factor in the increase of diabetes death rates because of a presumed reduction in the per capita annual consumption of apples. Even if he can offer satisfactory evidence that there has been a bona fide reduction in apple consumption during the period of rising use of sugar, he would still have to meet the facts which Taylor mentions that there has been coincident with the reduction of per capita use of meat an increase in the use of fruits. Many other fruits besides apples carry a high sucrose content, and there is much evidence to show that increase in use of fruits (whether apples or not) has occurred over the same years which have seen the remarkable increase in sugar consumption above referred to.

SUMMARY AND CONCLUSIONS

The increase in the incidence and death rate from diabetes in the United States, and in New York City in particular, has been more rapid than that of any other disease for which we have records in the last fifty years.

22. Riesman, D.: Quoted by Forsheimer, 1914, p. 718.

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This increase, while it has affected all ages to some degree, has been most marked among women at all ages and among both men and women over 35 years of age in particular.

There are wide variations in the susceptibility to diabetes, or at least in their ability to survive when it develops in them, among persons of different races, those of Semitic stock showing consistently the highest death rates and those of the Negro race in the United States the lowest.

It is not at all clear that these marked differences in the death rates from diabetes in the people of various races are of fundamental biologic significance, since many elements of occupation, economic status, dietetic habits, etc., may be found sufficient to explain the range of experience with what may fairly be considered a disease of a fatigued function in the great majority of cases.

Although the relative rarity of diabetes among rural workers and those engaged in hard manual labor or trades would appear significant, the lack of a thoroughly satisfactory basis for calculating death rates by occupational groups in this country deprives the contrasting picture, of high rates among desk workers and others engaged chiefly in mental rather than physical processes for their living, of much of its force.

Seasonal variations in death rates, calculated on a monthly basis, are marked and apparently significant. Whether temperature and other accompanying weather conditions are responsible, or the similar seasonal incidence of infections, usually accompanied by fever and interference with nutrition and deteriorated bodily resistance, cannot be stated on the basis of present information.

Geographical distribution of the disease as measured by death rates in the United States appears to be explicable on the basis of differences in the age grouping, race, economic status, and occupation of the people, high rates being found where there is a high proportion of the population in the later decades of life, after 45, where there are many Jews and where per capita wealth is high. Where life expectancy is high there is a lower diabetes death rate than in states where life expectancy is low, but this is probably due to the fact that the low expectancy states are those with a high proportion of Negroes in the population.

The changes in food habits in the United States have probably contributed to the increase of diabetes, the higher carbohydrate element and greater abundance or superalimentation being believed to be a cause of overfatiguing the function of sugar tolerance.

It is considered of much importance that educational measures be instituted to inform the public through medical and public health channels of the seriousness of the situation, and of the necessity of adjustment of food intake to exercise and vice versa.

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Moderation in the use of food and sufficient exercise with the entire body to justify the food absorbed, are important rules of hygiene for other reasons besides that of the relationship between obesity and diabetes, but if there were no other excuse for bringing this ancient teaching to people's attention, the greatly increased frequency of diabetes as a cause of sickness and death would alone seem to justify physicians and all those dealing with health and its protection in initiating and pushing vigorously a campagin of information in this subject.

ABSTRACT OF DISCUSSION

DR. LOUIS I. DUBLIN, New York: Dr. Emerson is to be commended not only for bringing together for us these very interesting facts in regard to diabetes, but especially for his effort in utilizing a method which has rarely been used in the study of any of the degenerative diseases. As he pointed out, the method of the epidemiologist and the vital statistician has been used in the study of the communicable diseases, in tracing the causes and the interrelations of disease but rarely in such diseases as diabetes, nephritis, heart disease and the others where obviously we are not concerned with an infective organism. The value of this new method is not only in giving us a glimpse into the natural history of the particular disease, but also in permitting us to make comparisons and in finding those diseases which are of a similar character. You will remember that he showed that diabetes had a heavy incidence among females, a heavier incidence among whites than among the colored, that it had a very definite racial incidence, particularly among the Jews and Irish. If you begin to look for other diseases that show similar characteristics you soon find them. Take a disease like exophthalmic goiter, for example, it has these very characteristics, heavier incidence among females than males, heavier among whites than among colored and a special incidence among certain stocks. Addison's disease is another. I might list two or three others which show exactly these same relations. It is clear that we are concerned here with a group of diseases that have a similar origin. We are concerned in diabetes, exophthalmic goiter and Addison's disease with disorders of endocrine function, and no wonder we get the same kind of a picture when we plot the incidence of these diseases in this way.

