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DEATHS FROM LEAD POISONING

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PART I.—STATISTICS OF CHRONIC LEAD POISONING IN THE UNITED STATES AND FOREIGN COUNTRIES

The present investigation is primarily concerned with the available statistics of chronic lead poisoning, for the United States and certain foreign countries, which are useful for practical purposes. In most of the works on lead poisoning there are numerous statistical references suggestive of the urgent need for a more comprehensive viewpoint of the past and present situation. Most of the data included in the present inquiry are for the last 10 years, which should prove sufficient at least as an introduction to the proper statistical treatment of this important subject.

UNITED STATES REGISTRATION AREA

Through the courtesy of the Division of Vital Statistics of the United States Bureau of the Census, I have been furnished with original death certificates representing all the deaths from lead poisoning which are a matter of record for the registration area for the period 1914–1924. I am not aware that in any previous investigation original death certificates have been considered with a due regard to all essential facts contained therein.

Table 1 shows the number of deaths classified as chronic lead poisoning for the United States registration area during each of the years 1910 to 1924.

TABLE 1.—DEATHS FROM CHRONIC LEAD POISONING, UNITED STATES REGISTRATION AREA, 1910 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1910.....	53,831,742	136	2.5	1918.....	81,333,675	124	1.5
1911.....	59,183,071	145	2.5	1919.....	85,166,043	148	1.7
1912.....	60,358,974	148	2.5	1920.....	87,486,713	120	1.4
1913.....	63,200,625	162	2.6	1921.....	88,667,602	142	1.6
1914.....	65,813,315	149	2.3	1922.....	93,241,643	137	1.5
1915.....	67,096,681	155	2.3	1923.....	96,936,371	141	1.5
1916.....	71,349,162	190	2.7	1924.....	99,200,298	142	1.4
1917.....	74,964,493	147	2.0				

According to this table there were 1,085 deaths from lead poisoning during the first seven years of the period and 959 deaths during the last. The rate in proportion to population decreased from 2.5 per million in 1910 to 1.4 per million in 1924.

The decrease in the death rate is progressive and obviously reflects the results of the efforts that have been made in the direction of improving factory and workshop hygiene on the one hand and the personal hygiene of the worker on the other.

INDUSTRIAL EXPERIENCE OF METROPOLITAN LIFE INSURANCE CO.

The returns for the United States registration area are in a large measure confirmed by corresponding data representing the industrial insurance experience of the Metropolitan Life Insurance Co. for the years 1911 to 1924, which are shown in Table 2.

TABLE 2.—DEATHS FROM CHRONIC LEAD POISONING, INDUSTRIAL DEPARTMENT OF THE METROPOLITAN LIFE INSURANCE CO., 1911 TO 1924, BY YEARS

Year	Number exposed to risk	Number of deaths	Death rate per 1,000,000 exposed	Year	Number exposed to risk	Number of deaths	Death rate per 1,000,000 exposed
1911.....	7,790,227	17	2.2	1918.....	11,553,347	29	2.5
1912.....	8,219,695	37	4.5	1919.....	12,424,509	26	2.1
1913.....	8,696,543	35	4.0	1920.....	13,086,725	29	2.2
1914.....	9,247,323	39	4.2	1921.....	13,500,762	26	1.9
1915.....	9,665,699	30	3.1	1922.....	13,776,239	30	2.2
1916.....	10,177,060	33	3.2	1923.....	14,534,242	33	2.3
1917.....	10,847,852	25	2.3	1924.....	15,382,916	24	1.6

Leaving out of the comparison the first year of the period, it is shown that the rate decreased from 4.5 per million in 1912 to 1.6 per million in 1924. This experience represents the wage-earning population of the country and, largely, employments in which chronic lead poisoning is most likely to occur. It is therefore of particular interest and value in supporting the returns of the registration area of the country as a whole. During 1925, in the experience of the Metropolitan Life Insurance Co., there were 26 deaths from chronic lead poisoning, equivalent to a rate of 1.6 per million; for white males the rate was 3.4 per million and for colored males 3.2.

UNITED STATES NAVY

Through the courtesy of the Surgeon General of the United States Navy I have been furnished with the chronic lead poisoning statistics of the Navy, differentiating the acute and the chronic lead poisoning cases which have occurred in the Navy during 1913-1924. Table 3, which presents these statistics, is of general interest, as it illustrates that the case frequency rate may be high, while the resulting mortality may be practically nil. The returns also indicate a decrease in the relative frequency of the disease, except as regards acute cases, which in 1923 were 25. During 1925, there were 6 cases of acute lead poisoning, but no deaths, in the United States Navy, giving a case rate of 5.2 per 100,000. There were 3 cases of chronic lead poisoning, but no deaths, giving a case rate of 2.6 per 100,000.

TABLE 3.—NUMBER OF CASES AND DEATHS FROM LEAD POISONING, UNITED STATES NAVY, 1913 TO 1924, BY YEARS

Year	Com- plement	Acute lead poisoning			Chronic lead poisoning		
		Cases	Deaths	Case rate per 1,000	Cases	Deaths	Case rate per 1,000
1913	65,926	25	0	0.4	36	0	0.5
1914	67,141	34	0	.5	30	0	.4
1915	68,075	46	0	.7	24	0	.4
1916	69,294	45	0	.6	20	0	.3
1917	245,580	19	0	.08	21	0	.09
1918	503,792	12	0	.02	13	0	.03
1919	298,774	19	0	.06	11	1	.04
1920	140,773	4	0	.03	1	0	.007
1921	148,861	3	0	.02	1	0	.007
1922	122,126	7	0	.06	7	0	.06
1923	116,565	25	1	.2	8	0	.07
1924	119,280	1	-----	.008	6	-----	.05

STATE AND CITY STATISTICS

It has not seemed necessary for the present purpose to tabulate in detail the statistics of chronic lead poisoning for the several States otherwise than as appears in connection with the analysis of the data for the period for which actual death certificates have been available. (See Part II.) The data in Tables 4 to 17 have been in most cases furnished by the local health authorities and the figures may possibly differ slightly from the returns for the United States registration area in view of differences in methods of death classification.

CALIFORNIA

The first of this series of tables is for the State of California, limited to the years 1912 to 1920, no later data being available.

TABLE 4.—DEATHS FROM CHRONIC LEAD POISONING IN CALIFORNIA, 1912 TO 1920, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1912	2,616,234	8	3.1	1917	3,156,652	6	1.9
1913	2,724,317	16	5.9	1918	3,264,736	0	-----
1914	2,832,400	14	4.9	1919	3,372,819	7	2.1
1915	2,940,464	7	2.4	1920	3,480,902	4	1.1
1916	3,048,568	8	2.6				

The indications are strongly to the effect that chronic lead poisoning in California, as reported by the State board of health, has been considerably on the decrease during the last half of the decade.

CHICAGO, ILL.

That the conclusions drawn from the general returns for the country are in full conformity to the local rates for representative cities in which certain lead industries are represented on a large scale is shown in Tables 5 and 6, though in St. Louis the rate for 1924 shows an increase over 1923. Table 5 is for the city of Chicago, covering

the period 1914 to 1924. The frequency rate at the beginning of the period was 3.3 per million, but during the last year under observation the rate was only 0.69.

TABLE 5.—DEATHS FROM CHRONIC LEAD POISONING IN CHICAGO, ILL., 1914 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1914.....	2,411,018	8	3.3	1920.....	2,728,022	2	0.7
1915.....	2,464,452	2	.8	1921.....	2,780,655	5	1.8
1916.....	2,517,486	5	2.0	1922.....	2,833,288	7	2.5
1917.....	2,570,120	3	1.2	1923.....	2,886,971	2	.7
1918.....	2,622,754	2	.8	1924.....	2,900,000	2	.69
1919.....	2,675,388	5	1.9				

ST. LOUIS, MO.

Table 6 gives corresponding statistics for the city of St. Louis for 1913-1924.

TABLE 6.—DEATHS FROM CHRONIC LEAD POISONING IN ST. LOUIS, MO., 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	715,405	0	-----	1919.....	768,475	4	5.2
1914.....	724,250	4	5.5	1920.....	777,320	0	-----
1915.....	733,095	1	1.4	1921.....	786,164	1	1.3
1916.....	741,940	3	4.0	1922.....	795,008	0	-----
1917.....	759,680	2	2.6	1923.....	803,853	0	-----
1918.....	759,680	1	1.3	1924.....	812,700	4	4.9

NEW JERSEY

Of special interest in this connection are the returns for the State of New Jersey, in which lead-using industries, particularly the pottery industry, are carried on on a considerable scale. These returns are shown in Table 7.

TABLE 7.—DEATHS FROM CHRONIC LEAD POISONING IN NEW JERSEY, 1914 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1914.....	2,806,375	9	3.2	1920.....	3,187,767	8	2.5
1915.....	2,869,107	9	3.1	1921.....	3,251,499	6	1.6
1916.....	2,932,839	16	5.5	1922.....	3,315,231	8	2.4
1917.....	2,996,671	9	3.0	1923.....	3,378,963	6	1.8
1918.....	3,060,303	7	2.3	1924.....	3,442,695	4	1.2
1919.....	3,124,035	4	1.3				

The frequency of chronic lead poisoning in New Jersey reached a maximum of 5.5 per million in 1916, while during the last year the observed rate was only 1.2. The strenuous efforts of the New

Jersey Bureau of Labor in cooperation with manufacturing industries, especially the pottery industry which has left little undone to reduce the lead-poisoning hazard, are considered primarily responsible for these gratifying results. The facts in the case are fully confirmed by certain statistics of labor organizations, which also show that chronic lead poisoning is no longer an occupational hazard of serious concern, at least in the pottery industry.

NEW YORK STATE

Table 8 gives data for the State of New York, furnished by the State health officer. Other statistics for lead poisoning, derived from the State department of labor, will be dealt with later.

TABLE 8.—DEATHS FROM CHRONIC LEAD POISONING IN NEW YORK STATE, 1915 to 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1915.....	9,795,808	24	2.5	1920.....	10,450,718	14	1.3
1916.....	9,926,790	15	1.5	1921.....	10,581,700	15	1.4
1917.....	10,057,772	22	2.2	1922.....	10,712,690	8	.7
1918.....	10,188,754	21	2.1	1923.....	10,843,661	14	1.3
1919.....	10,319,736	19	1.8	1924.....	10,974,642	15	1.4

The preceding table, amplified to some extent by returns for New York City (see Table 9) fully confirms the downward trend of the lead poisoning death rate in a section of the country in which lead-using industries are represented on a considerable scale. During 1915-1924 the rate for New York State decreased from 2.5 to 1.4 per million.

NEW YORK CITY

Table 9 presents data for the city of New York covering the period 1901-1924. It is a most illuminating return, in view of the enormous building activity in New York, involving an exceptional amount of exposure to the risk of lead poisoning on the part of painters, plumbers, and others.

TABLE 9.—DEATHS FROM CHRONIC LEAD POISONING IN THE CITY OF NEW YORK, 1901 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1901.....	3,544,000	7	2.0	1913.....	5,040,667	14	2.8
1902.....	3,665,000	13	3.5	1914.....	5,129,972	12	2.3
1903.....	3,781,000	7	1.9	1915.....	5,219,277	13	2.5
1904.....	3,971,422	18	4.5	1916.....	5,308,582	10	1.9
1905.....	4,104,977	8	1.9	1917.....	5,397,887	15	2.8
1906.....	4,238,632	9	2.1	1918.....	5,487,192	14	2.6
1907.....	4,372,087	11	2.5	1919.....	5,576,497	9	1.6
1908.....	4,505,642	10	2.2	1920.....	5,665,803	7	1.2
1909.....	4,639,197	15	3.2	1921.....	5,755,107	9	1.2
1910.....	4,772,752	18	3.8	1922.....	5,844,411	5	.9
1911.....	4,862,057	16	3.3	1923.....	5,933,715	9	1.5
1912.....	4,951,362	16	3.2	1924.....	6,023,019	7	1.2

While the population of New York City in the 20 years from 1904 to 1924 increased 54.6 per cent, the actual number of deaths from lead poisoning decreased from 18 in 1904 to 7 in 1924, while the relative frequency rate decreased from 4.5 to 1.2 per million. During 1925 there were 5 deaths from chronic lead poisoning in the city of New York in an estimated population of 6,877,000, or 0.7 per million.

BUFFALO, N. Y.

Returns for the city of Buffalo, presented in Table 10, are equally suggestive of a decided diminution in deaths from lead poisoning during the period 1914-1924. There were six deaths from lead poisoning during the first five years and only three during the last, regardless of an increase in lead-using industries. It would have been interesting to have had an extended and detailed statement of the lead-poisoning cases of Niagara Falls, where certain lead-using industries with a high degree of hazard are in operation on a large scale. Unfortunately, the data can not be furnished by the local board of health, but some information has been obtained through the State department of labor and will be dealt with later. The local hazard of Niagara Falls is particularly connected with the making of electrical storage batteries, which seems to involve a special liability to lead poisoning, but probably most cases are of a minor or mild character, while the fatality rate has apparently been very low.

TABLE 10.—DEATHS FROM CHRONIC LEAD POISONING IN BUFFALO, N. Y., 1914 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1914	459,718	1	2.2	1920	511,053	0	-----
1915	463,273	2	4.3	1921	519,608	0	-----
1916	476,829	1	2.1	1922	528,163	0	-----
1917	485,385	1	2.1	1923	536,718	2	3.7
1918	493,941	1	2.0	1924	545,273	1	1.8
1919	502,497	1	2.0				

OHIO

Table 11 shows data for the State of Ohio, covering the period 1913-1924. It is also suggestive of a decline in frequency, regardless of the expansion of lead-using industries.

TABLE 11.—DEATHS FROM CHRONIC LEAD POISONING IN OHIO, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913	5,095,042	12	2.4	1919	5,708,290	10	1.8
1914	5,197,250	12	2.3	1920	5,810,498	10	1.7
1915	5,299,458	9	1.7	1921	5,912,706	13	2.2
1916	5,401,666	18	3.3	1922	6,014,914	7	1.2
1917	5,503,874	13	2.4	1923	6,117,122	8	1.3
1918	5,506,082	6	1.1	1924	6,200,000	11	1.8

PENNSYLVANIA

Quite similar are the returns shown in Table 12 for the State of Pennsylvania, where the frequency rate has decreased from a maximum of 2.8 per million in 1916 and 1917 to 2.1 per million in 1924.

TABLE 12.—DEATHS FROM CHRONIC LEAD POISONING IN PENNSYLVANIA, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	8, 013, 727	17	2.1	1919.....	8, 665, 687	19	2.2
1914.....	8, 122, 387	17	2.1	1920.....	8, 774, 347	9	1.0
1915.....	8, 231, 047	15	1.8	1921.....	8, 883, 006	13	1.5
1916.....	8, 339, 707	23	2.8	1922.....	8, 991, 666	11	1.2
1917.....	8, 448, 367	24	2.8	1923.....	9, 100, 326	12	1.3
1918.....	8, 557, 027	12	1.4	1924.....	9, 208, 986	19	2.1

PROVIDENCE, R. I.

Table 13 shows the lead poisoning deaths for the city of Providence, in which, however, such deaths have been of extremely rare occurrence.

TABLE 13.—DEATHS FROM CHRONIC LEAD POISONING IN PROVIDENCE, R. I., 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	228, 710	0	-----	1919.....	236, 912	1	4.2
1914.....	230, 077	0	-----	1920.....	238, 279	0	-----
1915.....	231, 444	0	-----	1921.....	239, 635	0	-----
1916.....	232, 811	1	4.3	1922.....	241, 011	0	-----
1917.....	234, 178	0	-----	1923.....	242, 388	1	4.1
1918.....	235, 545	1	4.2	1924.....	244, 000	-----	-----

MAINE

In somewhat curious contrast to the foregoing are the lead poisoning returns for the State of Maine, presented in Table 14, which show an increase from 29 deaths during the six years ending with 1918 to 37 deaths during the six years ending with 1924. The average rate for these groups of years has increased from 6.4 to 8 per million.

TABLE 14.—DEATHS FROM CHRONIC LEAD POISONING IN MAINE, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	750, 840	4	5.5	1919.....	766, 692	10	13.0
1914.....	753, 482	5	6.6	1920.....	769, 334	4	5.2
1915.....	756, 124	4	5.3	1921.....	771, 976	3	3.9
1916.....	758, 766	4	5.3	1922.....	774, 617	10	12.9
1917.....	761, 406	7	9.2	1923.....	777, 259	3	3.9
1918.....	764, 050	5	6.5	1924.....	779, 900	7	9.0

In Maine very few deaths from chronic lead poisoning are due to industrial causes, practically all the deaths being the result of water contamination from lead pipes. As will be shown later the lead-poisoning hazard in Maine is largely concentrated in two counties, where most of the deaths have occurred.

