

THE DECREASE IN MORTALITY DURING EARLY ADULT MALE LIFE IN ENGLAND AND WALES

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(With 5 Graphs in the Text)

THE course of mortality has undergone some remarkable changes since the early part of the last century, the period for which official statistics are available. The variations in the death-rates are emphasised when the rates of various countries are compared, and the cause of the difference in the trend of mortality between various countries has been the source of much speculation. The most striking contrast between the course of mortality in two countries is, probably, that discussed by Prof. Greenwood (1924) in his paper, "The vital statistics of Sweden and England" (*J. Roy. Stat. Soc.* **87**, Part 4). He made a comparison between the two countries for the ages 10–50 for two periods. The first period covered the years 1838–54 for England and Wales and 1841–50 for Sweden, the second period was 1901–10 for both countries. The probability of dying for males during the first period was greater in England and Wales between the ages 10–35 than in Sweden. The greatest difference occurred at age 19, when the value for England and Wales was 151·2 per cent. of the Swedish figure. From age 36 the male mortality in Sweden was in excess of that for England and Wales. The female mortality was greater in England and Wales for every age 10–50. In the second period the mortality at adolescence in England and Wales had made such an improvement that it was less than that of Sweden, the probability of dying for males in England and Wales being less than that of Sweden for the ages 10–31. The England and Wales value at age 19 was now only 59·8 per cent. of that of Sweden. From age 32 the male mortality in Sweden was less than that of England and Wales. The female rate for England and Wales was below that of Sweden for the ages 10–36 and above for 37–50. The mortality of 1901–10, of both countries, had shown considerable improvement on that of the earlier period. This decline in mortality has been general and has been shown in the experience of most countries.

An interesting feature exhibited by German, French and other continental life tables is that the probability of dying in early adult male life does not rise steadily with age but for a few years of life shows a slight decline. This phenomenon is not present in the corresponding English life tables, or amongst females for whom the probability of dying steadily increases with advancing

age. The values of q_x for Germany, France, England and Wales for post- and pre-war periods are shown in the graph and in Table I. For the first periods given in this table the q_x for males in Germany reaches a maximum value at age 21, then declines and does not exceed this value until age 25. The maximum occurs a little later for France than for Germany but the depression in the curve is longer, the maximum being at age 23 and the next greater value occurring at age 30. This indentation of the q_x curve for France and Germany and its absence from the English table, for the first periods, was noted by Otto Von Schjerning in his book *Sanitätsstatistische Betrachtungen über Volk und Heer*, published in 1910. He pointed out that while Germany and France had compulsory military service, England did not have this system, and he attributed the diminution of the rate of mortality to the favourable influence of military service. For the second period the decline with age in the probability of dying for both France and Germany is more pronounced than in the first period. Male mortality in France reached a maximum at the age of 21 and then declined, remaining below this value until age 34. In Germany the maximum occurred at age 22, and the lessened rate of mortality lasted until age 37. This diminution of the values of the probability of dying is absent from the three English life tables, although the slope of the male q_x curve of 1920–2 for the ages 23–26 was appreciably less than for the other ages.

The official life tables for 1931 are not yet published, but with the issue of the census it was thought of interest to test whether the probability of dying for England and Wales steadily increased with advancing age or not. The life tables constructed on the census population of 1931 and the deaths of 1930–2, showed for females the usual increasing series of values, but for males the value of q_x was lower at ages 24–28 years than it was for age 23. Thus in the most recent years the mortality of young adult males shows in England and Wales the same kind of course as has been previously observed in Germany and France but not before in this country. Compulsory military service cannot be invoked as an explanation of this change in England and Wales. To determine the factor that might be responsible, it appeared necessary to examine the causes of death in young adult life and thus detect which of them were responsible for the decline in the total q_x values at these particular ages. For this purpose the causes of death were grouped into fourteen categories and the probability of dying found for each group, for the two periods 1920–2 and 1930–2. The life tables were constructed using King's method and were based on the deaths for 3 years and the census population. The census population of 1931 was brought down to the mid-year value on the assumption of a geometric increase in the intercensal period 1921–31. The quinquennial pivotal values were derived from the grouping 5–9, 10–14, 15–19, etc., since the separate causes of death are only given in this grouping and it was thought best to use the same pivotal value throughout. A comparison with the 1921 table shows that the different pivotal values give very small differences in the value of q_x . The probability of dying from each group of diseases is shown in Table II and

