MORTALITY IN YOUNG CHILDREN IN THE CITY OF ABERDEEN DURING THE FIFTY YEARS 1900-1949

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Much has been written and spoken concerning the mortality of infancy, but much less has been said about that of the pre-school child. The pre-school period is an important one, and many troubles in childhood and later life can be traced to infections and difficulties experienced during this time. As Sir Charles Newman said: 'A rich harvest will reward careful supervision and nurture at this age period.' To a certain extent, these children have been less studied than those who are younger or older, for unless they come under the care of the family doctor, usually with acute illnesses, they are not supervised medically; and till toddlers' clinics and nursery schools were instituted, these pre-school children were too old for the child welfare centres, and not old enough for the school medical services.

The fall in the deaths in young children during the last 50 years has been as striking as the fall in infant deaths; and this article is a preliminary study of pre-school child deaths in children in the second, third, fourth, and fifth years of life as recorded in the City of Aberdeen in the 50 years from 1900 to 1949 inclusive. The data are derived chiefly from the excellent annual reports of the Medical Officers of Health, the late Professor Matthew Hay and Dr. J. Parlane Kinloch, and from the present holder of the office, Dr. Harry J. Rae, to whom I am indebted for much information.

The physiology and pathology of the young child are characteristic, and differ from those of the infant and the school child. It may be recalled that the diet is changing, and that milk is no longer the chief food, although still an important one. The growth in height and weight may be slowing down, but there are striking advances in accomplishments, in movement and activity, in contacts with the outside world, and in the growth of personality and adjustment to environment. The young child is losing any immunity to certain infectious diseases that may have been acquired from the mother, and must acquire his own by the painful process of battling with the organisms themselves, or in other

instances, such as in diphtheria, by reacting successfully to toxins or vaccines artificially introduced. The body chemistry is still unstable, and the young child remains sensitive to deficiencies in food and vitamins. All these differences are reflected in the mortality rates of the age period.

The population of the City of Aberdeen, 150,906 in 1900, has slowly increased during the century, and in 1949 it was estimated to be 189,314. In 1951 the census reported a population of 182,714. With the fall in the birth rate, the numbers of children in the four year age period between one and five have not increased, and, indeed, have decreased slightly as is shown in Table 1.

TABLE 1
NUMBERS OF CHILDREN BETWEEN 1 AND 5 YEARS OF AGE
IN ABERDEEN

Year	Number
1901	14,758
1911	14,938
1921	10,591
1931	11,396
1951	14,000 (estimated)

At the beginning of the century, the mortality rates in Aberdeen in the school age period, and to a less extent in the pre-school period, were falling, but the infant mortality was rising, and giving cause for concern and investigation. Measles, whooping cough, diphtheria, and scarlet fever were showing an increasing prevalence but a diminishing mortality. Antitoxin was already being used in hospitals for diphtheria cases, but it was not supplied free before 1906, along with a syringe, swabs, and other necessary equipment, to general practitioners. There was, of course, no specific therapy for the other zymotic diseases.