NEW HAMPSHIRE

Much the same conclusions apply to the State of New Hampshire, where, in proportion to the population, the mortality from lead poisoning is also excessive, although the actual number of deaths is relatively small. Table 15 gives the facts for the years 1913 to 1924.

TABLE 15.—DEATHS FROM CHRONIC LEAD POISONING IN NEW HAMPSHIRE, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	434,712	4	9.2	1919.....	442,440	1	2.3
1914.....	436,000	1	2.3	1920.....	433,726	1	2.3
1915.....	437,288	2	4.6	1921.....	445,016	1	2.2
1916.....	438,576	6	13.7	1922.....	446,304	3	6.7
1917.....	439,864	4	9.1	1923.....	447,592	1	2.2
1918.....	441,152	0	-----	1924.....	448,882	2	4.5

The preceding table, however, indicates a substantial reduction in the frequency rate during recent years, although the returns for 1924 are suggestive of a continued risk, the entire elimination of which is, of course, a matter of great practical difficulty.

CONNECTICUT

Table 16 includes fragmentary returns for the State of Connecticut, covering the period 1910–1918, suggestive of a decline in the rate during the later years of the period as compared with earlier years.

TABLE 16.—DEATHS FROM CHRONIC LEAD POISONING IN CONNECTICUT, 1910 TO 1918, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1910.....	1,122,512	1	0.9	1915.....	1,259,442	2	1.6
1911.....	1,149,898	6	5.2	1916.....	1,286,828	1	.8
1912.....	1,177,284	4	3.4	1917.....	1,314,214	1	.8
1913.....	1,204,670	7	5.8	1918.....	1,341,600	2	1.5
1914.....	1,232,056	2	1.6				

WISCONSIN

Table 17, for the State of Wisconsin, covers the period ending with 1924 and suggests a material decrease in the mortality from chronic lead poisoning in that State.

TABLE 17.—DEATHS FROM CHRONIC LEAD POISONING IN WISCONSIN, 1914 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1914.....	2,463,130	3	1.2	1920.....	2,647,426	3	1.1
1915.....	2,493,846	1	.4	1921.....	2,678,142	4	1.5
1916.....	2,524,562	3	1.2	1922.....	2,708,559	2	.7
1917.....	2,555,278	10	3.9	1923.....	2,739,574	1	.4
1918.....	2,565,994	3	1.2	1924.....	2,300,000	15	2.2
1919.....	2,616,710	0	-----				

¹ Deaths due to mineral inhalation containing lead.

In addition to the preceding statistics for the United States and certain selected States and cities, I am able to include some returns for foreign countries which will be found both interesting and valuable.

CANADA

Table 18 is for the Dominion of Canada, covering the registration area of that country for the period 1921-1924. The rate has been relatively low, the deaths being largely concentrated in the Province of Ontario, as shown in Table 19.

TABLE 18.—DEATHS FROM CHRONIC LEAD POISONING IN CANADA, 1921 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population
1921.....	8,788,483	3	0.3
1922.....	8,900,000	4	.4
1923.....	9,000,000	5	.6
1924.....	9,100,000	6	.7

ONTARIO

Ontario statistics covering the period 1913-1924, shown in Table 19, are indicative of a slight tendency toward a diminishing rate of frequency, more or less corresponding to the observed decline in this country.

TABLE 19.—DEATHS FROM CHRONIC LEAD POISONING IN ONTARIO, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913.....	2,605,352	1	0.4	1919.....	2,851,584	1	0.4
1914.....	2,646,390	1	.4	1920.....	2,892,623	2	.7
1915.....	2,687,428	4	1.5	1921.....	2,933,662	1	.3
1916.....	2,728,468	5	1.8	1922.....	2,981,182	4	1.3
1917.....	2,769,507	5	1.8	1923.....	3,028,907	3	1.0
1918.....	2,810,546	3	1.1	1924.....	3,062,000	-----	-----

GREAT BRITAIN

For Great Britain, data are available from two different sources: First, there are the returns of cases and deaths made annually by the Chief Inspector of Factories, and second, the returns of deaths from chronic lead poisoning as returned by the Registrar General. The former, of course, cover only the employed population, while the latter cover all ages and both sexes. Table 20 gives a report of the cases of lead poisoning for 1914 to 1923 according to the returns of the Chief Factory Inspector, differentiating important industries and employments. The returns are particularly suggestive as indicating a decline in the frequency of lead poisoning among house painters and house plumbers.

TABLE 20.—NUMBER OF CASES OF CHRONIC LEAD POISONING IN FACTORIES AND WORKSHOPS IN GREAT BRITAIN, 1914 TO 1923, BY YEARS

Industry	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Smelting of metals	36	47	39	46	15	24	45	25	9	19
Plumbing and soldering	27	17	12	34	24	10	6	14	25	46
Printing	23	27	12	6	8	10	9	12	11	6
File cutting and hardening	11	2	8	4	2	0	3	2	1	2
Tinning and metals	10	3	4	2	2	2	2	1	2	2
Other contact with molten lead	21	16	29	27	7	9	13	7	15	12
White and red lead works	35	48	33	30	2	25	28	17	22	37
Pottery	28	26	23	15	11	21	25	35	42	44
Vitreous enameling	11	5	5	1	1	2	2	8	3	5
Electric storage batteries	41	64	44	27	16	48	47	35	32	95
Paint and color works	21	12	22	10	3	11	9	13	14	11
India rubber	9	8	9	8	7	5	7	4	3	5
Coach building	57	39	33	21	12	11	13	20	15	13
Shipbuilding	31	18	25	19	9	8	9	4	12	8
Paints used in other industries	39	16	20	20	15	9	10	12	23	21
Other industries	45	33	30	47	11	13	15	23	19	13
Total	445	381	348	317	144	207	243	230	247	337
House painters ¹	207	108	52	43	25	37	46	42	40	53
House plumbers ¹	34	23	20	14	10	3	10	8	16	17

¹ Not compulsorily reportable under the factory and workshop act, 1901.

Table 21 gives the deaths from lead poisoning as reported by the Chief Inspector of Factories in an identical manner.

TABLE 21.—NUMBER OF DEATHS FROM CHRONIC LEAD POISONING IN FACTORIES AND WORKSHOPS IN GREAT BRITAIN, 1914 TO 1923, BY YEARS

Industry	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Smelting of metals	3	1	4	1	1	5	3	4	2	2
Plumbing and soldering	2	2			2		1			1
Printing	1	3		3	1	1		1		1
File cutting and hardening	1		2	1			1			
Other contact with molten lead	2		1			1	2	1		1
White and red lead works	1		1						2	
Pottery	6	4	7	7	1	8	13	11	17	11
Vitreous enameling		1								
Electric storage batteries			1	1		2	2			2
Paint and color works								1	1	1
India rubber								1		
Coach building	4	5		2	3	3		1	1	3
Shipbuilding	5	2	3		2	2		1	1	1
Paints used in other industries		2		1		3	1		2	
Other industries	4	1	2	5	1	1		1		2
Total	29	21	21	21	11	26	23	23	26	25
House painters ¹	35	29	15	13	13	16	21	15	12	17
House plumbers ¹	4	8	5	5	7	1	6	4	5	7

¹ Not compulsorily reportable under the factory and workshop act, 1901.

In amplification of the foregoing statistics on lead poisoning for Great Britain I am able, through the courtesy of the Chief Inspector of Factories, to present a table of statistics for the period 1900-1925, which is also indicative of a decided downward trend in cases of lead poisoning in both fatal and nonfatal form. Table 22 is for all the principal industries in which the disease is most likely to occur, but does not include house painters and plumbers, for whom the return of information is not obligatory.

TABLE 22.—NUMBER OF CASES OF LEAD POISONING IN GREAT BRITAIN, 1900 TO 1925, BY YEARS AND OCCUPATIONS

Occupation or industry	1900	Average, 1915-1917	Average, 1918-1920	Average, 1921-1923	1924	1925
Smelting and refining	34	44	28	18	38	22
Plumbing and soldering	9	21	11	8	6	7
Ship breaking			2	21	131	31
Printing	18	15	9	10	6	8
Tinning	5	3	2	2	3	4
Other contact with molten lead	30	24	10	11	23	17
White and red lead works	377	37	18	24	20	19
Vitreous enameling	11	4	1	5	9	9
Potteries	210	21	19	40	47	47
Electric storage batteries	33	45	37	54	101	73
Paints and colors	56	15	8	13	15	8
India rubber	1	8	6	4	3	2
Coach building	70	31	12	16	30	23
Shipbuilding	32	20	9	8	8	13
Paints used in other industries	50	19	11	19	24	43
Other industries	122	42	15	18	22	
Total	1,058	349	198	271	486	326

Excluding house painters and plumbers, for whom notification is not obligatory, the number of cases of lead poisoning in 1925 was 326, as against 486 in 1924; in 1900, however, the number of such cases was 1,058. The number of deaths from lead poisoning in 1925 was only 13 against 32 in 1924 and 38 in 1900.

In the smelting of metals there were 22 cases in 1925 against 38 in 1924. In plumbing and soldering there were 7 in 1925 and 6 in 1924. In ship breaking, which no doubt had to do chiefly with dismantling of ships after the war, there occurred 31 cases in 1925 and 131 cases in 1924. In printing there were 8 cases in 1925 and 6 in 1924; in 1900, however, the number of such cases was 18. In the manufacture of white and red lead there occurred 19 cases in 1925 and 20 in 1924; in 1900, however, the number of such cases was 377 with 6 deaths, as against 1 death in 1925. In the pottery industry there occurred 47 cases in 1925 and the same number in 1924; in 1900, however, the number of such cases was 210. The number of deaths in the pottery industry in 1925 was 5 as against 18 in 1924. The indications are that since 1915 conditions in this respect in the pottery industry have not improved but rather grown worse.

In the manufacture of electric storage batteries there were 73 cases in 1925 against 101 cases in 1924; in 1900, however, the number of such cases was only 33. In the manufacture of paints and colors there were 8 cases in 1925 and 15 in 1924; in 1900 there were 56. In the manufacture of india rubber there were 2 cases in 1925 and 3 in 1924, as against an average of 8 cases during the period

1915-1917. In coach building, which has reference chiefly to painting and enameling, there were 23 cases in 1925, as against 30 cases in 1924; an average of 90 cases occurred in this industry during 1909-1911. In shipbuilding there were 13 cases in 1925, as against 8 in 1924.

With reference to house painters and plumbers, it is said that for 1925 information was obtained for 89 cases of lead poisoning with 9 deaths among house painters and that the corresponding number for 1915 was 108 cases with 29 deaths.

ENGLAND AND WALES

The returns of the Registrar General for England and Wales, shown in Table 23, cover the period 1908-1922, differentiating the sexes and in the summary the occupational and nonoccupational cases, suicides, and accidents.

Table 23.—DEATHS FROM LEAD POISONING, ENGLAND AND WALES, 1908 TO 1922, BY YEARS

Year	Number of deaths			Death rate per 1,000,000 population	Occupational	Year	Number of deaths			Death rate per 1,000,000 population	Occupational
	Males	Females	Total				Males	Females	Total		
1908	105	12	117	3.33	105	1917	51	8	59	1.75	50
1909	90	14	104	2.34	91	1918	35	1	36	1.08	36
1910	82	11	93	2.60	86	1919	48	2	50	1.36	45
1911	108	13	121	3.34	110	1920	56	5	61	1.62	61
1912	108	9	117	3.21	106	1921	57	3	60	1.58	58
1913	87	6	93	2.54	81	1922	48	6	54	1.42	45
1914	84	6	90	2.44	79						
1915	71	1	72	2.04	67	Total	1,087	101	1,188		1,080
1916	57	4	61	1.76	54						

SUMMARY

Occupational, males	1,046
Occupational, females	34
Nonoccupational	67
Accidents	36
Suicides	5
Total	1,188

It is explained in this connection by the Registrar General that:

Before 1911 chronic nonoccupational poisonings were listed to violence. The nonoccupational chronic poisonings of females prior to 1918 were probably due to the use of diachylon as an abortifacient. In 1917 the sale of diachylon was restricted by its being scheduled as a poison. Some lead deaths before 1917 are omitted owing to their being classed as criminal abortion without distinction of lead as the agent.

SCOTLAND

Through the kindness of the Registrar General of Scotland I have been furnished with the returns for that country, covering the period 1917-1924, and they are presented in Table 24. Chronic lead poisoning is obviously a disease of much less frequency in Scotland than in England.

TABLE 24.—DEATHS FROM CHRONIC LEAD POISONING IN SCOTLAND, 1911 TO 1924, BY YEARS

Year	Estimated population		Deaths from lead poisoning			
	Males	Females	Males	Rate per 1,000,000 population	Females	Rate per 1,000,000 population
1911	2,304,100	2,447,032	4	1.7	—	—
1912	2,300,941	2,440,136	2	.9	—	—
1913	2,295,370	2,431,762	2	.9	—	—
1914	2,307,334	2,439,833	3	1.3	—	—
1915	2,312,946	2,457,852	4	1.7	—	—
1916	2,318,722	2,475,986	4	1.7	—	—
1917	2,320,493	2,489,845	3	1.3	—	—
1918	2,308,024	2,504,250	4	1.7	—	—
1919	2,313,600	2,506,477	3	1.3	—	—
1920	2,337,010	2,527,386	2	.9	—	—
1921	2,347,642	2,534,855	3	1.3	—	—
1922	2,358,201	2,546,255	2	.8	—	—
1923	2,356,587	2,544,513	3	1.3	1	0.4
1924	2,347,228	2,534,409	1	.4	1	.4

¹ Female child, age 4 months; it is stated that "the mother was using lead nipple shields."

² Wife of a railway surfaceman, age 53.

AUSTRALIA

From the Commonwealth of Australia I have been able to secure returns of chronic lead poisoning for the period 1913–1924, as shown in Table 25.

TABLE 25.—DEATHS FROM CHRONIC LEAD POISONING IN AUSTRALIA, 1913 TO 1924, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1913	4,800,000	10	2.1	1919	5,200,000	18	3.5
1914	4,800,000	6	1.2	1920	5,400,000	13	2.4
1915	5,000,000	11	2.2	1921	5,500,000	20	3.5
1916	5,000,000	18	3.6	1922	5,600,000	25	4.5
1917	5,000,000	18	3.6	1923	5,700,000	22	3.9
1918	5,000,000	10	2.0	1924	5,800,000	26	4.5

In Australia the rate has shown a tendency to increase rather than to decrease, though the situation is more or less stationary.

NEW ZEALAND

Lead poisoning is relatively uncommon in New Zealand, where lead-using industries are not developed on a large scale, but Table 26 gives the returns for 1912 to 1923.

TABLE 26.—DEATHS FROM CHRONIC LEAD POISONING IN NEW ZEALAND, 1912 TO 1923¹ BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1912	1,052,627	—	—	1918	1,108,373	1	0.9
1913	1,084,662	—	—	1919	1,177,405	3	2.5
1914	1,095,994	2	1.8	1920	1,207,835	1	.8
1915	1,102,794	—	—	1921	1,239,966	—	—
1916	1,100,563	3	2.7	1922	1,265,397	1	.8
1917	1,097,672	—	—	1923	1,290,000	1	.8

ITALY

There is also included in the present discussion a rather interesting return on chronic lead-poisoning deaths in Italy covering the period 1908-1915, later records being as yet unavailable. It is shown by Table 27 that the rate has not been excessive, but corresponds in a general way with the rate for this country, while there is apparently a slight decrease.

TABLE 27.—DEATHS FROM CHRONIC LEAD POISONING IN ITALY, 1908 TO 1915, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1908.....	33,826,688	58	1.7	1912.....	35,026,486	70	2.0
1909.....	34,077,068	64	1.9	1913.....	35,418,391	56	1.6
1910.....	34,376,610	57	1.7	1914.....	35,858,951	48	1.3
1911.....	34,688,814	54	1.6	1915.....	36,394,325	55	1.5

PARIS, FRANCE

Finally, I include in the foreign statistics Table 28, covering deaths from chronic lead poisoning in Paris during the period 1908-1919.

TABLE 28.—DEATHS FROM CHRONIC LEAD POISONING IN PARIS, 1908 TO 1919, BY YEARS

Year	Population	Number of deaths	Death rate per 1,000,000 population	Year	Population	Number of deaths	Death rate per 1,000,000 population
1908.....	2,772,530	20	7.2	1914.....	2,893,618	10	3.5
1909.....	2,797,430	30	10.7	1915.....	2,895,454	8	2.8
1910.....	2,822,329	20	7.1	1916.....	2,897,291	12	4.1
1911.....	2,888,110	15	5.2	1917.....	2,899,127	8	2.8
1912.....	2,889,946	14	4.8	1918.....	2,900,983	5	1.7
1913.....	2,891,782	18	6.2	1919.....	2,902,799	9	3.1

The returns for Paris also indicate a material decline during the period under observation, corresponding to the observed decline in chronic lead poisoning in this country.