in the graphs. The two groups, suicide, accidents and homicide, are more important causes of death in 1930-2 than in 1920-2 and are the only causes that show an appreciable increase during the decade. Cancer and tumours show a slight rise and there is a small increase in ages over 24 for diseases of the digestive system and in ages under 24 for epidemic diseases (less influenza and tuberculosis). All the other causes of death have declined from the 1921 values. Turning from the secular trend of mortality to its course with age tuberculosis and accidents are the only groups which exhibit a decline in the mortality rates for 1930-2, between the ages of 24 and 27, when as we have seen the mortality from all causes declined. The drop in the rate for tuberculosis from age 23 to age 28, although contributing to the fall at those ages in the rate for all causes, cannot be responsible for the lowering of the mortality between ages 24-28 observed in the total rate for 1930-2 but not in 1920-2, for this cause of death had shown a similar but somewhat steeper decline in 1920-2 and, as is shown in Table III, tuberculosis in 1930-2 was proportionately slightly less important than in 1920-2. If it had become more important proportionately it might have been partly responsible for the indentation. This leaves accidents to account for the diminution in the probability of dying. It will be seen from the graph that the curve of mortality from this cause has altered considerably between 1920-2 and 1930-2. Not only is the curve of 1930-2 higher than that of 1920-2 but it has a pronounced maximum at age 22 followed by a steep decline. Table III shows the probability of dying for each group expressed as a percentage of the all causes rate. This table shows that the fall in the probability of dying from tuberculosis after age 23 was steeper in 1920-2 than in 1930-2, whilst the accident values show a steeper decline in 1930-2 than in 1920-2 for ages over 22. To compare the course of mortality from both causes of death more readily, the q_x for ages over 23 have been expressed as a percentage of that of age 23. The values are:

Age	Accidents		Tuberculosis	
	1920-2	1930-2	1920-2	1930-2
23	100	100	100	100
24	97.9	96.2	98.7	99.2
25	95.3	91.0	96.0	97.0
26	92.9	85.5	93.3	94.7
27	91.5	81.2	91.9	93.4
28	91.0	77.2	91.8	93.1
29	91.6	73.4	92.1	93.0
30	92.4	69.8	92.9	93.2