TABLE 2

BIRTHS, INFANT DEATHS, PRE-SCHOOL AGE DEATHS, AND SCHOOL AGE DEATHS IN CITY OF ABERDEEN FROM 1900 TO 1949 INCLUSIVE

Year	Population of City of Aberdeen	Total Live Births	Infant Deaths (0-1)	Infant Mortality Rate per 1,000 Live Births	Total Deaths between 1 and 5 Years of Age	Deaths in Each Year between 1 and 5 Years of Age				Total School Child Deaths between 5 and 15
						1+	2+	3+	4+	
1900	150,906	4,810	717	149	289	169	59	39	22	102
1	154,280	4,784	727	152	261	143	63	29	26	119
2	157,505	4,814	657	137	279	149	70	30	30	100
3	158,300	4,986	675	135	305	181	73	31	20	103
4	160,100	4,885	733	151	370	216	67	58	29	112
5	161,500	4,892	678	138	226	132	50	22	22	108
6	162,500	4,712	599	127	273	157	64	37	15	94
7	163,100	4,502	561	125	260	141	61	33	25	99
8	163,600	4,472	574	129	268	156	46	35	31	106
9	164,100	4,518	671	149	273	133	80	38	22	107
1910	164,800	4,319	478	111	167	98	24	25	20	103
11	165,426	4,057	563	139	285	172	61	37	15	115
12	164,875	4,187	530	127	232	138	50	17	27	105
13	164,324	3,852	591	152	400	227	79	52	42	138
14	163,773	4,006	487	121	259	111	65	41	42	195
15	163,222	3,784	654	173	405	200	106	56	43	156
16	162,670	3,546	398	112	182	84	45	29	24	95
17	162,119	2,880	399	139	270	148	60	42	20	96
18	161,568	2,721	390	143	267	155	60	36	16	117
19	161,017	3,379	399	118	159	72	30	31	26	103
1920	160,466	4,868	591	121	144	68	42	15	19	70
21	159,915	4,254	460	108	80	54	7	8	11	74
22	160,764	3,969	527	133	284	177	71	22	14	62
23	161,617	3,766	391	104	157	89	40	17	11	40
24	162,475	3,437	421	122	207	113	44	26	24	47
25	163,337	3,390	368	109	143	82	36	13	12	52
26	164,204	3,406	328	96	105	56	27	12	10	65
27	165,075	3,182	334	105	101	56	19	13	13	58
28	165,952	3,314	313	94	142	83	27	18	14	53
29	166,833	3,112	297	95	113	69	21	13	10	54
1930	167,718	3,303	265	80	86	40	19	10	17	59
31	168,608	3,231	292	90	69	34	17	14	4	43
32	170,562	3,188	296	93	98	52	20	13	13	45
33	172,036	3,019	238	79	94	50	18	14	12	46
34	173,215	3,071	235	77	80	33	17	14	16	63
35	175,373	3,157	286	91	118	57	25	17	19	67
36	176,897	3,048	214	70	77	49	12	6	10	42
37	177,317	3,026	219	72	62	31	18	8	5	47
38	178,199	3,008	215	71	78	36	20	9	13	38
39	179,628	2,977	177	59	38	16	9	9	4	40
1940	172,310	2,804	241	86	70	36	12	11	11	35
41	167,800	2,907	224	77	39	15	8	7	9	39
42	164,100	2,904	194	67	39	18	10	8	3	37
43	159,162	2,876	195	68	34	14	9	7	4	42
44	159,263	2,989	169	57	36	16	9	4	7	29
45	163,108	2,830	152	54	34	18	7	5	4	27
46	176,939	3,762	158	42	25	11	7	4	3	26
47	187,751	4,124	263	64	19	9	3	4	3	21
48	188,853	3,598	121	34	14	9	0	3	2	22
49	189,314	3,306	100	30	23	11	7	4	1	10

Total Deaths

It will be seen from Table 2 and Fig. 1 that during the half century there has been a tremendous fall in the yearly number of deaths: from 289 in 1900, to 23 in 1949, and the fall has been well maintained in the last 10 years. Table 4, showing deaths in quinquennial periods, reflects an even more striking

The trends in the mortality rates have been steadily downwards, but their courses have been punctuated by temporary rises, for example, in 1904, 1913, 1915, and 1922. The rises, as will be seen, were largely due to deaths from measles and whooping cough. The worst year of all was 1915 with 405 deaths; measles and whooping cough were

Fig. 1.—Total pre-school age deaths (1-5) and infant deaths (0-1) in the City of Aberdeen from 1900 to 1949 inclusive.

difference, when it is noted that in the first quinquennium of our period, 1,499 young children died, and in the last, only 115. More deaths occurred, and still occur, in the second year of life than in the third, fourth, and fifth years, and the saving of lives has been greater in the earliest year of the pre-school period. Deaths in 1900 in the second, third, fourth, and fifth years of life were 169, 59, 39, and 32 respectively, whereas in 1949 they were 11, seven, four, and one.