OPPELN, GERMANY

Efforts were made to secure statistics for Germany, but the data furnished are not so comprehensive as would be desirable. Table 29 gives a record of the sickness experience of persons employed in lead smelters in the administrative district of Oppeln.

TABLE 29.—CASES OF LEAD POISONING IN LEAD SMELTERS IN THE ADMINISTRATIVE DISTRICT OF OPPELN, GERMANY, 1903 TO 1912, BY YEARS

Year	Number of workers	Number of cases	Case rate per 1,000 workers	Year	Number of workers	Number of cases	Case rate per 1,000 workers
1903.....	875	340	388.6	1909.....	834	106	127.1
1904.....	912	321	352.0	1910.....	803	204	254.0
1905.....	999	329	329.3	1911.....	798	224	280.7
1906.....	897	190	211.8	1912.....	822	277	337.0
1908.....	828	165	199.3				

PART II.—ANALYSIS OF DEATHS FROM CHRONIC LEAD POISONING IN THE UNITED STATES REGISTRATION AREA, 1914–1924

For the purpose of a reasonably thorough study of the recent chronic lead poisoning situation, I decided upon a detailed examination of the original death certificates representing the recorded mortality in the United States registration area during the 11 years 1914 to 1924. Through the courtesy of William M. Davis, chief of the division of vital statistics of the United States Bureau of the Census, I was able to obtain transcripts of original death certificates comprehending the entire recorded mortality from chronic lead poisoning during the 11 years under observation, represented by 1,592 deaths. This mortality was found to have been distributed, by principal occupations or otherwise, as follows:

TABLE 30.—OCCUPATIONAL DISTRIBUTION OF DEATHS FROM CHRONIC LEAD POISONING, UNITED STATES REGISTRATION AREA, 1914 TO 1924

Occupation	Number of deaths	Occupation	Number of deaths
Lead workers.....	62	Carpenters and joiners.....	18
Metal miners.....	35	Laborers.....	93
Painters.....	841	Farmers.....	61
Paint mixers.....	15	Professional.....	29
Plumbers.....	25	Miscellaneous.....	114
Potters and tile workers.....	13	Unknown or retired.....	103
Rubber workers.....	3	Women.....	48
Storage battery workers.....	5	Boys under 18.....	11
Printers.....	67	Girls under 18.....	8
Tin and coppersmiths.....	9	Total.....	1,592
Glass industry.....	9		
Metal workers.....	23		

As far as known, this is the first definite statement of its kind ever published revealing the true extent of the mortality from chronic lead poisoning among the American people. It brings out the startling fact that a considerable proportion of the deaths are non-industrial or not connected directly with lead-using industries. This conclusion will be more clearly emphasized in a detailed analysis of the different 21 groups. It will certainly prove a surprise that 48 of the deaths should have occurred among women* and 19 of the deaths among boys and girls under 18 years of age. Of particular interest also is the relative frequency of chronic lead poisoning among farmers, who are, of course rarely exposed to the risk of industrial lead poisoning, except occasionally in connection with painting jobs done on the farm.

* With reference to the liability of women to lead poison, it may be said that excepting five deaths, all the deceased were nonindustrial. Of the five deaths, one was a school teacher, one a florist, one a weaver, one a dressmaker, and one a waitress, all involving no industrial occupational lead hazard.

A question of considerable interest is the age distribution at death from the disease, which will be dealt with in each and every group individually, but which is here briefly summarized in Table 31.

TABLE 31.—AVERAGE AGE AT DEATH FROM CHRONIC LEAD POISONING, 1914-1924, BY OCCUPATION

Occupation	Number of deaths	Aggregate years of life	Average age at death (years)	Occupation	Number of deaths	Aggregate years of life	Average age at death (years)
Lead workers	62	2,808	45.3	Carpenters and joiners...	18	1,035	57.5
Metal miners	35	1,507	43.1	Laborers	93	3,894	41.9
Painters	841	43,165	51.3	Farmers	61	3,460	56.7
Paint mixers	15	659	43.9	Professional	29	1,463	50.4
Plumbers	25	1,205	48.2	Miscellaneous	114	5,386	47.3
Potters	13	588	45.2	Unknown	103	5,440	52.8
Rubber workers	3	141	47.0	Women	48	2,485	51.8
Storage battery workers...	5	228	45.6	Boys under 18	11	84	7.6
Printers	67	3,044	45.4	Girls under 18	8	41	5.1
Tin and coppersmiths...	9	438	48.7				
Glass industry	9	345	38.3	Total	1,592	78,413	49.3
Metal workers	23	987	42.9				

According to this tabulation the average age at death in 1,592 fatal cases of chronic lead poisoning was 49.3 years, while, leaving out of consideration boys and girls, the average was as high as 57.5 years for carpenters and joiners and as low as 38.3 years for the glass industry. The boys and girls were mostly little children who accidentally contracted lead poisoning as the result of reckless exposure.

LEAD WORKERS

In the group of lead workers there occurred 62 cases, distributed as follows:

At smelting plants there occurred 28 deaths, of an aggregate age of 1,334 years and an average age of 47 years. Some of the smelting operations were unquestionably merely incidental to other lead plants while most of the smelters were probably chiefly devoted to lead production processes. Other smelting plants were in connection with silver and zinc smelting. The largest number of deaths in any one State occurred in smelting plants in Utah, where there were 9 deaths, mostly in and about Salt Lake City. A specific occupation mentioned is "yard foreman," but the remainder of the deaths were of laborers. There were 3 deaths in Colorado, one of which occurred at a silver smelter; 2 in Kansas, 2 in Nebraska, 4 in Missouri, 1 each in Washington and Texas, 2 in Illinois, 3 in Essex County, N. J., and 1 in Brooklyn, N. Y.

Of deaths of lead workers not otherwise specified, practically all common laborers, there were 19, and of this number 5 were colored persons, most of whom were employed in East St. Louis and in Essex County, N. J.

Four deaths were returned of lead burners, 2 of whom were employed in New Jersey, 1 in Maryland, and 1 in Indiana. There were only 8 deaths of persons (2 of whom were colored) directly con-

nected with white lead plants, as far as it is possible to judge from the certificates. One of the plants in question was located in Essex County, N. J.; 2 in Cook County, N. Y.; 1 in Philadelphia; 2 in St. Louis; 1 at Anderson, Mo.; and 1 in Madison County, Ill. One of the persons was a fireman, 1 was a packer, and 1 was a foreman and the remainder were laborers.

One person died from chronic lead poisoning while employed in a lead-dipping shed in a cutter factory in Michigan, and 1 was a lead puller at a white lead works in East St. Louis. Finally, there was 1 person engaged in spraying lead who died from chronic lead poisoning in Detroit. In Table 32 is given the age distribution at death of lead workers from chronic lead poisoning, which will be useful for comparative purposes. The lowest age at death was 17 years and the highest age 78.

TABLE 32.—DEATHS OF LEAD WORKERS FROM CHRONIC LEAD POISONING, BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
Under 20 years.....	2	3.2	60 to 69 years.....	13	21.0
20 to 29 years.....	6	9.7	70 years and over.....	1	1.6
30 to 39 years.....	15	24.2	Total.....	62	100.0
40 to 49 years.....	16	25.8			
50 to 59 years.....	9	14.5			

MINERS

Among miners there were 35 deaths from chronic lead poisoning, excluding 1 death of a coal miner, which was included in miscellaneous occupations. The mining occupations represented by this group were as follows:

Mining and quartz mining.....	28
Silver lead mines.....	2
Lead mines.....	2
Jiggerman in mines.....	1
Laborer in mines.....	1
Zinc miner.....	1
Total.....	35

By States the distribution of the deaths have been as follows: California, 2; Washington, 3; Colorado, 4; Utah, 14; Montana, 1; Kansas, 3; Missouri, 5; Illinois, 1; Virginia, 1; and Florida, 1. The 14 deaths in Utah were distributed by locality as follows: Salt Lake, 7; Summit County, 3; Toole County, 2; Wasatchie County, 1; and Jordan County, 1. The Missouri deaths occurred in St. Louis (2), Jasper County (2), and Jefferson County (1). Of the total deaths 12 were persons of foreign birth, 5 having been born in Austria, 2 in Finland, 1 in Poland, 1 in Russia, 1 in Germany, 1 in Denmark, and 1 in England. The number of deaths of single persons was 11 and of married persons 24. By divisional periods of life the ages at death follows.

TABLE 33.—DEATHS OF MINERS FROM CHRONIC LEAD POISONING, BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
20 to 29 years.....	6	17.1	60 to 69 years.....	4	11.4
30 to 39 years.....	9	25.7	70 years and over.....	1	2.9
40 to 49 years.....	11	31.4	Total.....	35	100.0
50 to 59 years.....	4	11.4			

The aggregate number of years lived by the 35 miners was 1,507, giving an average age of 43.1 years. The deaths occurring in the individual years were as follows: 1914, 6; 1915, 6; 1916, 4; 1917, 4; 1918, 3 (1914-1918, 23); 1919, 1; 1920, 4; 1921, 2; 1922, 2; 1923, 2 (1919-1923, 11); 1924, 1—making a total of 35 deaths.

PAINTERS

Deaths from chronic lead poisoning among painters represent approximately one-half of the total mortality during the period under observation. There were in the aggregate 841 deaths of painters distributed during the period 1914-1924, as follows:

TABLE 34.—DEATHS OF PAINTERS FROM CHRONIC LEAD POISONING, 1914-1924, BY YEARS

Year or period	Number of deaths	Aggregate years of life	Average age at death (years)	Year or period	Number of deaths	Aggregate years of life	Average age at death (years)
1914.....	81	3,992	49.3	1919.....	72	3,812	52.9
1915.....	85	4,266	50.2	1920.....	67	3,430	51.2
1916.....	99	5,096	51.5	1921.....	73	3,771	51.7
1917.....	75	3,790	50.5	1922.....	74	3,834	51.8
1918.....	67	3,440	51.3	1923.....	74	3,845	52.0
Total, 1914-1918.....	407	20,584	50.6	Total, 1919-1923.....	360	18,692	51.9
				1924.....	74	3,889	52.6
				Total, 1914-1924.....	841	43,165	51.3

It is shown that the average age at death has increased from 49.3 years in 1914 to 52.6 years in 1924. During the first five years of the period the average age at death was 50.6 years, while during the five years ending with 1923 it was 51.9 years. Distributed by divisional periods of life, the mortality has been as follows:

TABLE 35.—DEATHS OF PAINTERS FROM CHRONIC LEAD POISONING, 1914-1924, BY AGE GROUPS

Age group	Deaths		Aggregate years of life	Age group	Deaths		Aggregate years of life
	Number	Per cent			Number	Per cent	
20 to 29 years.....	33	3.9	858	60 to 69 years.....	179	21.3	11,454
30 to 39 years.....	112	13.3	3,958	70 to 79 years.....	46	5.5	3,334
40 to 49 years.....	214	25.4	9,550	Total.....	841	100.0	43,165
50 to 59 years.....	257	30.6	14,011				

The geographical distribution of deaths from chronic lead poisoning among painters during the period 1914-1924 is given in Table 36.

TABLE 36.—GEOGRAPHICAL DISTRIBUTION OF DEATHS OF PAINTERS, FROM CHRONIC LEAD POISONING, 1914-1924

State	Number of deaths	State	Number of deaths
Connecticut.....	15	District of Columbia.....	5
Rhode Island.....	6	Maryland.....	16
Massachusetts.....	74	Virginia.....	9
New Hampshire.....	12	West Virginia.....	2
Vermont.....	4	Tennessee.....	7
Maine.....	20	Kentucky.....	12
Total, New England.....	131	North Carolina.....	9
New York.....	127	South Carolina.....	11
New Jersey.....	52	Georgia.....	5
Pennsylvania.....	96	Florida.....	4
Total.....	275	Alabama.....	4
Ohio.....	64	Mississippi.....	1
Illinois.....	59	Louisiana.....	16
Indiana.....	20	Texas.....	9
Michigan.....	22	Total, Southern States.....	110
Wisconsin.....	19	California.....	54
Minnesota.....	13	Oregon.....	5
Iowa.....	2	Washington.....	14
Nebraska.....	5	Colorado.....	5
Missouri.....	25	Utah.....	2
Kansas.....	13	Montana.....	2
Total, Central West.....	242	Hawaii.....	1
		Total, Pacific coast.....	83
		Grand total.....	841

It would have been of interest had it been possible to have given frequency rates in proportion to the total number of painters exposed to risk. But such a calculation is not possible in the absence of accurate information regarding the geographical distribution of painters for the period under observation. It is possible, however, to work out an approximate death rate of painters from chronic lead poisoning on the basis of the available membership of painters' unions as given in the report on The Growth of American Trade Unions, by Leo Wolman, published by the National Bureau of Economic Research in 1924. This, of course, does not make allowance for the painters not connected with labor organizations, but their number in proportion to the total is probably relatively small. In any event, it will be sufficient to make allowance for this omission and consider that the rate is somewhat understated throughout the period under observation.

TABLE 37.—CHRONIC LEAD POISONING: DEATH RATES OF PAINTERS, BASED ON TRADE-UNION MEMBERSHIP, 1914 TO 1924, BY YEARS

Year	Trade-union membership	Total number of deaths	Death rate per 1,000 union members	Year	Trade-union membership	Total number of deaths	Death rate per 1,000 union members
1914.....	74,400	81	1.09	1920.....	103,100	67	0.65
1915.....	75,300	85	1.13	1921.....	113,300	73	.64
1916.....	78,200	99	1.27	1922.....	97,800	74	.76
1917.....	85,200	75	.88	1923.....	82,800	74	.80
1918.....	84,500	67	.79	1924.....	93,500	74	.79
1919.....	82,700	72	.87				

Granting the inherent deficiencies of this tabulation the results are nevertheless of considerable interest as suggestive of a measurable decline in the relative frequency of chronic lead poisoning among painters during the period 1914-1924.

It would, of course, serve no practical purpose to have worked out frequency rates on the basis of the general population. But for certain large cities some additional information may be of interest. The number of deaths from chronic lead poisoning in Boston, Mass., during the period under observation was 16. In New York City it was 69, distributed by boroughs as follows: Manhattan, 27; Brooklyn, 24; Bronx, 9; Queens, 7; Richmond, 2.

In Philadelphia there were 24 deaths; in Newark, 8; in Cincinnati, 9; in Cleveland, 16; in Columbus, 6; in San Francisco, 13; and in Los Angeles, 7. For other cities the numbers are too small to justify extended consideration.

The economic loss from chronic lead poisoning is, of course, partly proportionate to the marital condition. It has therefore seemed of some value to extract from the data the information as regards the married and single, with the following results. Of the 841 deaths from chronic lead poisoning among painters 134 were of single persons while 707 were of married, widowed, or divorced; in other words, the proportion of the unmarried was 15.9 per cent. This proportion can be compared with the proportion of the unmarried in other important occupations.

The race factor is not apparently of much relative importance, except in certain specified lead-using industries in which a considerable number of negroes are employed. Whether the latter have a lesser or greater liability to lead poisoning can not be determined. For painters I have extracted such information for the Southern States only, and it shows that out of 110 deaths from chronic lead poisoning 18 were deaths of colored persons. The question of nativity is somewhat more significant, but here again it is not possible to calculate frequency rates for the different racial elements. As a matter of interest, the following information is, however, included. Of the 841 deaths, 224 were deaths of painters born in foreign countries, distributed as follows: Fifty-six were born in Germany, 28 in Canada, 22 in Russia, 20 in Ireland, 20 in Sweden, 15 in England, 13 in Austria, 10 in Hungary, 9 in Norway, 6 in Italy, 4 in Denmark, 3 each in Scotland, Poland, and France, 2 each in Finland, Rumania, Belgium, and Spain, and 1 each in Greece, Switzerland, Holland, and China.