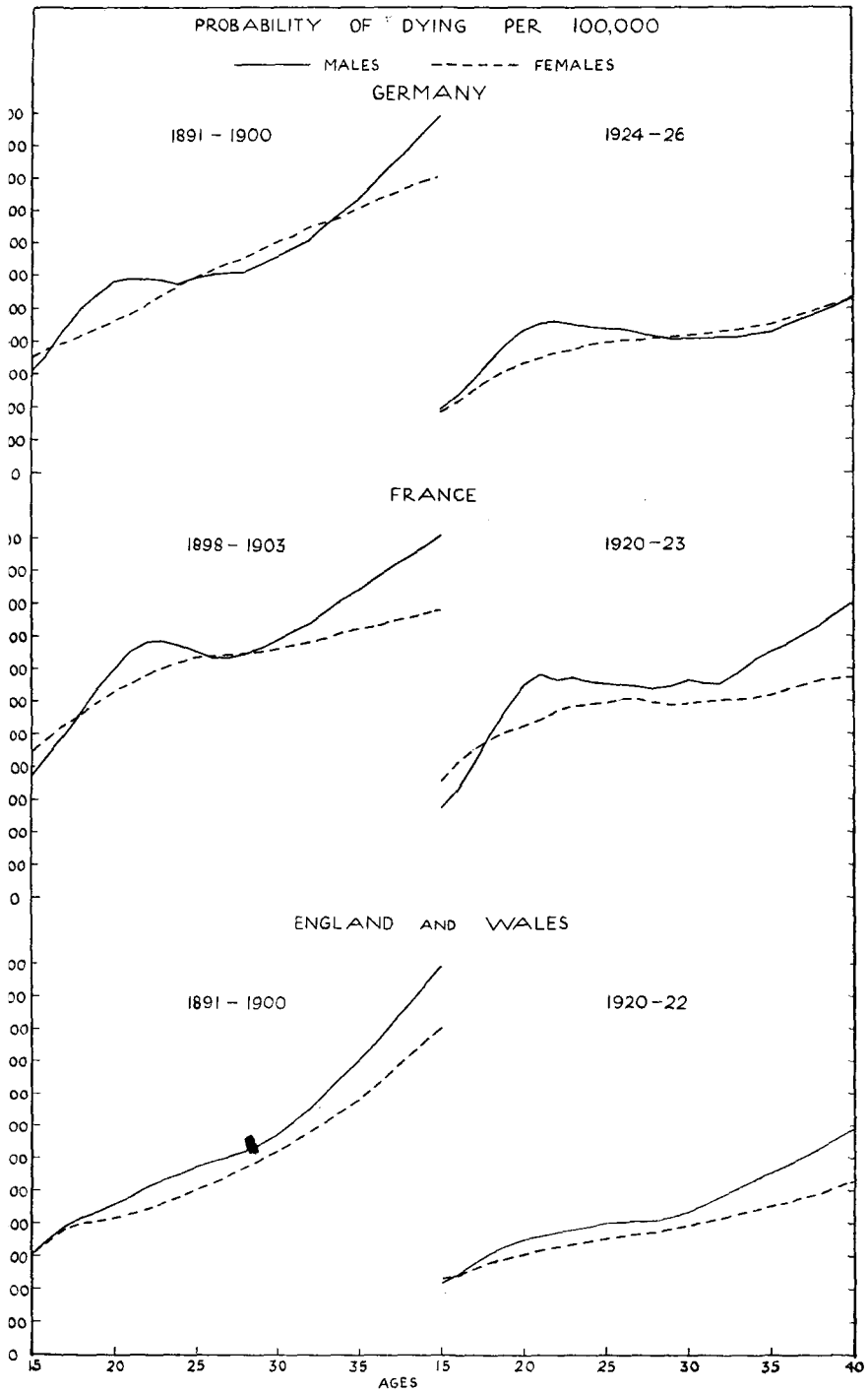
From this it will be seen that the greatest age decline is in accidents which have become proportionately much more important, while the tuberculosis decline has slackened and is proportionately less important. Hence the new indentation must be derived from accidents.

It is of interest to see whether tuberculosis and accident mortality for females has undergone any changes similar to those found in the male mortality experience. Accordingly the probability of dying was found for all causes, tuberculosis and accidents for the females for 1920-2 and 1930-2.