then rife, and, in addition, scarlet fever was more prevalent than it had been since the beginning of notification in 1881, and more frequently fatal than it had been since 1895. The best year in the first quarter of the century, with only 80 deaths, was 1921, when there were no deaths from measles and whooping cough, only two from scarlet fever, only five from tuberculosis, and only 17 from pneumonia and bronchitis. Figures for the following year, 1922, are very different; in that

TABLE 3

NUMBERS OF DEATHS FROM VARIOUS CAUSES IN CHILDREN BETWEEN 1 AND 5 YEARS OF AGE IN ABERDEEN FROM 1900 TO 1949 INCLUSIVE

Year	Total Deaths (1-5 Years)	Measles	Scarlet Fever	Whooping Cough	Diphtheria	All Forms of Tuberculosis	Enteritis and Diarrhoea	Convulsions	Pneumonia and Bronchitis	Burns and Scalds	Other Accidents
1900	289	38	6	39	20	30	4	14	72		13
1	261	34	6	6	10	38	31	13	72		7
2	277	5	7	65	9	46	18	8	76		16
3	305	65	6	22	6	46	34	10	70		11
4	367	65	15	80	7	54	20	12	67		7
5	226	20	9	18	4	36	22	8	82		5
6	268	42	2	35	12	53	22	10	58		11
7	260	21	2	34	8	58	24	11	61	13	3
8	268	30	9	29	13	36	19	6	62	14	5
9	273	24	7	53	19	39	15	12	49	6	4
1910	167	1	4	8	17	30	22	6	50	6	2
11	285	72	10	32	15	36	18	12	50	10	3
12	232	25	16	28	20	27	16	9	53	5	4
13	400	90	14	29	63	40	29	14	61	14	4
14	259	4	27	4	71	28	27	14	37	4	6
15	405	95	82	26	29	38	27	13	56	7	2
16	182	5	14	12	20	34	14	9	37	4	3
17	270	59	8	29	10	52	21	8	54	10	3
18	267	30	0	33	13	40	23	11	70	6	1
19	159	1	2	18	12	28	9	12	38	5	3
1920	144	24	2	8	14	19	7	3	34	10	6
21	80	0	2	0	19	5	9	5	17	6	2
22	284	93	6	51	9	23	9	3	54	8	2
23	156	28	1	2	5	33	6	6	31	22	3
24	207	34	1	44	5	36	1	6	32	13	7
25	143	11	8	34	12	13	11	6	23	6	6
26	105	11	2	4	5	24	5	2	28	4	0
27	101	0	2	8	10	24	0	2	31	3	2
28	142	29	4	20	7	23	6	0	27	0	6
29	113	0	1	6	7	12	4	2	54	0	8
1930	85	12	1	3	5	14	2	0	17	6	7
31	69	3	2	9	2	7	0	1	27	4	3
32	98	10	1	14	4	20	2	2	41	3	8
33	94	4	3	10	4	8	2	0	35	1	7
34	80	5	2	9	10	7	6	1	15	1	5
35	118	15	4	3	18	8	0	0	32	5	3
36	77	1	3	9	7	4	2	0	25	8	1
37	62	0	0	7	9	3	3	0	20	3	4
38	78	11	1	8	11	4	3	0	11	3	8
39	38	0	1	0	14	0	2	0	8	3	2
1940	70	8	0	5	8	5	4	2	17	2	6
41	39	2	0	4	12	4	2	0	5	2	3
42	39	0	0	1	6	9	2	0	11	0	3
43	34	1	1	1	4	7	1	0	10	1	1
44	36	0	0	1	4	9	0	1	5	2	3
45	34	2	0	0	5	4	0	0	6	1	3
46	25	0	0	2	0	3	1	0	5	1	0
47	19	0	0	1	0	2	2	0	3	2	2
48	14	1	1	0	0	1	1	0	0	2	2
49	23	0	0	0	0	3	1	1	4	0	6