I have throughout proceeded upon the assumption that the present methods of death certification are at least approximately complete and scientifically correct. A careful examination of each and every certificate leaves a question of doubt in a small number of cases in which the word "probably" is used, while in others circumstances justify a suspicion of incorrectness. Examining the certificates with particular reference to contributory causes or conditions it is evident that the terms have been introduced convertibly as regards primary and secondary causes; in other words, in some cases lead poisoning is given as the primary cause and in others as the contributory cause. But under a rule of statistical practice of the Census Office all such certificates are listed in the final classification as deaths from chronic lead poisoning which is assumed to be the primary cause through-

out. The contributory causes are of considerable interest, and they have therefore been separately tabulated with the following results:

TABLE 38.—CONTRIBUTORY CAUSES OF DEATHS OF PAINTERS, FROM CHRONIC LEAD POISONING, 1914-1919

Contributory causes	Number of deaths	Aggregate years of life	Average age at death (years)	Contributory causes	Number of deaths	Aggregate years of life	Average age at death (years)
Chronic and acute nephritis.....	193	9,499	49.2	Insanity.....	9	450	50.0
Cardiovascular.....	113	5,908	52.3	Alcoholism.....	4	190	47.5
Arteriosclerosis.....	57	3,320	58.2	Diabetes.....	3	149	49.7
Intestinal and digestive.....	52	2,378	45.7	Appendicitis.....	3	125	41.7
Respiratory.....	44	2,320	52.7	Leucæmia.....	2	116	58.0
Apoplexy.....	38	1,999	52.6	Drug addiction.....	2	108	54.0
Anæmia.....	35	1,923	54.9	Tuberculosis.....	1	57	57.0
Encephalitis.....	23	1,118	48.6	Goiter.....	1	41	41.0
Paralysis.....	23	1,254	54.5	Miscellaneous.....	49	2,589	52.8
Liver diseases.....	17	881	51.8	No complications.....	152	7,730	50.9
Spinal cord.....	11	558	50.7	Total.....	841	43,165	51.3
Tumors, benign, and ulcers.....	9	452	50.2				

Chronic and acute nephritis.—The outstanding fact of the preceding table is the predominating occurrence of acute and chronic nephritis in complication with chronic lead poisoning. Since there is some question as to the absolute accuracy of the statements it does not seem advisable to separate acute from chronic nephritis cases or from other renal complications. The average age at death in these cases was 49.2 years, which compares with 51.3 years for all the cases whether complicated or not.

Cardiovascular diseases.—The second most important complication is the group of cardiovascular diseases, chiefly myocarditis. Here again it has not seemed advisable to specify the different forms of complications in the table but myocarditis appears to have been more common than endocarditis. In a good proportion of cases there was dilation of the heart, in others, mitral insufficiency, and in still others, cardiac asthma or aortic insufficiency. In 11 cases chronic lead poisoning was complicated by angina pectoris. The specified indications of myocarditis number 34 and of endocarditis 11.

Arteriosclerosis complicated lead poisoning in 57 cases, the average age at death being 58.2 years. In a few cases arteriosclerosis complicated other circulatory affections included under diseases of the heart.

Intestinal and digestive complications accounted for 52 cases with an average age at death of 45.7 years. This group includes a large variety of affections which it would hardly serve a useful purpose to discuss in matters of detail. As would be natural in chronic lead poisoning there are quite a number of cases of intestinal obstruction, intestinal paralysis, diarrhea, etc., but none of them seem to be of special significance.

Respiratory affections of a nontubercular type occurred to the number of 44 cases, chiefly in the form of pulmonary embolism, pneumonia, lung abscesses, pulmonary œdema, lung paralysis, etc. The average age at death in these cases was 52.7 years.

Apoplexy and brain softening.—There were 38 cases of this group, of an average age of 52.6 years. The certificates reveal no facts of special interest.

Anemia, both in the common and the pernicious form, occurred to the extent of 35 cases, of which 17 specified the anemia as having been of the pernicious type, while 7 stated it to have been of the secondary type. The average age at death in these cases was 54.9 years.

Encephalitis occurred in 23 cases with an average age at death of 48.6 years. The inflammation of the encephalon or brain is of comparatively common occurrence in fatal cases of lead poisoning, but no doubt often obscured by other concurrent diseases to which the preference is given in death certification. Legge and Goadby, in their treatise on Lead Poisoning, give a tabulation of cases of encephaloma which shows a fairly consistent occurrence in Great Britain. They also describe a case of chronic lead encephalitis, with an examination of the nervous system, which may be referred to for the purpose of a better understanding of this important aspect of lead poisoning.

Paralysis is one of the most important contributory effects in chronic lead poisoning but apparently not as common at the present time as would be assumed. There were only 23 cases of various forms of paralysis but mostly of the progressive type involving the extremities. Unfortunately, the death certificates do not contain much information regarding the part or portion of the body chiefly affected corresponding to those which are included in the treatise by Legge and Goadby, which indicates a larger relative degree of frequency than is met with in this country.

Liver.—Diseases of the liver have been almost as common as paralysis. There were 17 cases, with an average age at death of 51.8 years. In 11 of these cases, the affection was cirrhosis of the liver. Curiously enough, Legge and Goadby do not mention liver diseases in their tabulation of 264 cases. It is, of course, an open question as to how far those cases were complicated by alcoholism.

Of the other complicating diseases special reference may be made to *ulcers and benign tumors*. There were 9 of these cases, of an average age at death of 50.2 years. In view of the extended recent discussion of the possible influence of lead on malignant tumors, the question has arisen whether cancer is met with among workers exposed peculiarly to lead poison. The present investigation concerned with 841 death certificates does not reveal a single case in which the occurrence of malignant tumor concurrently with lead poisoning is indicated. Ulcers, abscesses, and benign tumors, however, have occurred, and in detail were as follows: One case was that of a chronic epileptic who had what is referred to as probably a brain tumor, most likely of a nonmalignant type; 5 cases were gastric or peptic ulcers; 1 case was an ulcer of the duodenum, 1 a case of ulcerative colitis, and 1 a pelvic abscess. There were 4 cases of alcoholism, 3 of diabetes, and 3 of appendicitis, and 2 drug addicts. There was 1 case of tuberculosis, probably pulmonary, and 1 case of goiter in a painter, aged 41 years, who died in Holt County, Nebr. The proportion of cases of *insanity* seems rather large, there having been 9 cases at an average age of 50 years. In 1 of these cases chronic lead poisoning is referred to as the cause of paresis, while the other cases of this type of insanity are referred to as acute and chronic melancholia, possibly directly induced by the physical condition resulting from lead poisoning.

Of the miscellaneous affections, which number 49, reference may be made to 4 cases of sclerosis, 3 of peritonitis, 3 of neuritis, 4 of rheumatism, 3 of thrombosis, and 2 of meningitis.

Death certificates indicating no complications number 152, of which the average age was 50.9 years. For all cases combined, with or without complications, the average age at death, as previously stated, was 51.3 years.

I conclude the foregoing discussion with Table 39, showing the age distribution by divisional periods of life for the four principal joint causes and for the group without complications.

TABLE 39.—CONTRIBUTORY CAUSES OF DEATHS OF PAINTERS FROM CHRONIC LEAD POISONING, 1914-1919, BY AGE GROUPS

Age group	Nephritis		* Cardio-vascular		Arterio-sclerosis		Anemia		No compli-cations	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Under 30 years.....	4	2.1	2	1.8	1	1.8	3	8.6	9	5.9
30 to 39 years.....	34	17.6	16	14.2	8	14.0	5	14.3	19	12.5
40 to 49 years.....	60	31.1	31	27.4	13	23.6	13	37.1	36	23.7
50 to 59 years.....	57	29.5	25	22.1	22	38.6	13	37.1	52	34.2
50 to 69 years.....	32	16.6	33	29.2	21	36.8	12	34.3	24	15.8
70 to 79 years.....	6	3.1	6	5.3	5	8.8	2	5.7	12	7.9
Total.....	193	100.0	113	100.0	57	100.0	35	100.0	152	100.0

PAINT MIXERS

There have been only 15 deaths of paint mixers during the 11-year period, who died at an average age of 43.9 years. The certificates reveal nothing of special interest, with the possible exception of one case in which a laborer was employed as a maker of paint sand paper at a Ford plant in the city of Newark, N. J. An even more interesting case is that of a salesman for a paint and glass house, who may possibly have formerly been a worker. This death occurred in Highland Town, Md. There was also the death of a foreman of a paint company in St. Louis, Mo. Three of the deaths were of negroes.

PLUMBERS

Relatively to the number of plumbers employed throughout the country the number of deaths from lead poisoning appears disproportionately low. The number of plumbers in labor organizations is fortunately known so that an approximate estimate can be given. There were 25 deaths during the 11-year period, distributed by age groups as follows:

TABLE 40.—DEATHS OF PLUMBERS FROM CHRONIC LEAD POISONING, 1914-1924, BY AGE GROUPS

Age group	Num-ber	Per-cent
20 to 29 years.....	4	16
30 to 39 years.....	4	16
40 to 49 years.....	10	40
50 to 59 years.....	5	20
60 to 69 years.....	2	8
Total.....	25	100

The union membership has changed so much from year to year that it probably does not exceed at the present time 60,000, which if increased by an arbitrary estimate of the nonunion membership, would give an approximate number of 100,000 plumbers throughout the country, which for the year 1924 would give a rate of 7 per 100,000. This can not be considered excessive and may be compared with the corresponding rate for painters given as 79 in the previous discussion.

There have been included in this group three acetylene burners or welders. Two of the deaths occurred in Philadelphia and one in the city of Detroit, Mich. The subject of lead poisoning among acetylene burners has been discussed with admirable thoroughness by Lieut. Commander E. W. Brown in the United States Naval Medical Bulletin for 1925. I quote from a summary of his conclusions the following statement:

The lead poisoning in this study was induced by the inhalation of lead volatilized in fumes arising from the burning of paint adherent to scrap metal in the process of cutting by the oxyacetylene torch. The lead particles are extremely fine being about one-half micron for the average diameter, or one-fifteenth of the diameter of a red blood cell.

With reference to the admissions it is said:

Eighty-three first admissions of plumbism over a period of observation approximating 8 months—i. e., from June 6, 1924, to February 15, 1925; 29 recurrences; total of 112 cases; number of men employed the entire time, 221; number working not less than 1 week, 201; average period worked per man, 3.6 months; 37.5 per cent of first admissions and 50.7 per cent of total admissions based on 221 men; 41.2 per cent and 55.7 per cent based on 201 men. Of the 82 cases of plumbism, the shortest period was 7 days, the longest 13.2 months, the average 2.4 months. The duration of disability varied from 3 days to 69 days, average 20 days.

For first admissions the rate varied from 225.3 per 1,000 in June, 1924, to 5,830 in January, 1925. The average admission rate was 2,578 per 1,000 for all classes.

The preventive measures recommended are as follows:

The essential requirement is a protective apparatus to prevent the inhalation of the lead fume. Among the various devices tested the modified Burrell industrial gas mask was found to be decidedly the most efficient.

POTTERS AND TILE WORKERS

The occupation of potters and tile workers is generally thought of as one in which lead poisoning is proportionately still of considerable frequency. As a matter of fact, the present investigation reveals a surprisingly small number of fatal cases. There have been in the aggregate only 13 cases, distributed by specific occupations, as follows: Potters, 3; dippers, 3; kiln men, 1; enamellers, 5; and tile workers, 1. Five of these cases were of persons born in foreign countries, 2 having been born in England, 1 in Ireland, 1 in Sweden, and 1 in Poland. By conjugal condition, 11 were married while 2 were single. The average age at death was 45.2 years. One of the deaths occurred in 1914, 2 in 1916, 1 in 1917, 1 in 1918, 2 in 1919, 1 in 1920, 3 in 1922, 1 in 1923, and 1 in 1924. The membership of the potters' labor organizations in 1920 was 8,000. The number of wage earners employed in the pottery industry in 1920 was returned by the census as 29,273. Assuming, therefore, an average membership of 30,000 for the 11-year period and making no allowance for

enamblers and tile workers, who have been included in the mortality returns, the average fatality rate from chronic lead poisoning was approximately 4.3 per 100,000.

In this connection references may be made to a consolidated mortality report for the 9 years ending with 1923 published by the National Brotherhood of Operative Potters. In the aggregate there were 839 deaths, of which only 2 were specifically attributed to lead poisoning.

RUBBER WORKERS

Of rubber workers there were only 3 deaths each reported from Passaic, N. J.; Providence, R. I.; and Walpole, Mass.

STORAGE BATTERY WORKERS

The occupation of storage battery workers is frequently referred to as one of exceptional hazard, with particular reference to liability to chronic lead poisoning. A special bulletin on the subject published by the United States Bureau of Labor Statistics in 1915¹ gives a record of 164 cases of chronic lead poisoning among 915 workers in 5 large factories during 1913, equivalent to a rate of 17.9 per cent of the number of persons employed. Information derived from other sources, particularly the New York Department of Labor, is decidedly suggestive of an extraordinarily higher degree of frequency of cases of lead poisoning in the manufacture of electric storage batteries, but as far as it is possible to judge the affections as a rule are non-fatal and are of a comparatively slight degree of intoxication. Be this as it may, it is certainly suggestive that there have been only 5 deaths reported for the United States registration area for the 11 years ending with 1924, or 1 in 1915, 1 in 1917, 2 in 1919, and 1 in 1920. The cases occurred at the following points: Two in Chicago, 1 in St. Louis, 1 in Camden, N. J., and 1 in Philadelphia. None appeared to have occurred at Niagara Falls, from which a large number of cases have been reported through the New York Department of Labor. The experience suggests possible inaccuracies in death certification in connection with lead poisoning, well deserving of more extended consideration.

PRINTERS

The printing trades have for many years been charged with a specific and exceptional liability to chronic lead poisoning. It is rather curious that most of those who have written on the subject should have been satisfied with rather crude data, in many cases derived from foreign sources. Granting that deaths from chronic lead poisoning are not necessarily a satisfactory index of disease liability in the nonfatal form, it is, nevertheless, decidedly suggestive that during the last 11 years only 67 deaths from chronic lead poisoning should have been reported for the United States registration area for the different branches of the printing trades. The death certificates, unfortunately, do not indicate the specific occupation followed, with a few exceptions in which the employment is given

¹ U. S. Bureau of Labor Statistics Bul. No. 165: Lead poisoning in the manufacture of storage batteries. Washington, 1915. 38 pp.

as that of linotype or monotype operator. The approximate number of printing employees in the United States is probably not less than 300,000, while the average number of deaths from chronic lead poisoning is about 6; in other words, the frequency rate is equivalent to about 2 per 100,000 workers. Of course, a considerable proportion of these workers are not in any way exposed to the risk of lead poisoning, but for the present it is not feasible to calculate more specific death rates for particular branches of the printing trades.

The 67 deaths which occurred were distributed during the last 11 years as follows:

TABLE 41.—DEATHS OF PRINTERS FROM CHRONIC LEAD POISONING, 1914-1924, BY YEARS

Year	Number of cases	Aggregate years of life	Average age at death (years)	Year	Number of cases	Aggregate years of life	Average age at death (years)
1914.....	5	238	47.6	1921.....	10	445	44.5
1915.....	4	168	42.0	1922.....	7	314	44.9
1916.....	11	534	48.5	1923.....	10	487	48.7
1917.....	4	185	46.3	Total, 1919-1923.....	38	1,739	45.6
1918.....	2	61	30.5	1924.....	3	119	39.7
Total, 1914-1918.....	26	1,186	45.6	Total, 1914-1924.....	67	3,044	45.4
1919.....	7	302	43.1				
1920.....	4	191	47.8				

The distribution of deaths by divisional periods of life is given below:

TABLE 42.—DEATHS OF PRINTERS FROM CHRONIC LEAD POISONING, BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
Under 20 years.....	2	3.0	60 to 69 years.....	3	4.5
20 to 29 years.....	5	7.5	70 to 79 years.....	5	7.5
30 to 39 years.....	9	13.4	Unknown.....	1	1.5
40 to 49 years.....	27	40.3	Total.....	67	100.0
50 to 59 years.....	15	22.4			

The youngest death occurred at the age of 19 and the oldest at the age of 75.

The subject of lead poisoning in the printing trades will be exhaustively dealt with in a forthcoming report on Health Survey of the Printing Trades,² which includes extended field investigations and analysis of the mortality experience of printers' labor organizations for recent years. The evidence contained in that report will confirm the conclusion that the rate of fatal incidence is not a matter of serious concern at the present time, while the relative frequency of the affliction is unquestionably diminishing. Of the 67 printers who died from chronic lead poisoning, 13 were single and the remainder were married, widowed, or divorced. Only one was a colored person. All but a few were native born, there having been 2 deaths of printers born in England, 1 in Ireland, 2 in Canada, 1 in Germany,

² U. S. Bureau of Labor Statistics Bul. 427. [In press.]

and 1 in Italy. The outstanding complicating diseases were nephritis in six different forms, there having been 19 cases, or 28.4 per cent. Other complications were not of sufficient numerical importance to justify detailed consideration. The average age at death for this group was 45.4.

TIN AND COPPER SMITHS

In the group of tin and copper smiths there occurred 9 deaths from chronic lead poisoning, of which 6 were returned as tanners and 3 as coppersmiths, including 1 mentioned as a coppersmith's laborer. The average age at death in these cases was 48.7 years. The certificates reveal nothing additional of special interest.

GLASS WORKERS

There were 9 deaths of workers in the glass industry, occurring at an average age of 38.3 years. The occupational distribution is fairly well indicated, the different employments having been as follows: One glass worker, 1 laborer in a plate-glass company, 1 glass molder, 1 glass mixer, 1 glass decorator, 1 glass cutter, 2 glaziers, and 1 glass worker not otherwise specified. Deaths occurred in the following places: Philadelphia, 1; Beaver County, Pa., 1; Chicago, 1; Oak Park, Ill., 1; Jefferson County, Mo., 1. Of the 9 glass workers 6 were foreign born, 1 having been born in Germany, 1 in Bohemia, 2 in Austria, 1 in England, and 1 in Italy.