It is true that diabetes has increased rapidly in recent years. It has increased more rapidly, however, in certain areas than in others. It has increased in those areas where people who are more inclined to diabetes live. The enormous increase in the city of New York is obviously due to the large increase in the number of Jews in that community, also in the number of Irish. I may say, also, that there are a number of phenomena in this disease which future research will have to clear up. Here and there in the study of the figures for localized areas we encounter conditions which are very difficult to explain on any theory. While it is true that very generally the colored race has a low incidence compared to the white race, there are states in the South in which the condition is reversed and that is especially true of the urban populations. In studying the figures for insured lives in the Metropolitan Insurance Company, we are struck with the fact that in certain southern communities in which the number of negroes is very large, the rates are higher for the colored than for the whites, but just why, I do not know.

Finally, I would call attention to the fact that during the last year and a half, in fact, since the beginning of the very general use of insulin, the marked increase in the diabetes death rate seems to have come to a stop. I am the last one to draw conclusions from a solitary and isolated fact like this covering a very short period. I would call attention, however, to the fact that during the last twenty years, the death rate from diabetes has mounted as no other

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condition. It has jumped a number of points a year. Certainly when this disease suddenly stops rising and begins to fall month by month and falls more rapidly with advancing time, it is suggestive that the increased use of insulin may be producing this result. It looks like a remarkable illustration of the efficiency of the new therapeutic agent.

DR. EUGENE L. FISK, New York: Dr. Emerson has shown us a wonderful exposition of the fact that diabetes is something more than a cloud as big as a man's hand on the civilized horizon. While we are urging immunization against typhoid and vaccination against smallpox and measures of that sort we might well urge with more emphasis not only the periodic examination of the urine, but blood sugar tests, especially in middle aged people who tend to overweight; that is, the type of person who has been hinted at as the one most likely to have this trouble. I can give you a single instance of a tragic result from not following such custom—a sign of warning not to rely too much on the routine examination of the urine alone. A middle aged man, about 30 pounds overweight, showed a trace of albumin and a few hyaline casts in his urine, but no sugar. He was warned about these conditions, and advised to have the urine examined periodically; in addition, he was urged to have blood sugar examinations made, a warning he ignored. He got no encouragement from his physician to have that done as he had no sugar in the urine. That man died within eighteen months of diabetes. Now one death of that kind in a group of that sort is one death too many and I think health officers and others could with just as much reason urge functional tests of kidneys and blood tests to aid in checking inroads of disease like this as to advise vaccination, the Schick test and other measures commonly employed to combat communicable diseases.

DR. ISAAC I. LEMANN, New Orleans: While there is less diabetes among the negroes than among whites, it is probable that the same cause that is operating to increase the diabetes among the whites is operating to exactly the same extent to increase diabetes among the negroes. I have compiled statistics from the Charity Hospital of New Orleans during two decades, from 1900 to 1910 and from 1910 to 1920. While the negroes contributed in this period somewhat less than one-half of the total admissions of the hospital, they contributed something less than their share of diabetes. Their share of diabetes was about one-third less than would have been expected as based on their proportion of admissions. That was true of both periods. When we compared the total incidence of diabetes in the two periods we found that it had gone up very markedly. We found, also, that the rate at which it had increased was exactly the same in the negroes as in the whites. So that we draw the conclusion that the same conditions were operating to increase it in the two races. It is worth while to note in this connection that there is nothing in the statistics to bear out the suggestion of Warthin that syphilis plays a rôle in the production of diabetes, for the negroes in these groups contributed a very much larger share of the syphilitic diseases, as everybody knows, but exhibited a less share of diabetes.

DR. HAVEN EMERSON, New York: In considering the reduction in the diabetes death rate during 1923 and the first quarter of 1924 in New York, it is worth while to bear in mind that similar and quite as extensive drops in the rate have occurred as shown in the chart already presented, particularly in 1890 and during and after the influenza epidemic and food restriction periods of 1917 to 1919. Although it is possible that insulin is the main factor in the reduction of diabetes death rates in the last eighteen months, in this city and elsewhere in the United States, we cannot be sure of this until the reduction has continued for a considerably longer period. With regard to the effect of overliberal diets in causing diabetes, I must call your attention to the fact that while in the United States 150 pounds of meat is used per capita per annum, the people of Australia use 250 pounds per capita and the discrepancy between these two is made up in the United States chiefly by increased per

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capita consumption of sugar, cereals, milk, vegetables and fruits. It would appear to me that evidence presented in my report supports the contention of Allen to the effect that much diabetes, among the wealthy in particular, is due to a fatigue of the function of carbohydrate tolerance by an attempt to assimilate a diet which overstrains this function. Apparently, among the reasons for the low rate among negroes is the fact that their occupations involve chiefly the use of the heavy muscles of the trunk and legs and arms, whereas the occupations of those among whom diabetes is most common involve the least physical effort.

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