TABLE 4

NUMBERS OF DEATHS FROM VARIOUS CAUSES IN CHILDREN BETWEEN 1 AND 5 YEARS OF AGE IN ABERDEEN IN QUINQUENNIAL PERIODS FROM 1900 TO 1949

Quinquennium	Total Deaths	Measles	Scarlet Fever	Whooping Cough	Diphtheria	All Forms of Tuberculosis	Enteritis and Diarrhoea	Convulsions	Pneumonia and Bronchitis	Burns and Scalds	Other Accidents
1900-04	1,499	207	40	212	52	214	107	57	357	54	
1905-09	1,295	137	29	169	56	222	102	47	312	61	
1910-14	1,343	192	71	101	186	161	112	55	251	39	19
1915-19	1,283	190	106	118	84	192	94	53	255	32	12
1920-24	871	179	12	105	52	116	32	23	168	59	20
1925-29	604	51	17	72	41	96	26	12	163	13	22
1930-34	426	34	9	45	25	56	12	4	135	15	30
1935-39	373	27	9	27	59	19	10	0	96	22	18
1940-44	218	11	1	12	34	34	9	3	48	7	16
1945-49	115	3	1	3	5	13	5	1	18	6	13

year the total deaths in pre-school children rose to 284.

Deaths from Various Causes

The common infectious diseases were the fatal ones throughout the half century, and the general fall in the deaths is largely due to the lessened mortality from these diseases. In 1949 there was not a single death from measles, scarlet fever, whooping cough, or diphtheria.

Measles. This disease was one of the 'captains of the men of death' until the 20s. It has, unfortunately, not been compulsorily notifiable in

our region since 1903, and the numbers of cases can only be assessed on the basis of information from the Education Authority. But it appears that it has been occurring here as elsewhere in epidemics every two to three years, as new groups of susceptible children grew up, and these occasions are shown by the increased mortality rates (Table 3 and Fig. 2) of the epidemic years. Although the disease still affects most children sooner or later, it is not as mortal as it was. For example, in 1940, an epidemic year, there were 1,571 known cases at all ages in Aberdeen with 12 deaths (eight in pre-school children), whereas in 1922, another epidemic year,

TABLE 5

NUMBERS OF DEATHS FROM DIFFERENT FORMS OF TUBERCULOSIS IN QUINQUENNIAL PERIODS FROM 1900 TO 1949

Quinquennium	Total	Brain and Meninges	Abdomen	Lungs	Other Forms
1900-04	214	111	46	32	25
1905-09	222	108	60	32	22
1910-14	161	82	39	21	19
1915-19	192	80	59	39	14
1920-24	116	59	24	13	20
1925-29	96	52	26	7	11
1930-34	56	29	9	5	13
1935-39	19	9	4	3	3
1940-44	34	26	0	4	4
1945-49	13	8	1	3	1

there were 3,684 cases with 142 deaths (93 in pre-school children). Since 1942 there have been only four deaths from measles in pre-school children, three of which occurred in the second year of life.

children. The case mortality was 7.7%, nearly three times the average rate for the preceding 10 years. Since then the yearly death rate from scarlet fever has been low, several hundred cases have

FIG. 2.—Deaths from measles in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

Scarlet Fever. The incidence and mortality of this disease have varied throughout 50 years. It was very prevalent from 1911 to 1915. In the latter year there were 1,873 cases at all ages with 142 deaths, 82 of which were deaths of pre-school

children. It occurred each year, about one-quarter to one-third of them in the age group under review, but, as will be seen from Table 3 and Fig. 3, the deaths have been few. Even in 1934, an epidemic year, there were 2,122 cases of scarlet fever at all ages

with 16 deaths, and of these 546 cases were in pre-school children with only two deaths. The variations in the prevalence and in the mortality of this disease have been independent of therapy, isolation, and medical attention, and would appear to be due to biological changes in the organism. The treatment by sulphonamides and penicillin may

in some epidemic years. The mortality is now very low, and only about one child a year now dies from the disease in the pre-school age group. The mortality rate was falling before the introduction of sulphonamides and the antibiotics, but has certainly been lower since. These materials may have contributed to the present very low rate.