METAL WORKERS

The group "Metal workers" includes a variety of specific occupations which for the sake of convenience have been combined. There were 23 deaths in this group, of an average age of 42.9 years, distributed by specific occupations as follows:

Metal pattern maker.....	1
Sheet metal workers.....	3
Laborer in iron shop.....	1
Metal polishers.....	2
Iron worker.....	1
Helper in machine shop.....	1
Moulder.....	1
Foundry worker.....	1
Superintendent metal specialties.....	1
Laborer in steel works.....	1
Riveter.....	1
Metal workers not otherwise specified.....	2
Machinists.....	7

Six of the 23 were single. Most of the metal workers were native born, 2, however, having been born in Germany, 1 in England, 3 in Austria-Hungary, and 1 in Canada.

CARPENTERS AND WOODWORKERS

The number of deaths from chronic lead poisoning among carpenters and woodworkers was 18, with an average age at death of 57.5 years. In the nature of the carpenter's occupation he is apt to do painting to a limited extent. By specific occupations 12 were carpenters, 3 were wood finishers, 2 were woodworkers, and 1 was a cabinet maker. Certificates reveal nothing of special interest, excepting that in one case it is specifically stated that "lead poisoning was

due to drinking water through a lead pipe." This death occurred in the township of Hampden, Me. In another case which occurred in Cheshire County, N. H., a woodworker died from chronic lead poisoning, the cause being specifically stated to have been the drinking water. In another case a woodworker is mentioned also as having been a painter by trade, and the same statement was made with reference to a carpenter.

LABORERS

The group "Laborers" includes all whose occupations were simply designated as laborers, with no clue to a more specific employment followed. There were 93 deaths in this group, occurring at an average age of 41.9 years. The most suggestive aspect of the mortality is the distribution by nativity, 51 having been native born, while of the remainder 3 were born in Germany, 1 in Switzerland, 9 in Poland, 2 in Russia, 11 in Austria, 6 in Ireland, 1 in Belgium, 1 in Holland, 1 in France, 3 in Italy, 1 in Armenia, 1 in the Azore Islands, 1 in the West Indies, and 1 in Mexico.

The geographical distribution of the deaths of laborers from chronic lead poisoning is a matter of some interest in view of the possible concentration of lead-using industries in particular sections. The deaths were distributed as follows: Pennsylvania, 18; Missouri, 11; Ohio, 10; New York, 9; Indianapolis, 6; Illinois, 6; California, 5; Michigan, 4; New Jersey, 4. There were two deaths each in Wisconsin, Massachusetts, New Hampshire, Utah, Virginia, and Connecticut, and one death each in Minnesota, Nebraska, Kentucky, Washington, Louisiana, South Carolina, Florida, and Georgia. The geographical distribution is more or less suggestive of the conclusion that many of the laborers were employed in connection with lead-using industries, particularly in the States of Pennsylvania and Missouri. It is regrettable that the death certificates should not be more definite with reference to the specific occupation of the deceased, for the term "laborer" for practical purposes is, broadly speaking, meaningless.

FARMERS

There were 61 deaths of farmers from chronic lead poisoning, at an average age of 56.7 years. By divisional periods of life the deaths were distributed as follows:

TABLE 43.—DEATHS OF FARMERS FROM CHRONIC LEAD POISONING, BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
20 to 29 years.....	3	4.9	70 to 79 years.....	10	16.4
30 to 39 years.....	4	6.6	80 years and over.....	3	4.9
40 to 49 years.....	9	14.8			
50 to 59 years.....	16	26.2	Total.....	61	100.0
60 to 69 years.....	16	26.2			

It has previously been intimated that deaths from chronic lead poisoning among farmers are, to a certain extent, the result of painting done on the farm and probably in a more or less careless manner. The large majority of the deaths was unquestionably nonindustrial and attributable to drinking water obtained through lead pipes, as is clearly proven by definite statements to this effect on some of the death certificates. The first question of importance, therefore, is the

geographical distribution of the deaths of farmers from chronic lead poisoning, which presents some really extraordinary aspects. The deaths by States are given in Table 44.

TABLE 44.—GEOGRAPHICAL DISTRIBUTION OF DEATHS OF FARMERS FROM CHRONIC LEAD POISONING, 1914 TO 1924

State	Number of deaths	State	Number of deaths	
Connecticut.....	4	Colorado.....	3	
Rhode Island.....		Utah.....	2	
Massachusetts.....		Wyoming.....	4	
Maine.....		Washington.....		
New Hampshire.....		California.....		
Total, New England.....	29	Total.....	9	
New York.....	4	Maryland.....	1	
Pennsylvania.....	4	North Carolina.....	1	
Ohio.....	3	Virginia.....	3	
Michigan.....	3	Total.....	5	
Illinois.....			Grand total.....	61
Wisconsin.....				
Missouri.....	4			
Total.....	18			

It is shown by the preceding table that nearly one-third of all of the deaths of farmers from chronic lead poisoning occurred in the State of Maine, while a relatively large number of such deaths also occurred in the adjoining State of New Hampshire. On further examination it appears that the 18 deaths in Maine were distributed as follows: Oxford County, 10; Franklin County, 5; Knox County, 1; Cumberland County, 1; city of Lewiston, 1. For New Hampshire the county distribution was as follows: Carroll County, 2; Merrimack County, 2; Sullivan County, 2; Grafton County, 1.

The preceding analysis of deaths by counties is strongly suggestive of local conditions favoring chronic lead poisoning through lead pipes, for there are no industrial conditions in the counties referred to which could possibly have a bearing upon the occurrence of chronic lead poisoning cases among farmers. As a matter of fact, the death returns for Maine specifically mention water supplied through lead pipes as a contributory cause of chronic lead poisoning in 8 out of the 18 deaths which are a matter of record. No mention of lead pipes, however, is made in the 7 death certificates for New Hampshire.

The distribution of the deaths by years has been quite irregular, due possibly to the relatively small number of cases involved. The information is given in the statement following as a matter of record:

TABLE 45.—DEATHS OF FARMERS FROM CHRONIC LEAD POISONING, 1914 TO 1924, BY YEARS

Year	Maine	New Hampshire	Year	Maine	New Hampshire
1914.....		1	1921.....		
1915.....	1	1	1922.....	4	
1916.....	1	1	1923.....	1	1
1917.....	4	1	Total, 1919-1923.....	10	1
1918.....	1		1924.....	1	2
Total, 1914-1918.....	7	4	Total, 1914-1924.....	18	7
1919.....	5				
1920.....					

In the 18 cases for Maine, chronic and acute nephritis was the principal complicating contributory cause, observed, however, in only 4 instances out of 11 showing complications, the remainder having been arteriosclerosis, 2; apoplexy, 2; and heart disease, pulmonary cedema, and spinal sclerosis, 1. In 7 cases there were no complications. In the New Hampshire cases the complications were paralysis, 2; pneumonia, 1; myelitis, 1; and hemorrhage of the brain, 1.

The preceding data are decidedly suggestive of the risk of nonindustrial lead poisoning in certain sections of the country where peculiarly soft water supplies very probably aid in the introduction of minute but accumulative substantial quantities of dissolved lead into the human system. It is certainly extremely significant that one county in the State of Maine should have had more than twice as many deaths from chronic lead poisoning among farmers as the entire State of New York or the entire State of Pennsylvania. The subject matter is certainly one fully deserving of more extended investigation on the part of the authorities directly concerned.

PROFESSIONAL OCCUPATIONS

Differentiating obviously professional or exceptionally scheduled occupations from general industrial pursuits classified as miscellaneous for the present purpose, there were 29 deaths thus classified, of an average age at death of 50.4 years. These deaths are of exceptional interest in revealing a wide range of employments, most of which have no connection whatever with lead-using industries. It is quite probable that the consideration emphasized in the case of farmers applies also to professional occupations—that is, the general risk of chronic lead poisoning due to water supplies derived from lead pipes. The professional occupations classified for the present purpose are as follows:

Physician who died of chronic lead poisoning in Franklin County, Me., at the age of 56 years.

Dentist, Huron County, Ohio, who died at the age of 70 years.

Accountant, Spokane, Wash., 64 years of age.

Chemist, Dayton, Ohio, age 24, death attributed to tetraethyl lead poisoning.

Chemist, Columbus, Ohio, age 32.

Musician, Canton, Ohio, age 35.

Commercial artist, Minneapolis, Minn., age 40.

Art teacher, Johnson County, Kans., age 54.

Policeman, Grant County, Ky., age 56.

Fire marshal, Chester, Pa., age 56.

Mail clerk, San Diego, Calif., age 59.

Electrician, age 18, Putnam County, Ohio.

Electrician, age 42, Manhattan, N. Y.

Civil engineer, Pittsburgh, Pa., age 46, complicated by Addison's disease.

Civil engineer, age 64, Stevens County, Wash.

Railroad engineer, 69 years of age, Pueblo County, Colo. (this man died at the county poor farm).

Gas engineer, Bronx Borough, N. Y., age 55.

Engineer, age 54, Mecorta County, Mich.

Engineer, age 41, Northampton, Mass.

Stenographer, age 58, Chester County, Pa.

The remainder were commercial occupations, including traveling salesmen, real estate dealers, grocers, etc.

MISCELLANEOUS OCCUPATIONS

This relatively large group of employments not directly or obviously connected with lead-using industries is represented by 114 deaths at an average age of 47.3 years. Of course, in possibly quite a number of cases persons concerned may have been incidentally engaged in painting operations. A rather suggestive group of employments, however, concerns the ship trades or workers at navy yards. There were 9 such cases, distributed by specific occupations, as follows: Lighthouse keeper, 1; shipyard worker, 1; navy-yard helper, 1; chief gunman, United States Navy, 1; shipyard laborer, 1; mariners, 2; seaman, 1; quartermaster, 1. The risk of lead poisoning on ship-board or in lighthouses where drinking water may be kept in lead tanks is, of course, self-evident. Of considerable interest also are deaths among persons connected with the automobile industry. There were 5 deaths in this group, 1 auto dealer, 1 auto mechanic, 1 garage man, and 2 chauffeurs. The death certificates do not indicate whether deaths in any of these cases were the result of tetraethyl lead poisoning. There were 3 deaths of barkeepers, regarding which it may be said that in former years lead pipes were rather extensively used in old bar fixtures, and the risk may possibly repeat itself in soda-water fountains unless carefully supervised. There was 1 sudden death from tetraethyl lead poisoning, complicated by duodenal ulcer, at a dye works in Salem County, N. J. The man died at the age of 28. Particularly suggestive also is the death of a horticulturist who died at Danville, Ill., at the age of 35, possibly because of the use of lead arsenic in spraying. There were also 2 deaths of foresters, who likewise may have been employed in spraying operations for the destruction of insects injurious to forest life. In one of these cases, at Boston, Mass., the death certificate contained the specific statement that "lead poisoning was due to exposure to lead from arsenic spray for many years." The other death, at the age of 72, occurred in Essex County, Mass., also of a forester, but with no further specific information except that the disease had a duration of only six months. There were three deaths of brass finishers and bronzers, all occurring in the city of New York. Another case of tetraethyl lead intoxication occurred in the case of a janitor, also employed at Salem, N. J., who died at the age of 47 years. Curiously enough, there were 4 deaths from chronic lead poisoning among shoe workers, occurring, however, in 4 different places, or Alameda County, Calif.; Norfolk County, Mass.; Stafford County, N. H.; and Fulton County, Ohio. The last case was of special interest, it being stated that the same was of a duration of 8 years. It would hardly serve a useful purpose to further enlarge upon the deaths of this group, but a few individual occupations may be mentioned: One railroader, 1 switchman, 1 clock maker, 1 building contractor, 1 lumberman, 1 electric worker, 1 elevator operator, 1 file cutter, 1 boiler engineer, 1 electric laborer, 1 silver gilder, 1 boilermaker, 1 slater, 1 furnace keeper, 1 lineman, 1 bottler, 1 laundryman, 1 cement worker. There were also 5 blacksmiths. The latter, no doubt, may have been employed also in the painting of coaches or in using paint materials otherwise. It is, however, suggestive that one of these

deaths should have occurred in Oxford County, Me., and one in Hillsboro County, N. H. The wide occupational distribution of these deaths would seem to indicate that in most cases chronic lead poisoning was of a nonindustrial character and more probably the direct result of lead absorption through drinking water conveyed through lead pipes.

UNKNOWN OR RETIRED

The number of deaths in the group "Unknown or retired" was 103, of an average age at death of 52.8 years. The distribution of deaths by divisional periods of life was as follows:

TABLE 46.—DEATHS FROM CHRONIC LEAD POISONING IN GROUP OF "UNKNOWN OR RETIRED," BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
Under 30 years.....	8	7.8	70 to 79 years.....	15	14.6
30 to 39 years.....	11	10.7	80 years and over.....	3	2.9
40 to 49 years.....	26	25.2	Total.....	103	100.0
50 to 59 years.....	20	19.4			
60 to 69 years.....	20	19.4			

The higher average age at death in this group is clearly suggestive of the fact that many of the men, as occasionally intimated on the death certificate, had retired, but, unfortunately, the previous occupation is not indicated. In some cases a direct connection with previous painting operations is clearly evident. It is rather curious that only one case of this group in which lead poisoning from water supplied through lead pipes is indicated to have occurred was in Penobscot County, Me. One certificate of a death in Cook County Hospital, Chicago, states that death was due to involvement of kidneys and urinary organs, the results of lead absorption and mercury taken in medicine. The certificates reveal nothing else of special interest, but it may be pointed out in this connection that investigations of this kind would be materially facilitated if the death certificates were more completely filled out, especially as to the specific occupation followed and possible contributory causes or conditions bearing upon the death of the deceased.

WOMEN

There were 48 deaths of women from chronic lead poisoning, at an average age at death of 51.8 years. These deaths are of special significance, in that it is self-evident, of course, that with few exceptions the women in question were not exposed to lead as an industrial hazard. Yet relatively the number of deaths is very large and deserving of extended consideration.³ By divisional periods of life the deaths were distributed as follows:

TABLE 47.—DEATHS OF WOMEN FROM LEAD POISONING, BY AGE GROUPS

Age group	Number	Per cent	Age group	Number	Per cent
Under 30 years.....	3	6.3	60 to 69 years.....	11	22.9
30 to 39 years.....	7	14.5	70 years and over.....	5	10.4
40 to 49 years.....	11	22.9	Total.....	48	100.0
50 to 59 years.....	11	22.9			

³ See United States Bureau of Labor Statistics, Bul. No. 253: Women in the lead industries. Washington, 1919.

As in the case of farmers there is in the case of women an extraordinary geographical distribution, with a peculiar concentration of the deaths in Maine, New Hampshire, and Massachusetts. In the State of Maine there occurred 16 deaths of women from chronic lead poisoning, distributed by counties as follows: Franklin County, 8, in 2 of which death was attributed directly to lead absorption in water conveyed through lead pipes; Oxford County, 3, in 1 of which death was attributed to lead poisoning by drinking water which passed through 30 feet of lead pipe; Kennebunk County, 2; Cumberland County, 1; Androscoggin County, 1; and Penobscot County, 1.

In New Hampshire there were 7 deaths, distributed as follows: Carroll County, 2; Grafton County, 2; and 1 each in Hillsboro, Merrimac, and Cheshire Counties. In the one which occurred in Cheshire County, in the city of Keene, death was attributed to chronic lead poisoning from the domestic water supply.

In Massachusetts 7 deaths occurred, distributed as follows: Worcester County, 2; Hampshire County, 2; Middlesex County, 2; and Plymouth County, 1. The death in Plymouth County was attributed to water from lead pipes, one death in Middlesex County, in the city of Lowell, being attributed to "lead poisoning as the result of hair dyes." The death in Dracut, Middlesex County, was attributed to the water supply, and likewise a death in Worcester was attributed to drinking water drawn through a lead pipe.

In Connecticut 1 death occurred; in New York, 1; in New Jersey, 1; in Pennsylvania, 2; in Ohio, 4; in Missouri, 4. One of these deaths, the case of a woman 34 years of age, was attributed to "lead poisoning from using white flake face powder." The remainder of the deaths occurred, 1 in Indiana, 1 in Illinois, 1 in Kentucky, 1 in Kansas, and 1 in Louisiana attributed to drinking water from a roof painted red. Only 5 of the 48 deaths were of unmarried women, suggesting the seriousness of the deaths from a social economic point of view, in that 43 were married and no doubt, in many cases, mothers. As shown before, 18 of the deaths were of women between 30 and 50 years of age. The evidence is quite suggestive that in most of the cases deaths were directly the result of drinking contaminated water but particularly so in the cases in the States of Maine, New Hampshire, and Massachusetts.