FIG. 3.—Deaths from scarlet fever in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

have contributed a little to the almost complete absence of mortality since 1937.

Whooping Cough. This behaves epidemiologically (Table 3 and Fig. 4) like measles, and attacks many children at pre-school age. It has not been compulsorily notifiable in Aberdeen since 1903, but it is known that epidemics have been occurring every two to three to four years. Several hundred cases occur in most years, and over 1,000 cases are known

Diphtheria. Diphtheria accounted for many deaths in the first 25 years despite the fact that antitoxin was free and widely used after 1906. In each of the first 10 years of the century about 300 cases of diphtheria occurred at all ages, and in 1913 and 1914 there were 2,062 and 1,627 cases respectively. The great increase in the deaths in 1913 and 1914 in pre-school children will be noted (Table 3 and Fig. 5). The former year was a bad one

with the simultaneous prevalence of measles, whooping cough, and diphtheria, and an increase in deaths from tuberculosis. The deaths from diphtheria both in 1913 and 1914 were spread over the four years of the pre-school age; the 63 deaths in 1913 being 19, 19, 13, and 12; and the 71 in 1914 being 16, 19, 16, and 20 in the second, third, fourth,

The incidence of the disease, of which 586 cases were notified in 1940, began to fall in 1941, and more acutely in 1943, but there were still 136 cases at all ages in 1945 including 49 pre-school children of whom five died. In the following year, 1946, only 68 cases occurred, 17 in pre-school children, and for the first time there was not a single death

FIG. 4.—Deaths from whooping cough in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

and fifth years respectively. Active immunization was tentatively begun from 1921 to 1923, and was reintroduced more widely in 1936 at the welfare centres, the nursery schools and at the City (Fever) Hospital, but there was no difference in the attack incidence in the child population. Free and increased facilities were provided after 1940, and by the middle of 1945, 25% of pre-school children were immunized fully, and a further 4% had received one inoculation.

from the disease. By this time 90% of the school children were known to be fully immunized against diphtheria; and 40% of the infants and children between 6 months and 5 years of age. Only nine cases were notified in 1947 (three in pre-school children), and four in 1948 of whom only one was a child aged 2 years and not immunized. No deaths occurred. By the end of 1948, 92.3% of school children had been immunized (and many thousands had been reinoculated), and 55.5% of pre-school

children had been similarly protected. There appears to be no doubt whatever of the value of active immunization against diphtheria when it is carried out in practically every infant and child.

Tuberculosis. For a long time tuberculosis was a common cause of death in pre-school children, and it will be seen from Tables 3 and 5 and Fig. 6

The fall increased in the middle 30s and continued with only a slight lag in the war years, 1942 to 1944. This fall has influenced the mortality rates for all forms of tuberculosis: meningeal, abdominal, respiratory, and other forms. During the last ten years there has been only one death from abdominal tuberculosis. This may be related

FIG. 5.—Deaths from diphtheria in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

that the rate did not begin to fall appreciably until the 1920s. Even then there was a tendency for the rate to rise with the rise in measles and whooping cough, an association that is well known. It has already been noted that in 1921 there were no deaths from measles or whooping cough. In the same year there were only five deaths from tuberculosis. In 1939 there were no deaths from measles and whooping cough, and no deaths at all from any form of tuberculosis.

to the pasteurization of milk which became general in the City in 1940, to the distribution of such milk to children under 5 years old, and to the use by infants of dried milk and vitamin supplements which became general after August, 1940.

Enteritis and Diarrhoea. This heading represents an ill-defined group, and probably included various diseases, such as dysentery and non-specific enteritis. The diseases in the group have not been an important cause of death for the last 30 years,

although there were in the City small epidemics of Flexner dysentery from time to time, and Sonne dysentery has been endemic for many years. There have been a few years, for example, 1940 and 1947, when infantile gastroenteritis was epidemic, and the cause of many deaths in the first year of life.