BOYS UNDER 18

There were 11 deaths of boys under 18. The youngest of these was only 9 months of age, it being stated that death was caused by the "unwarranted use of lead ointments by the parents." The death occurred in Wellesville, Columbiana County, Ohio. The second death occurred at the age of 1 year and 7 months, it being attributed to "eating paint." This death occurred in New Orleans. The third death, which occurred in Baltimore, was that of a boy 1 year and 10 months, and was also attributed to "eating paint off toys." A death in Franklin County, Me., occurred at the age of 5 years and 4 months. Another death in Baltimore, that of a boy 6 years and 11 months old, was attributed to "eating paint and enamel off toys," while another in the same city at the age of 7 years and 9 months was attributed to "playing in a paint shop." Other deaths were 1 at 11 years and 7 months, a boy in Reynolds County,

Mo.; 1 at 16 years of age, a school boy in Scott County, Minn.; 1 at the age of 17 years and 4 months in King County, Wash., the death being attributed to "chewing lead foil." There was also a death at the age of 17 years and 8 months of a boy who died in the city of Indianapolis.

GIRLS UNDER 18

There were 8 deaths of girls under 18 regarding which the following details are of interest. One girl died in New Haven, Conn., at the age of 10 months, death being attributed to the infant having "gnawed lead paint from the side of the bed." One at the age of 11 months occurred in Madison County, Ill. The third death occurred at the age of 2 years and 4 months in Westchester County, N. Y., being attributed to "eating paint from window sill and paint can." The fourth case occurred in New Rochelle, N. Y., at the age of 2 years 8 months; the fifth case in Boston, Mass., at the age of 3 years and 1 month; the sixth case in Cleveland, Ohio, at the age of 3 years and 2 months, it being attributed to "eating enamel off bed"; the seventh case in New Haven, Conn., at the age of 13; and the eighth case in Minneapolis, Minn., at the age of 16 years and 1 month, death being attributed to "face powder containing white lead carbon flake."

PART III.—STATISTICS OF CHRONIC LEAD POISONING FROM STATE INDUSTRIAL ACCIDENT BOARDS

My efforts to secure a reasonably complete statement of lead poisoning cases and deaths reported to industrial accident boards have not been successful. I am able, however, to furnish statistics for a few States, which make a useful addition to the preceding information.

MASSACHUSETTS

According to the Department of Labor and Industries of the State of Massachusetts the returns regarding chronic lead poisoning made to that department during the period 1921-1925 have been as follows:

TABLE 48.—NUMBER OF CASES OF CHRONIC LEAD POISONING AND OF DEATHS FROM IT IN MASSACHUSETTS, 1921-1925, BY YEARS

Year	Cases	Deaths
1921.....	89	2
1922.....	71	1
1923.....	85	1
1924.....	102	1
1925.....	67	
Total.....	414	4

This indicates approximately 1 death to every 100 cases, which compares with Great Britain as follows: During 1925 there were 326 cases of lead poisoning, with 13 deaths, reported to the Chief Inspector of Factories. This would give 1 death to every 25 cases, suggestive of the possibility that in this country more mild cases are reported than in England. In 1925 the British returns gave 89 cases of lead poisoning among house painters, with 9 deaths, or approxi-

mately 1 death to every 10 cases. It is conceivable, of course, that chronic lead poisoning cases in this country, while fairly common, receive earlier and more qualified treatment and are therefore less fatal than abroad. The Massachusetts returns, by industries and years, are given in Table 49.

TABLE 49.—LEAD POISONING CASES IN MASSACHUSETTS, 1921 TO 1925, BY YEARS AND INDUSTRIES

Industry	1921	1922	1923	1924	1925	1921-1925	
						Number	Per cent
Paint and varnishing.....	49	24	43	43	28	187	45.2
Rubber.....	9	6	21	20	12	68	16.4
Metals.....	13		1		9	23	5.6
Wire and cable manufacturing.....		7	3	8	3	21	5.1
Automobile.....	1	4	4	5	4	18	4.4
Printing.....	2	7		3	2	14	3.4
Plumbing.....	6	2	2			10	2.4
Lead.....			1	3	1	5	1.2
Shipbuilding.....	1	2		2		5	1.2
Storage battery.....		2		2		4	1.0
Brass and copper.....	1	2				3	.7
Insecticide and spraying.....	1	2				3	.7
Carpenters and furniture.....	2	1				3	.7
Potteries.....		2				2	.5
Farmers.....	1					1	.2
Glass.....				1		1	.2
Paint manufacture.....		1				1	.2
Miscellaneous.....	3	9	10	17	6	45	10.9
Total.....	89	71	85	104	65	414	100.0

As shown by this return, during the five years under review there were 187 cases of chronic lead poisoning among painters out of a total of 414, or 45.2 per cent. The next most important industry in Massachusetts as affected by lead poisoning is the rubber industry, reporting 68 cases. Plumbing accounts for 10 cases, while in the printing industry there occurred only 14 cases. Other occupations indicate a wide distribution of lead poisoning in Massachusetts industries, which, however, suggests that in a few cases the disease was probably not the result of the employment. Rather suggestive also is the relatively large number of cases occurring in the manufacture of steel and wire, while there have been only a few cases in connection with the handling of lead and none in the manufacture of white lead.

PENNSYLVANIA

The Department of Labor and Industry of the State of Pennsylvania has been good enough to furnish me with the following information:

The department receives cases of lead poisoning from only a very small proportion of the industries of this State in which workers are exposed to the hazards of lead. The reports we have been receiving are from the manufacturers of white and red lead, with occasionally a report from an industry using these substances. The data which we have on hand are as follows: 1920, 4 cases; 1921, 5 cases; 1922, 5 cases; 1923, 2 cases; 1924, 13 cases; 1925, 13 cases.

CALIFORNIA

The chairman of the Industrial Accident Commission of California informs me that—

The number of cases of lead poisoning reported to the board involving injuries that caused disability lasting longer than the day of the injury have been shown by the following returns. During 1919 there were 31 cases; 1920, 38 cases; 1921, 84 cases; during 1922 and 1923 no record was kept, while during 1924 there were 370 cases and during the first six months of 1925 there have been 117 cases. It is explained, however, that of the 370 cases reported for 1924, 278 were due to inhalation of fumes in burning paint from discarded battleships; of the 117 cases reported for the period January 1 to June 30, 1925, 60 were due to the same cause.

NEW YORK STATE

I have been favored with more detailed information by the Department of Labor for the State of New York, which has placed at my disposal the original certificates covering the reported cases of lead poisoning during the period 1912 to January, 1925, inclusive. This is perhaps the most interesting information which has thus far been made available, but unfortunately there is incompleteness for certain years. The information consists of 707 certificates, in detail by industries and principal occupations, as shown in Table 50.

TABLE 50.—LEAD POISONING CASES IN THE STATE OF NEW YORK, 1912 TO JANUARY, 1925, BY INDUSTRIES

Industry	Number	Aggregate ages (years)	Average age (years)	Industry	Number	Aggregate ages (years)	Average age (years)
Painters.....	285	11,696	41.0	Lead arsenate.....	3	114	38.0
Electric storage batteries.....	228	7,611	33.4	Glass workers.....	3	140	46.7
Lead workers.....	47	1,718	36.6	Potters.....	3	160	53.3
Paint workers.....	29	1,187	40.9	Carpenters.....	2	80	40.0
Brass and copper.....	25	1,025	41.0	Linoleum.....	2	63	31.5
Machinists, metal workers.....	16	524	32.8	Polishers and buffers.....	2	62	31.0
Tin and solder.....	8	281	35.1	White metal.....	2	104	52.0
Plumbers.....	7	284	40.6	Miscellaneous.....	29	1,235	42.6
Rubber.....	7	282	40.3				
Automobiles.....	5	134	26.8	Total.....	707	26,837	38.0
Wire and cables.....	4	137	34.3				

The outstanding fact of this experience is the really extraordinary relative proportion of cases reported in connection with the manufacture of electric storage batteries. An interesting parallel is the comparatively large number of cases reported for the rubber industry in Massachusetts. The incompleteness of the returns is best indicated by the following statement of lead-poisoning cases in the manufacture of electric storage batteries in New York during the entire period under review.

	Number		Number
1912.....	2	1920.....	17
1913.....	7	1921.....	10
1914.....	12	1922.....	5
1915.....	23	1923.....	31
1916.....	16	1924.....	38
1917.....	41	1925 (January).....	11
1918.....	2		
1919.....	13	Total.....	228

It would appear from this statement that for 1918 and 1922, in any event, the reports in all probability are incomplete, but no explanation regarding the deficiency is at the present time available.

Of the 228 cases of chronic lead poisoning which occurred in the manufacture of electric storage batteries, 164 were reported from a single establishment in Niagara Falls; 23 were reported from a single establishment at Depew; and 27 were reported from a single establishment in Brooklyn. When the certificates for Niagara Falls and Depew are analyzed by years of occurrence, it appears that of the 164 cases at Niagara Falls, 92 occurred subsequent to 1920, while out of the 23 cases at Depew only 2 cases have occurred since 1920. Likewise of the 27 cases reported from a single establishment in Brooklyn no cases have been reported since 1920. As far as it is possible to judge, therefore, the conditions giving rise to lead poisoning, other than at Niagara Falls, have been brought quite effectively under control.

The average age for all of the 707 cases was 38 years. The variations in the average age are apparently not of particular significance. They are, however, in marked contrast to the ages at death in fatal cases of chronic lead poisoning as dealt with in a preceding section of this report.

In somewhat more detail the following observations concerning certain important occupations may be of interest. Of the 47 lead workers included in Table 50, mention is made of the following specified occupations: Smelter working on lead and copper; burners reducing dross and scrap lead and copper to original metal; sprinkler in white lead works; lead workers recharging dry pans; type makers; laborer pouring molten lead; lead burner making copper; lead furnace stoker; laborer unloading lead; lead-pipe worker; smelter of dross lead and zinc; machine operator, copper and lead; lead pattern maker; lead burner making all kinds of utensils; lead burner for oil company; lead smelter; white-lead worker.

It is particularly significant in this connection that all of the white-lead workers' cases should have been reported previous to 1921 or in the following order: 1912, 1 case; 1914, 2 cases; 1915, 8 cases; 1916, 4 cases; 1917, 1 case; 1919, 2 cases; 1920, 1 case. It would, therefore, appear that the conditions giving rise to lead poisoning in white-lead plants in the State of New York have been brought entirely under control.

Cases of lead poisoning among other than white-lead workers in this group of lead workers were distributed by years as follows: 1912, 2 cases; 1913, 6 cases; 1914, 5 cases; 1915, 12 cases; 1916, 8 cases; 1917, 7 cases; 1919, 4 cases; 1920, 5 cases; 1921, 3 cases; 1922, 1 case; 1923, 3 cases; 1924, 2 cases. In this group of occupations, therefore, the trend has been measurably downward in the recent occurrence of lead poisoning.

It is also highly suggestive that in connection with the entire experience there should not have been reported a single case of chronic lead poisoning among employees in the different branches of the printing trades. This, of course, may be considered evidence that the returns are incomplete and defective in matter of detail.

The 29 miscellaneous cases referred to in Table 50 report the following particular employments: Fireman of furnaces melting scrap lead, furnace man in tin and brass plant, longshoreman, manufacture of window sashes, butcher, baker, gas engineer, grist mill, grocery clerk, ink mixer, surgical maker, flour maker, gas-meter inspector, elevator man, optical-instrument maker, laborer in copper company, worker in photo apparatus company, truck driver for builders' supplies company, stock handler, supply clerk and chauffeur. The remainder were common laborers or not specified.

Of special interest and importance, naturally, are painters, representing the largest number of certificates, 285 out of a total of 707, or 40.3 per cent. These have been distributed by years of occurrence as follows:

	Number		Number
1912.....	34	1920.....	6
1913.....	43	1921.....	8
1914.....	37	1922.....	5
1915.....	46	1923.....	4
1916.....	60	1924.....	5
1917.....	19	1925 (January).....	2
1918.....	4		
1919.....	12	Total.....	285

The certificates contain no information of importance that would justify extended consideration. Indications are, however, that there has been a substantial reduction in lead poisoning cases in the State of New York during the last five years, as compared with earlier years.

Since the foregoing data for New York State were received, I have been furnished with 45 additional lead-poisoning certificates covering the five months from February 1 to June 30, 1925. The details of these reports are as follows:

TABLE 51.—LEAD POISONING CASES IN THE STATE OF NEW YORK, FEBRUARY TO JUNE, 1925, BY INDUSTRIES

Industry	Number	Aggregate ages (years)	Average age (years)
Electric storage battery.....	40	1,429	35.7
Paint grinding.....	1	29	29.0
Painting.....	1	36	36.0
Building construction.....	1	31	31.0
Lead arsenate.....	2	74	37.0
Total.....	45	1,599	35.5

It is shown by this table that the average age of the 45 cases was 35.5 years, which compares with an average age of 38 years for 707 cases for the years 1912 to January, 1925, shown in Table 41.

It is highly significant that during the five months there should have been only one case of lead poisoning in painting. There were, however, 40 cases of lead poisoning in the manufacture of electric storage batteries. As I have previously pointed out, these cases occur at the present time chiefly at a single establishment at Niagara Falls, and all of the 40 cases have been reported by this one corporation during the five months under observation. I have thought it worth while to go somewhat farther into this matter and find that

of the 40 cases 14 were men employed as pasters, 7 as mixers, 3 as lead burners, 3 as inspectors, 2 as potsmen, 2 as repair men, 2 as sweepers, 1 as yardman, 1 as pressman, 1 as lead dipper, 1 as sawyer, 1 as weigher, and 1 as millwright.

It also appears that of the 45 cases reported for all occupations, 30 were married and 15 were single. Divided by race it appears that 37 were white and 8 were negroes. According to nativity there were 20 natives (1 from Porto Rico) and 25 foreigners, born respectively in the following countries: Italy, 8; France, 1; Bulgaria, 1; Poland, 2; Russia, 2; Lithuania, 1; England, 4; Wales, 1; Scotland, 1; Ireland, 1; Canada, 2; and Cuba, 1. In 3 of the 45 cases the report indicates a previous instance of lead poisoning. A blue line on the gum was observed in 5 out of the 45 cases. Otherwise the general symptoms were pain, nausea, and vomiting.

I have also been furnished by the chief medical examiner of the New York State Department of Labor with a statement of lead poisoning cases and deaths during the period September 1, 1911, to June 30, 1925. According to this statement there were in this period in the aggregate 890 cases of lead poisoning, with 105 deaths, or at a ratio of 1 death to every 7.6 cases. Of the foregoing, 375 affected painters with 67 deaths, while the ratio is 1 death to every 5.6 cases. Of the 375 cases in painters, 289 concerned house, structural or ship painting, while 85 cases concerned factory or shop painting. It is of interest that of the 85 cases, 31 should have occurred in the painting of automobiles.

In general manufacturing there occurred 465 cases with 26 deaths, or a ratio of 1 death to every 17.9 cases. The 465 cases in manufacturing represent chiefly the following industries:

TABLE 52.—LEAD POISONING IN NEW YORK MANUFACTURING INDUSTRIES, SEPTEMBER 1, 1911, TO JUNE 30, 1925

Industry	Cases	Deaths	Industry	Cases	Deaths
Electric storage batteries.....	269	3	Rubber goods.....	8	
White lead.....	69	5	Tin goods.....	5	2
Smelting or casting.....	23	4	Copper smelting.....	4	
Printing.....	21	5	Cut glass.....	3	1
Wire goods.....	8		Linoleum.....	3	
Electric goods.....	15	2	Sheet-metal work.....	3	
Brass and copper goods.....	11	1			

The remainder of some 19 different industries are represented by only one or two cases each. The manufacturing industries in which one or two cases of lead poisoning occurred are as follows: Breweries, white-metal goods, bridges, canned goods, casket trimming, china-ware, wagons, pumps, telephone, typewriters, surgical instruments, gas meters, automobiles, and insecticides. Aside from the foregoing there were 12 cases in plumbing with 3 deaths, 6 cases at electric power stations with no deaths, 12 cases in connection with tree spraying, 1 case in shipbuilding, and 29 miscellaneous cases with 11 deaths. To emphasize more clearly the distribution of cases and deaths by single years since 1912, Table 53 has been prepared, showing the essential facts for all industries, for painters, for white lead, and electric storage batteries.

TABLE 53.—NUMBER OF CASES AND OF DEATHS FROM LEAD POISONING IN SPECIFIED INDUSTRIES IN NEW YORK STATE, SEPTEMBER 1, 1911, TO JUNE 30, 1925, BY YEARS

Year	All industries		Painters		White lead		Electric storage batteries	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1912.....	125	8	73	5	9	-----	15	-----
1913.....	114	23	66	16	9	1	14	1
1914.....	74	25	43	15	4	1	12	2
1915.....	98	11	42	9	16	-----	21	-----
1916.....	73	12	35	8	7	-----	13	-----
Total, 1912-1916.....	494	79	259	53	45	2	75	3
1917.....	133	12	59	6	10	2	47	-----
1918.....	38	5	16	2	4	-----	4	-----
1919.....	37	3	12	1	1	1	8	-----
1920.....	18	2	4	2	1	-----	6	-----
1921.....	28	3	8	1	2	-----	11	-----
Total, 1917-1921.....	254	25	99	12	18	3	76	-----
1922.....	6	-----	4	-----	1	-----	1	-----
1923.....	45	-----	5	-----	-----	-----	34	-----
1924.....	34	-----	3	2	2	-----	28	-----
1925.....	67	1	5	-----	2	-----	55	-----
Total, 1912-1925.....	890	105	375	67	69	5	269	3

This table brings out in a very suggestive manner the very substantial decline in cases of lead poisoning in New York State industries, with the exception of the manufacture of electric storage batteries. It is particularly significant that cases of lead poisoning among painters, which in 1912 numbered 73, should by 1923 have diminished to 5, with no deaths. Equally significant is the reduction in the manufacture of white lead which in 1915 reached a maximum of 16 cases, while in 1925 there were only 2 cases. In electric-storage-battery manufacture the largest number of cases occurred in 1925 when there were 55 cases, closely approaching a previous maximum of 47 cases in 1917.

BIBLIOGRAPHY

- AUB, JOSEPH C., FAIRHALL, LAWRENCE T., MINOT, A. S., and REZNIKOFF, PAUL.**
Lead poisoning. Baltimore, The Williams & Wilkins Co., 1926. 265 pp.
Includes a chapter on the prevalence of industrial lead poisoning in the United States, by Alice Hamilton.
- AUSTRIA. Handelsministerium. Arbeitstatistisches Amt.**
Bleivergiftungen in Hüttenmännischen und gewerblichen Betrieben.
Ursachen und Bekämpfung. Vienna, 1909.
Part 1. Causes and prevention; Part 2. White lead and lead oxide; Parts 3 and 4. Official inspections; Part 5. Painters and painting trade; Part 6. Painters; Part 7. Printers and lithographers; Part 8. Pottery and glassware; Part 9. Clay industries.
- BLANSDORF, ELSE.**
Bleiliteratur Schriften aus den Gesamtgebiet der Gewerbehygiene. Berlin, 1922. (VII, Part II.)
- BLUMGART, HERMANN L.**
Lead studies: VI. Absorption of lead by the upper respiratory passages.
Journal of Industrial Hygiene, September, 1923, vol. V, pp. 153-158.
- BROWN, E. A.**
Lead poisoning among oxyacetylene welders in scrapping of naval vessels.
United States Naval Medical Bulletin, September-October, 1925, vol. 23, pp. 187-217.
- BURNHAM, A. C.**
The prevention of industrial poisoning in English factories.
Journal of Industrial Hygiene, June, 1923, vol. V, pp. 57-61.
- THE CLAGUE ELECTROLYTIC SYSTEM;** for the prevention and treatment of lead poisoning.
Philadelphia, 1225 South Fifty-seventh Street. (Photostat.)
- DAVIS, C. M.**
Lead poisoning in a golf professional: Case report.
Journal of Industrial Hygiene, November, 1923, vol. V, pp. 253, 254.
- DEAN, ARCHIBALD S.**
An epidemic of lead poisoning caused by the sandpapering of automobile bodies.
Journal of Industrial Hygiene, October, 1924, vol. VI, pp. 245-250.
- FAIRHALL, LAWRENCE T.**
Lead studies: I. The estimation of minute amounts of lead in biological material.
Journal of Industrial Hygiene, May, 1922, vol. IV, pp. 9-20.
- FAIRHALL, LAWRENCE T., and SHAW, CHARLOTTE P.**
Lead studies: X. The deposition of lead salts, with a note on the solubilities of di-lead phosphate in water at 25° C. and of di-lead and tri-lead phosphates in lactic acid at 25° C.
Journal of Industrial Hygiene, August, 1924, vol. VI, pp. 159-168.
- GESUNDHEITS-VERHÄLTNISSE in der deutschen Bleifarben-Industrie-Dargestellt vom Verein Deutscher Bleifarben-Fabrikanten.** (E. V. Coln.)
- GREAT BRITAIN. Home Department.**
Lead smelting. Special report on dangerous or injurious processes in the smelting of materials containing lead and in the manufacture of red and orange lead and flaked litharge, by Edgar L. Collis, medical inspector of factories.
London, Darling & Son (Ltd.), 1910. 29 pp. (Cmd. 5152.)
Reports of the departmental committees appointed to investigate the danger attendant on the use of paints containing lead in the painting of buildings, and on the use of lead compounds in the painting, enameling, and varnishing of coaches and carriages.
London, 1915, 1920. 4 vols.
Vol. I.—Report of committee on the use of lead in the painting of buildings. London, 1915. 134 pp. (Cmd. 7882.)
Vol. II.—Report of the committee on the use of lead compounds in the painting, enameling, and varnishing of coaches and carriages. London, 1920. 43 pp. (Cmd. 630.)
Vol. III.—Appendixes to both reports. London, 1920. 73 pp. (Cmd. 631.)
Vol. IV.—Minutes of evidence taken by both committees. London, 1920. 804 pp. (Cmd. 632.)

GREAT BRITAIN. *Imperial Mineral Resources Bureau.*

Laws and regulations relating to lead poisoning, by Gilbert Stone.
London, 1922. 250 pp.

— *Secretary of State.*

Regulations: Lead compounds. Regulations, dated August 23, 1921, made by Secretary of State under section 79 of the factory and workshop act, 1901, for the manufacture of certain compounds of lead, namely, any carbonate, sulphate, nitrate, or acetate of lead. (Stat. rules and orders, 1921, No. 1443.)

London, Harrison & Sons (Ltd.), 1921.

HAMILTON, ALICE.

Industrial poisons in the United States. New York, The Macmillan Co., 1925. 590 pp.

— Occupational diseases in Pennsylvania: Lead poisoning.

Monthly Labor Review, July, 1919, pp. 170-172.

HARN, ORLANDO C.

Lead, the precious metal. New York, The Century Co., 1924.

HARRIS, LOUIS I.

Clinical types of occupational diseases.

Journal of the American Medical Association, Sept. 20, 1919, vol. 73, pp. 880-886.

HAYHURST, EMERY R.

Critical examination of 100 painters for evidences of lead poisoning.

Journal of the Medical Sciences, June, 1914, vol. 147, p. 788.

HOPE, EDWARD W.

Industrial hygiene and medicine. New York, William Wood & Co., 1923. 766 pp.

HYGIENIC INSTITUTE OF COPENHAGEN.

Lead poisoning, by Johanus Lou.

Publications, 1923. Vol. 3.

HYGIENIC METHODS OF INDUSTRIAL PAINTING.

British Medical Journal, Jan. 27, 1923, vol. 1, pp. 167, 168.

INTERNATIONAL LABOR OFFICE.

Draft convention concerning the use of white lead in painting. Geneva, November, 1921.

— (New) article on lead poisoning.

Encyclopedia of Occupation and Health, Encyclopedia of Hygiene. Geneva, 1926.

— Prohibition of the use of white lead in painting. Geneva, October, 1921. Item III (b) of the agenda, International Labor Conference, 3d sess.

— The use of white lead in painting. Geneva, Oct. 24, 1921. 19 pp. (Studies and reports, series F, No. 4.)

Translation of a memorandum of the Dusseldorf Chamber of Commerce.

INTERNATIONAL PAINTING EQUIPMENT.

Malden, Mass., International Engineering Corp. [n. d.].

KLEIN, C. A.

Prevention of lead poisoning in industry: Part I. The India-rubber industry. Journal of industrial Hygiene, July, 1926, vol. VIII, pp. 296-299.

KOBER, GEORGE M., and HAYHURST, EMERY R.

Industrial health. Philadelphia, P. Blakiston's Son & Co., 1924. 1184 pp.

KOELSCH, F.

Bericht des Landesgewerbearztes. Munich, 1914, 1918, 1919, 1920, 1921, 1922.

Contains annual observations on lead poisoning in different trades.

— Die Bekämpfung der Bleivergiftung bei der Herstellung von Bleifarben und anderen Bleiverbindungen auf Grund der Verordnung vom 7. Januar 1920.

— Die Bleischadigungen im Maler- und Lackierergewerbe. Hamburg, 1921.

LEAD POISONING AT THE PHILADELPHIA NAVY YARD.

United States Naval Medical Bulletin, February, 1925, vol. XXII, p. 191.

- LEGG, THOMAS M., and GOADBY, KENNETH W.**
Lead poisoning and lead absorption: The symptoms, pathology and prevention, with special reference to their industrial origin, and an account of the principal processes involving risk. London, E. Arnold, 1912. 308 pp.
- THE MANUFACTURE OF STORAGE BATTERIES.**
Inspection News Bulletin, June, 1921.
- THE MANUFACTURE OF WHITE LEAD BY THE MODERN CARTER PROCESS.**
Chicago, Carter White Lead Co. [n. d.].
- MAYERS, MAY R.**
Lead anemia.
Journal of Industrial Hygiene, May, 1926, vol. VIII, pp. 222-231.
- McKAIL, DAVID.**
Prophylaxis in industrial lead poisoning.
Journal of Industrial Hygiene, February, 1926, vol. VIII, pp. 74-77.
- NEW SOUTH WALES. Board of Trade.**
Report on white lead as used in the painting industry: Its dangers and their prevention.
Sydney, 1921. 778 pp.
- NEW YORK (CITY). Department of Health.**
A clinical study of the frequency of lead, turpentine, and benzine poisoning in 400 painters, by Louis I. Harris.
Reprint series, No. 71. August, 1918.
- NEW YORK (STATE). Department of Health.**
Suggestions for painters: How to avoid lead poisoning. [n. d.]
— Suggestions for workers in lead and antimony. [n. d.]
- A NOVEL SOURCE OF LEAD POISONING.**
Journal of American Medical Association, Dec. 19, 1926, vol. 85, p. 1981.
- OHIO. State Board of Health.**
Lead poison—its chief causes, with observations on its diagnosis and prevention, by Emery R. Hayhurst.
Monthly Bulletin, May, 1914.
— The standardization of a method for the detection of lead in urine, by Charles H. Parkinson.
Monthly Bulletin, October, 1914.
- OLIVER, Sir THOMAS.**
Lead poisoning and the race.
The Eugenics Review, June, 1911.
— Lead poisoning: From the industrial, medical, and social points of view.
London, H. K. Lewis, 1914. 294 pp.
Lectures delivered at the Royal Institute of Public Health.
- ONTARIO. Provincial Board of Health.**
Lead poisoning (a compilation of present knowledge), by R. M. Hutton,
Division of Industrial Hygiene.
Toronto, 1923. 304 pp.
- THE PREVENTION OF PLUMBISM.**
The New Statesman, April 14, 1923, vol. XXI, pp. 11, 12.
- SABIN, ALVAH HORTON.**
White lead: Its use in paint. New York, John Wiley & Sons (Inc.), 1920.
- SELLERS, ARTHUR.**
A contribution to the study of punctate basophilia in lead workers.
Journal of Industrial Hygiene, April, 1925, vol. VII, pp. 145-154.
- SHARPE, N. C.**
Clinical aspects of industrial poisoning.
Public Health Journal, March, 1923, vol. 14, pp. 110-118; April, 1923, vol. 14, pp. 172-174.
— Report on an investigation to determine the hazard of the health of operators using the spraying machine for painting: The risk of lead poisoning.
Journal of Industrial Hygiene, April, 1922, vol. III, pp. 378-386.

TANQUEREL DES PLANCHES.

Lead diseases: A treatise from the French of L. Tanquerel des Planches, translated by Samuel L. Dana. Lowell, 1850.

TELEKY, LUDWIG.

Diagnosis of lead poisoning [in Austria].

Münchener Medizinische Wochenschrift, Feb. 29, 1924, vol. 71, pp. 266-269.

— Report on lead poisoning among painters and decorators in Vienna.

(See Great Britain. Home Department. Reports of the departmental committees appointed to investigate the dangers attendant on the use of paints containing lead in the painting of buildings, etc. London, 1920. Vol. III, pp. 40-47.)

TELEKY, LUDWIG, GROTJAHN, A., and KAUF, T.

Article on industrial poisons including lead, with bibliography. Handwörterbuch der Sozialen Hygiene, Leipzig, 1912.

TOLMAN, C. P.

Lead poisoning and its prevention.

(In National Safety Council, proceedings, eighth annual congress, Cleveland, Oct. 1-4, 1919. [Chicago, 1919?], pp. 448-458.)

UNITED STATES. Bureau of the Census.

Census of manufactures: Smelting and refining (nonferrous metals). Washington, 1923. 12 pp.

— *Bureau of Labor Statistics.*

Deaths from industrial lead poisoning (actually reported) in New York State in 1909 and 1910, by John B. Andrews. Washington, 1911. Bulletin No. 95, pp. 260-282.

— Clinical study of frequency of lead, turpentine, and benzine poisoning in 402 painters.

Monthly Labor Review, March, 1919, pp. 226-229.

— Hygiene of the printing trades, by Alice Hamilton and Charles H. Verrill.

Washington, 1917. 118 pp. (Bul. No. 209.)

— Industrial lead poisoning, with descriptions of lead processes in certain industries in Great Britain and the western States of Europe, by Sir Thomas Oliver.

Washington, 1911. Bulletin No. 95, pp. 1-188.

— Lead poisoning in potteries, tile works, and porcelain enameled sanitary ware factories, by Alice Hamilton.

Washington, 1912. 95 pp. (Bul. No. 104.)

— Lead poisoning in the smelting and refining of lead, by Alice Hamilton

Washington, 1914. 97 pp. (Bul. No. 141.)

— Lead poisoning in the manufacture of storage batteries, by Alice Hamilton.

Washington, 1914. 38 pp. (Bul. No. 165.)

— Mortality from respiratory diseases in dusty trades (inorganic dusts), by Frederick L. Hoffman.

Washington, 1918. 458 pp. (Bul. No. 231.)

— Report of British departmental committee on the danger in the use of lead in the painting of buildings.

Washington, 1918. 207 pp. (Bul. No. 188.)

— The white-lead industry in the United States, with an appendix on the lead-oxide industry, by Alice Hamilton.

Washington, 1911. Bulletin No. 95, pp. 189-259.

— Women in the lead industries, by Alice Hamilton.

Washington, 1919. 38 pp. (Bul. No. 253.)

UNITED STATES. *Public Health Service.*

Lead poisoning in the pottery trades, by B. J. Newman, W. J. McConnell, O. M. Spencer, and F. M. Phillips.

Washington, May, 1921. 223 pp. (United States Public Health Bulletin No. 116.)

— — — A note on the prevention of lead poisoning in certain rubber-working industries, by L. Greenburg.

Public Health Reports, June 27, 1924, pp. 1567, 1568.

— — — *Women's Bureau.*

Women workers and industrial poisons, by Alice Hamilton. Washington, 1926. 5 pp. (Bulletin No. 57.)

UNIVERSITETETS HYGIENISKE INSTITUT.

Meddelelser. Bind III. Copenhagen, 1923.

Lead poisoning, by Johanus Lou.

WELLER, CARL V.

Clinical aspects of lead meningo-encephalopathy.

Annals of Clinical Medicine, March, 1923, vol. 3, pp. 604-613.

WELLER, CARL V., and CHRISTENSEN, AILEEN D.

The cerebrospinal fluid in lead poisoning.

Archives of Neurology and Psychiatry, September, 1925, vol. 14, pp. 327-345.

THE WHITE LEAD QUESTION.

An anonymous contribution. [London, 1924?] (Photostat.)

LIST OF BULLETINS OF THE BUREAU OF LABOR STATISTICS

The following is a list of all bulletins of the Bureau of Labor Statistics published since July, 1912, except that in the case of bulletins giving the results of routine surveys of the bureau, only the latest bulletin on any one subject is here listed.

A complete list of the reports and bulletins issued prior to July, 1912, as well as the bulletins published since that date, will be furnished on application. Bulletins marked thus () are out of print.*

Wholesale Prices.

- No. 284. Index numbers of wholesale prices in the United States and foreign countries. [1921.]
- No. 416. Wholesale prices, 1890 to 1925.

Retail Prices and Cost of Living.

- *No. 121. Sugar prices, from refiner to consumer. [1913.]
- No. 161. Wheat and flour prices, from farmer to consumer. [1913.]
- *No. 164. Butter prices, from producer to consumer. [1914.]
- No. 170. Foreign food prices as affected by the war. [1915.]
- No. 357. Cost of living in the United States. [1924.]
- No. 369. The use of cost-of-living figures in wage adjustments. [1925.]
- No. 418. Retail prices, 1890 to 1925.