'Convulsions.' This is an unsatisfactory term

Pneumonia and Bronchitis. I have put these two diseases together for it is usually found that a young child very ill with supposed bronchitis has pneumonia on radiographic examination or at necropsy. These respiratory deaths were common; and although they fell in numbers steadily throughout the 50 years (Table 3 and Fig. 7), the fall was

FIG. 6.—Deaths from all forms of tuberculosis in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

when given as a certified cause of death, for 'convulsions' are only symptoms of many diseases, including the common infectious ones. However, I can find no correlation between deaths from these and the incidence of mortal convulsions. They fell rather abruptly as a cause of death in the 1920s, and it is possible that the fall was due to the lessened numbers of spasmophilic convulsions and of rickets that were seen after that time.

accentuated after 1938, and again during the last six years. It will be noted that the deaths rise in the years when measles is prevalent; that there was a rise in 1918 when influenza was pandemic; and that in 1929 there was also an increase. In this year there was a rise in pneumonia notifications at all ages to about twice the normal, due to an epidemic of 'influenza' in the early part of the year. The lowered death rates in recent years

may be partly due to the newer drugs and antibiotics.

Accidental Deaths. The progress of accidental deaths has varied. It will be seen that deaths from burns and scalds have fallen greatly, especially in the last 10 years. I doubt if this can be attributed entirely to a smaller number of cases, for the

Summary

The deaths in young children in the second, third, fourth, and fifth years of life in the City of Aberdeen during the 50-year period from 1900 to 1949 inclusive have been studied. The actual numbers of deaths have been used instead of death rates, as no age group estimates were compiled for local areas

FIG. 7.—Deaths from pneumonia and bronchitis in pre-school children (1-5) in the City of Aberdeen from 1900 to 1949 inclusive.

incidence of burns and scalds admitted to hospital has not fallen proportionately. It seems likely that better treatment (by drugs and antibiotics and by the giving of plasma) is responsible. Other accidents, now mainly from motor vehicles and from drowning, are not falling, and they remain one of the common causes of preventable deaths.

in Scotland later than 1930. Further, the actual numbers probably give a better picture of the progress of the different mortal diseases.

There has been a striking fall in the total deaths, largely owing to lowered mortality from measles, whooping cough, pneumonia, and tuberculosis. Diphtheria is no longer a common cause of death; indeed, the disease has almost disappeared. Scarlet

fever is at present a mild disease. So great has been the fall in the mortality of the infectious diseases that in 1949 there was not a single death in young children in Aberdeen from measles, whooping cough, scarlet fever, or diphtheria.

Deaths from tuberculosis are now mainly due to meningitis, the end-result of a primary lung infection; and deaths from abdominal tuberculosis are so rare that there was only one in the last 11 years of the half-century.

A persistently common cause of death was pneumonia. Its mortality fell steadily throughout the 50 years, but more quickly in the last six years when it has caused few deaths.

Accidents continue to be a relatively common cause of death in young children, and at present head the causes along with pneumonia and tuberculosis. Fewer deaths are now caused by burns and scalds, and the mortal accidents are due to motor vehicles and drowning.

There are probably many reasons for the lowered mortality rates. Diphtheria is almost certainly prevented by immunization; and the antibiotics and the sulphonamide group of drugs have lowered the death rates from primary and secondary pneumonia. Abdominal tuberculosis is avoided by using milk free from living tubercle bacilli. Some of the steady improvement throughout the 50 years may be due to improvement in living conditions, but there may also have been biological changes in the pathogenic organisms and their victims. Eternal vigilance is still necessary for freedom from infection, and the improved mortality figures should not lead to complacency.

Mortality rates give no real indication of morbidity; and although deaths in young children are now relatively infrequent, these children make up about one-third of the cases admitted to hospitals or treated by family doctors, and many conditions in later childhood, e.g. deafness, are due to disease in the pre-school period of life.