Wages and Hours of Labor.

- *No. 146. Wages and regularity of employment and standardization of piece rates in the dress and waist industry of New York City. [1914.]
- *No. 147. Wages and regularity of employment in the cloak, suit, and skirt industry. [1914.]
- No. 161. Wages and hours of labor in the clothing and cigar industries, 1911 to 1913.
- No. 163. Wages and hours of labor in the building and repairing of steam-railroad cars, 1907 to 1913.
- *No. 190. Wages and hours of labor in the cotton, woolen, and silk industries, 1907 to 1914.
- No. 204. Street-railway employment in the United States. [1917.]
- No. 225. Wages and hours of labor in the lumber, millwork, and furniture industries, 1916.
- No. 235. Industrial survey in selected industries in the United States, 1919.
- No. 297. Wages and hours of labor in the petroleum industry, 1920.
- No. 348. Wages and hours of labor in the automobile industry, 1922.
- No. 356. Productivity costs in the common-brick industry. [1924.]
- No. 358. Wages and hours of labor in the automobile-tire industry, 1923.
- No. 360. Time and labor costs in manufacturing 100 pairs of shoes. [1924.]
- No. 365. Wages and hours of labor in the paper and pulp industry, 1924.
- No. 371. Wages and hours of labor in cotton-goods manufacturing, 1924.
- No. 374. Wages and hours of labor in the boot and shoe industry, 1907 to 1924.
- No. 376. Wages and hours of labor in the hosiery and underwear industry, 1907 to 1924.
- No. 377. Wages and hours of labor in woolen and worsted goods manufacturing, 1924.
- No. 381. Wages and hours of labor in the iron and steel industry, 1907 to 1924.
- No. 387. Wages and hours of labor in the men's clothing industry, 1911 to 1924.
- No. 394. Wages and hours of labor in metalliferous mines, 1924.
- No. 404. Union scale of wages and hours of labor, May 15, 1925.
- No. 407. Labor cost of production and wages and hours in the paper box-board industry. [1926.]
- No. 412. Wages, hours, and productivity in the pottery industry, 1925.
- No. 413. Wages and hours of labor in the lumber industry in the United States, 1925.
- No. 416. Hours and earnings in anthracite and bituminous coal mining, 1922 and 1924.
- No. 421. Wages and hours of labor in the slaughtering and meat-packing industry, 1925. (In press.)
- No. 422. Wages and hours of labor in foundries and machine shops, 1925.

Employment and Unemployment.

- *No. 109. Statistics of unemployment and the work of employment offices in the United States. [1913.]
- No. 172. Unemployment in New York City, N. Y. [1915.]
- *No. 183. Regularity of employment in the women's ready-to-wear garment industries. [1915.]
- *No. 195. Unemployment in the United States. [1916.]
- No. 196. Proceedings of the Employment Managers' Conference held at Minneapolis, Minn., January, 1916.
- *No. 202. Proceedings of the conference of Employment Managers' Association of Boston, Mass., held May 10, 1916.
- No. 206. The British system of labor exchanges. [1916.]
- *No. 227. Proceedings of the Employment Managers' Conference, Philadelphia, Pa., April 2 and 3, 1917.
- No. 225. Employment system of the Lake Carriers' Association. [1918.]
- *No. 241. Public Employment offices in the United States. [1918.]
- No. 247. Proceedings of Employment Managers' Conference, Rochester, N. Y., May 9-11, 1918.
- No. 310. Industrial unemployment: A statistical study of its extent and causes. [1922.]
- No. 409. Unemployment in Columbus, Ohio, 1921 to 1925.

Proceedings of Annual Meetings of International Association of Public Employment Services.

- No. 192. First, Chicago, December 19 and 20, 1913; Second, Indianapolis, September 24 and 25, 1914; Third, Detroit, July 1 and 2, 1915.
- No. 220. Fourth, Buffalo, N. Y., July 20 and 21, 1916.
- No. 311. Ninth, Buffalo, N. Y., September 7-9, 1921.
- No. 337. Tenth, Washington, D. C., September 11-13, 1922.
- No. 355. Eleventh, Toronto, Canada, September 4-7, 1923.
- No. 400. Twelfth, Chicago, Ill., May 19-23, 1924.
- No. 414. Thirteenth, Rochester, N. Y., September 15-17, 1925.

Women and Children in Industry.

- No. 116. Hours, earnings, and duration of employment of wage-earning women in selected industries in the District of Columbia. [1913.]
- *No. 117. Prohibition of night work of young persons. [1913.]
- *No. 118. Ten-hour maximum working-day for women and young persons. [1913.]
- *No. 119. Working hours of women in the pea canneries of Wisconsin. [1913.]
- *No. 122. Employment of women in power laundries in Milwaukee. [1913.]
- No. 160. Hours, earnings, and conditions of labor of women in Indiana mercantile establishments and garment factories. [1914.]
- *No. 167. Minimum-wage legislation in the United States and foreign countries. [1915.]
- *No. 175. Summary of the report on conditions of women and child wage earners in the United States. [1915.]
- *No. 176. Effect of minimum-wage determinations in Oregon. [1915.]
- *No. 180. The boot and shoe industry in Massachusetts as a vocation for women. [1915.]
- *No. 182. Unemployment among women in department and other retail stores of Boston, Mass. [1916.]
- No. 193. Dressmaking as a trade for women in Massachusetts. [1916.]
- No. 215. Industrial experience of trade-school girls in Massachusetts. [1917.]
- *No. 217. Effect of workmen's compensation laws in diminishing the necessity of industrial employment of women and children. [1918.]
- No. 223. Employment of women and juveniles in Great Britain during the war. [1917.]
- No. 253. Women in lead industries. [1919.]

Workmen's Insurance and Compensation (including laws relating thereto).

- *No. 101. Care of tuberculous wage earners in Germany. [1912.]
- *No. 102. British National Insurance Act, 1911.
- *No. 103. Sickness and accident insurance law of Switzerland. [1912.]
- No. 107. Law relating to insurance of salaried employees in Germany. [1913.]
- *No. 155. Compensation for accidents to employees of the United States. [1914.]
- No. 212. Proceedings of the conference on social insurance called by the International Association of Industrial Accident Boards and Commissions, Washington, D. C., December 5-9, 1916.
- No. 243. Workmen's compensation legislation in the United States and foreign countries, 1917 and 1918.
- No. 301. Comparison of workmen's compensation insurance and administration. [1922.]
- No. 312. National health insurance in Great Britain, 1911 to 1920.
- No. 379. Comparison of workmen's compensation laws of the United States as of January 1, 1925.
- No. 423. Workmen's compensation legislation of the United States and Canada. [1926.]

Proceedings of Annual Meetings of the International Association of Industrial Accident Boards and Commissions.

- *No. 210. Third, Columbus, Ohio, April 25-28, 1916.
- No. 248. Fourth, Boston, Mass., August 21-25, 1917.
- No. 264. Fifth, Madison, Wis., September 24-27, 1918.
- *No. 273. Sixth, Toronto, Canada, September 23-26, 1919.
- No. 281. Seventh, San Francisco, Calif., September 20-24, 1920.
- No. 304. Eighth, Chicago, Ill., September 19-23, 1921.
- No. 333. Ninth, Baltimore, Md., October 9-13, 1922.
- No. 359. Tenth, St. Paul, Minn., September 24-26, 1923.
- No. 385. Eleventh, Halifax, Nova Scotia, August 26-28, 1924.
- No. 395. Index to proceedings, 1914-1924.
- No. 406. Twelfth, Salt Lake City, Utah, August 17-20, 1925.

Industrial Accidents and Hygiene.

- *No. 104. Lead poisoning in potteries, tile works, and porcelain enameled sanitary-ware factories. [1912.]
- No. 120. Hygiene in the painters' trade. [1913.]
- *No. 127. Dangers to workers from dust and fumes, and methods of protection. [1913.]
- *No. 141. Lead poisoning in the smelting and refining of lead. [1914.]
- *No. 157. Industrial accident statistics. [1915.]
- *No. 165. Lead poisoning in the manufacture of storage batteries. [1914.]
- *No. 179. Industrial poisons used in the rubber industry. [1915.]
- No. 188. Report of British departmental committee on the danger in the use of lead in the painting of buildings. [1916.]
- *No. 201. Report of committee on statistics and compensation-insurance cost of the International Association of Industrial Accident Boards and Commissions. [1916.]
- *No. 207. Causes of death by occupation. [1917.]
- *No. 209. Hygiene of the printing trades. [1917.]
- No. 219. Industrial poisons used or produced in the manufacture of explosives. [1917.]
- No. 221. Hours, fatigue, and health in British munition factories. [1917.]
- No. 230. Industrial efficiency and fatigue in British munition factories. [1917.]
- *No. 231. Mortality from respiratory diseases in dusty trades (inorganic dusts). [1918.]
- No. 234. Safety movement in the iron and steel industry, 1907 to 1917.
- *No. 236. Effect of the air hammer on the hands of stonecutters. [1918.]
- No. 249. Industrial health and efficiency. Final report of British Health of Munition Workers Committee. [1919.]
- *No. 251. Preventable death in the cotton-manufacturing industry. [1919.]
- No. 256. Accidents and accident prevention in machine building. [1919.]
- No. 267. Anthrax as an occupational disease. [1920.]
- No. 276. Standardization of industrial accident statistics. [1920.]
- No. 280. Industrial poisoning in making coal-tar dyes and dye intermediates. [1921.]
- No. 291. Carbon monoxide poisoning. [1921.]
- No. 293. The problem of dust phthisis in the granite-stone industry. [1922.]
- No. 298. Causes and prevention of accidents in the iron and steel industry, 1910 to 1919.
- No. 306. Occupational hazards and diagnostic signs: A guide to impairments to be looked for in hazardous occupations. [1922.]
- No. 339. Statistics of industrial accidents in the United States. [1923.]
- No. 392. Survey of hygienic conditions in the printing trades. [1925.]
- No. 405. Phosphorus necrosis in the manufacture of fireworks and the preparation of phosphorus. [1926.]
- No. 425. Record of industrial accidents in the United States to 1925.

Conciliation and Arbitration (including strikes and lockouts).

- *No. 124. Conciliation and arbitration in the building trades of Greater New York. [1913.]
- *No. 133. Report of the industrial council of the British Board of Trade in its inquiry into industrial agreements. [1913.]
- *No. 139. Michigan copper district strike. [1914.]
- No. 144. Industrial court of the cloak, suit, and skirt industry of New York City. [1914.]
- No. 145. Conciliation, arbitration, and sanitation in the dress and waist industry of New York City. [1914.]
- *No. 191. Collective bargaining in the anthracite coal industry. [1916.]
- *No. 198. Collective agreements in the men's clothing industry. [1916.]
- *No. 233. Operation of the industrial disputes investigation act of Canada. [1918.]
- No. 235. Joint industrial councils in Great Britain. [1919.]
- No. 283. History of the Shipbuilding Labor Adjustment Board, 1917 to 1919.
- No. 287. National War Labor Board: History of its formation, activities, etc. [1921.]
- No. 303. Use of Federal power in settlement of railway labor disputes. [1922.]
- No. 341. Trade agreement in the silk-ribbon industry of New York City. [1923.]
- No. 402. Collective bargaining by actors. [1926.]
- No. 419. Trade agreements, 1925.

Labor Laws of the United States (including decisions of courts relating to labor).

- No. 211. Labor laws and their administration in the Pacific States. [1917.]
- No. 229. Wage-payment legislation in the United States. [1917.]
- No. 285. Minimum-wage legislation in the United States. [1921.]
- No. 321. Labor laws that have been declared unconstitutional. [1922.]
- No. 322. Kansas Court of Industrial Relations. [1923.]
- No. 343. Laws providing for bureaus of labor statistics, etc. [1923.]
- No. 370. Labor laws of the United States, with decisions of courts relating thereto. [1925.]
- No. 403. Labor legislation of 1925.
- No. 408. Labor laws relating to payment of wages. [1926.]
- No. 417. Decisions of courts and opinions affecting labor, 1925.

Foreign Labor Laws.

- *No. 142. Administration of labor laws and factory inspection in certain European countries. [1914.]

Vocational and Workers' Education.

- *No. 159. Short-unit courses for wage earners, and a factory school experiment. [1915.]
- *No. 162. Vocational education survey of Richmond, Va. [1915.]
- No. 199. Vocational education survey of Minneapolis, Minn. [1916.]
- No. 271. Adult working-class education in Great Britain and the United States. [1920.]

Safety Codes.

- No. 331. Code of lighting factories, mills, and other work places.
- No. 336. Safety code for the protection of industrial workers in foundries.
- No. 338. Safety code for the use, care, and protection of abrasive wheels.
- No. 350. Specifications of laboratory tests for approval of electric headlighting devices for motor vehicles.
- No. 351. Safety code for the construction, care, and use of ladders.
- No. 364. Safety code for mechanical power-transmission apparatus.
- No. 375. Safety code for laundry machinery and operation.
- No. 378. Safety code for woodworking plants.
- No. 382. Code of lighting school buildings.
- No. 410. Safety code for paper and pulp mills.

Industrial Relations and Labor Conditions.

- No. 237. Industrial unrest in Great Britain. [1917.]
- No. 340. Chinese migrations, with special reference to labor conditions. [1923.]
- No. 349. Industrial relations in the West Coast lumber industry. [1923.]
- No. 361. Labor relations in the Fairmont (W. Va.) bituminous-coal field. [1924.]
- No. 380. Postwar labor conditions in Germany.
- No. 383. Works council movement in Germany. [1925.]
- No. 384. Labor conditions in the shoe industry in Massachusetts, 1920 to 1924.
- No. 399. Labor relations in the lace and lace-curtain industries in the United States. [1925.]

Welfare Work.

- *No. 123. Employers' welfare work. [1913.]
- *No. 222. Welfare work in British munitions factories. [1917.]
- *No. 250. Welfare work for employees in industrial establishments in the United States. [1919.]

Cooperation.

- No. 313. Consumers' cooperative societies in the United States in 1920.
- No. 314. Cooperative credit societies in America and in foreign countries. [1922.]

Housing.

- *No. 158. Government aid to home owning and housing of working people in foreign countries. [1914.]
- No. 263. Housing by employers in the United States. [1920.]
- No. 295. Building operations in representative cities in 1920.
- No. 424. Building permits in the principal cities of the United States, 1925.

Proceedings of Annual Conventions of the Association of Governmental Labor Officials of the United States and Canada.

- No. 266. Seventh, Seattle, Wash., July 12-15, 1920.
- No. 307. Eighth, New Orleans, La., May 2-6, 1921.
- *No. 323. Ninth, Harrisburg, Pa., May 22-26, 1922.
- No. 352. Tenth, Richmond, Va., May 1-4, 1923.
- No. 389. Eleventh, Chicago, Ill., May 19-23, 1924.
- No. 411. Twelfth, Salt Lake City, Utah, August 13-15, 1925.

Miscellaneous Series.

- *No. 174. Subject index of the publications of the United States Bureau of Labor Statistics up to May 1, 1915.
- No. 208. Profit sharing in the United States. [1916.]
- No. 242. Food situation in central Europe, 1917.
- No. 254. International labor legislation and the society of nations. [1919.]
- No. 268. Historical survey of international action affecting labor. [1920.]
- No. 282. Mutual relief associations among Government employees in Washington, D. C. [1921.]
- No. 299. Personnel research agencies. A guide to organized research in employment, management, industrial relations, training, and working conditions. [1921.]
- No. 319. The Bureau of Labor Statistics: Its history, activities, and organization.
- No. 326. Methods of procuring and computing statistical information of the Bureau of Labor Statistics.
- No. 342. International Seamen's Union of America: A study of its history and problems. [1923.]
- No. 346. Humanity in government. [1923.]
- No. 372. Convict labor in 1923.
- No. 386. The cost of American almshouses. [1925.]
- No. 398. Growth of legal-aid work in the United States. [1926.]
- No. 401. Family allowances in foreign countries. [1926.]
- No. 420. Handbook of American trade-unions. [1926.]

SPECIAL PUBLICATIONS ISSUED BY THE BUREAU OF LABOR STATISTICS

Description of occupations, prepared by the United States Employment Service, 1918-19.

- *Boots and shoes, harness and saddlery, and tanning.
- *Cane-sugar refining and flour milling.
- *Coal and water gas, paint and varnish, paper, printing trades, and rubber goods.
- *Electrical manufacturing, distribution, and maintenance.
Glass.
- *Hotels and restaurants.
- *Logging camps and sawmills.
- *Medicinal manufacturing.
- *Metal working, building and general construction, railroad transportation, and shipbuilding.
- *Mines and mining.
- *Office employees.
- *Slaughtering and meat packing.
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