Mortality in England and Wales

Table I. *Probability of dying per 100,000*

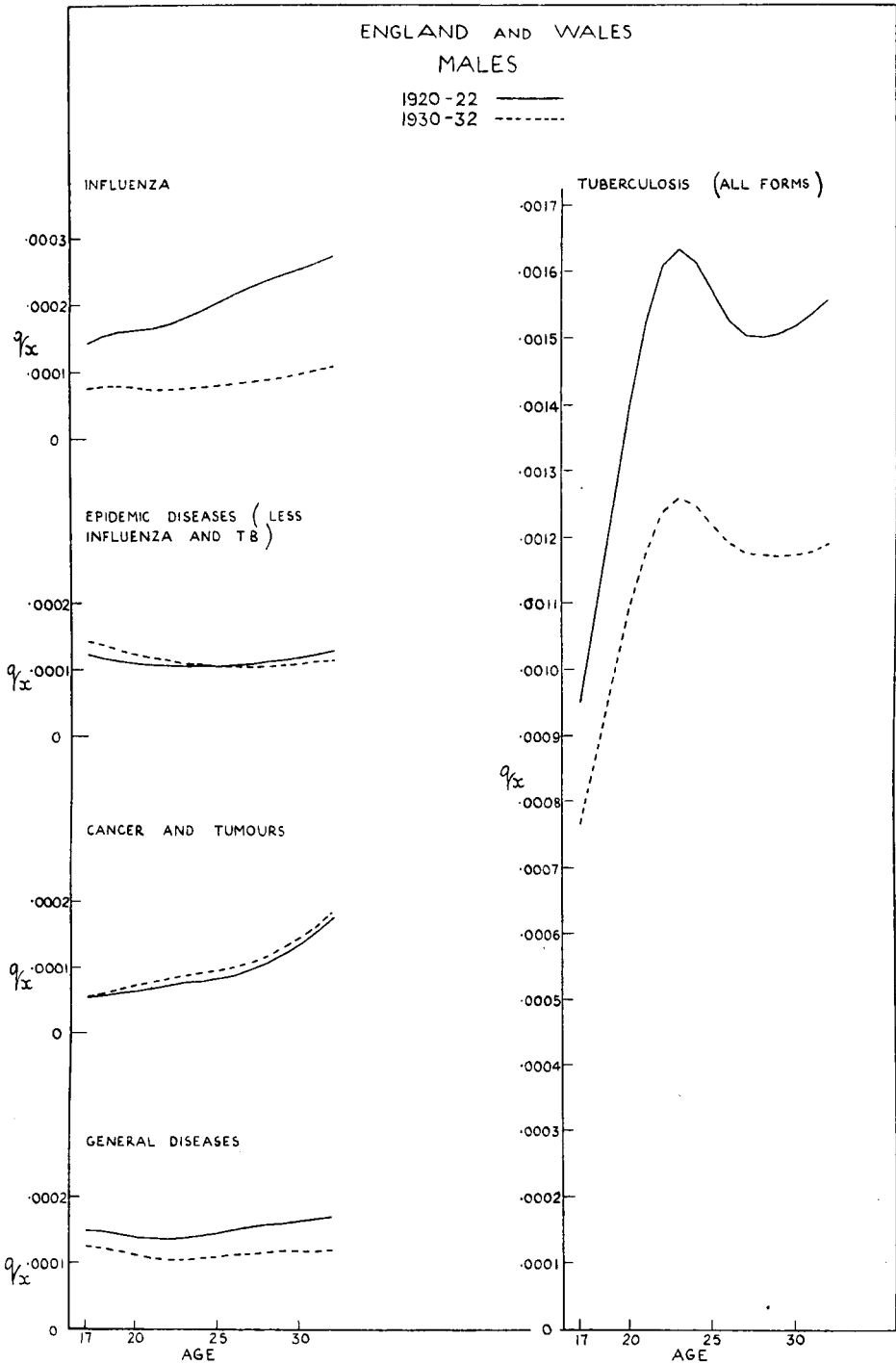
Age	Germany						France						England and Wales					
	1891-1900		1924-6		1898-1903		1920-3		1891-1900		1910-12		1920-2					
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females				
15	306	351	194	181	375	447	272	355	305	306	235	239	218	227				
16	360	375	232	213	437	489	328	409	351	347	259	257	246	243				
17	438	395	281	249	504	527	407	452	391	380	279	268	278	261				
18	497	416	336	282	570	562	499	484	416	396	302	278	308	279				
19	544	436	388	310	637	595	575	506	433	402	326	286	332	294				
20	577	459	427	332	699	627	639	519	457	414	348	295	349	306				
21	592	484	451	347	751	654	681	539	484	428	366	304	363	316				
22	592	514	457	360	780	680	664	565	509	443	378	313	374	325				
23	585	541	450	374	782	703	672	584	530	461	386	321	383	333				
24	575	572	443	386	770	722	655	587	549	482	392	330	392	342				
25	593	593	439	394	752	735	650	593	568	502	400	340	398	350				
26	602	615	433	397	735	742	646	602	586	523	411	351	401	358				
27	603	636	423	401	733	742	641	604	602	544	425	364	403	365				
28	608	651	411	406	744	745	632	591	620	567	440	379	408	373				
29	633	676	404	410	761	752	641	585	642	591	458	394	418	382				
30	655	696	405	414	786	759	660	590	671	618	478	411	434	392				
31	681	717	407	420	814	768	652	595	707	647	502	430	455	402				
32	706	737	408	427	846	778	648	600	750	678	528	451	479	414				
33	751	759	409	434	876	792	680	600	798	711	558	473	504	425				
34	788	776	414	441	909	806	722	605	847	745	590	497	529	438				
35	834	802	425	452	942	820	754	616	897	782	624	523	553	451				
36	885	828	444	467	976	832	774	633	952	823	659	549	576	464				
37	937	845	465	482	1009	845	803	645	1013	869	695	575	600	478				
38	978	848	483	496	1037	858	833	658	1074	915	731	602	627	494				
39	1036	886	506	513	1068	865	866	665	1134	957	769	630	656	512				
40	1094	901	535	531	1104	879	898	674	1190	995	811	660	688	532				



Graph 1.

Table II. *England and Wales. Males. Probability of dying from various causes of death per 100,000*

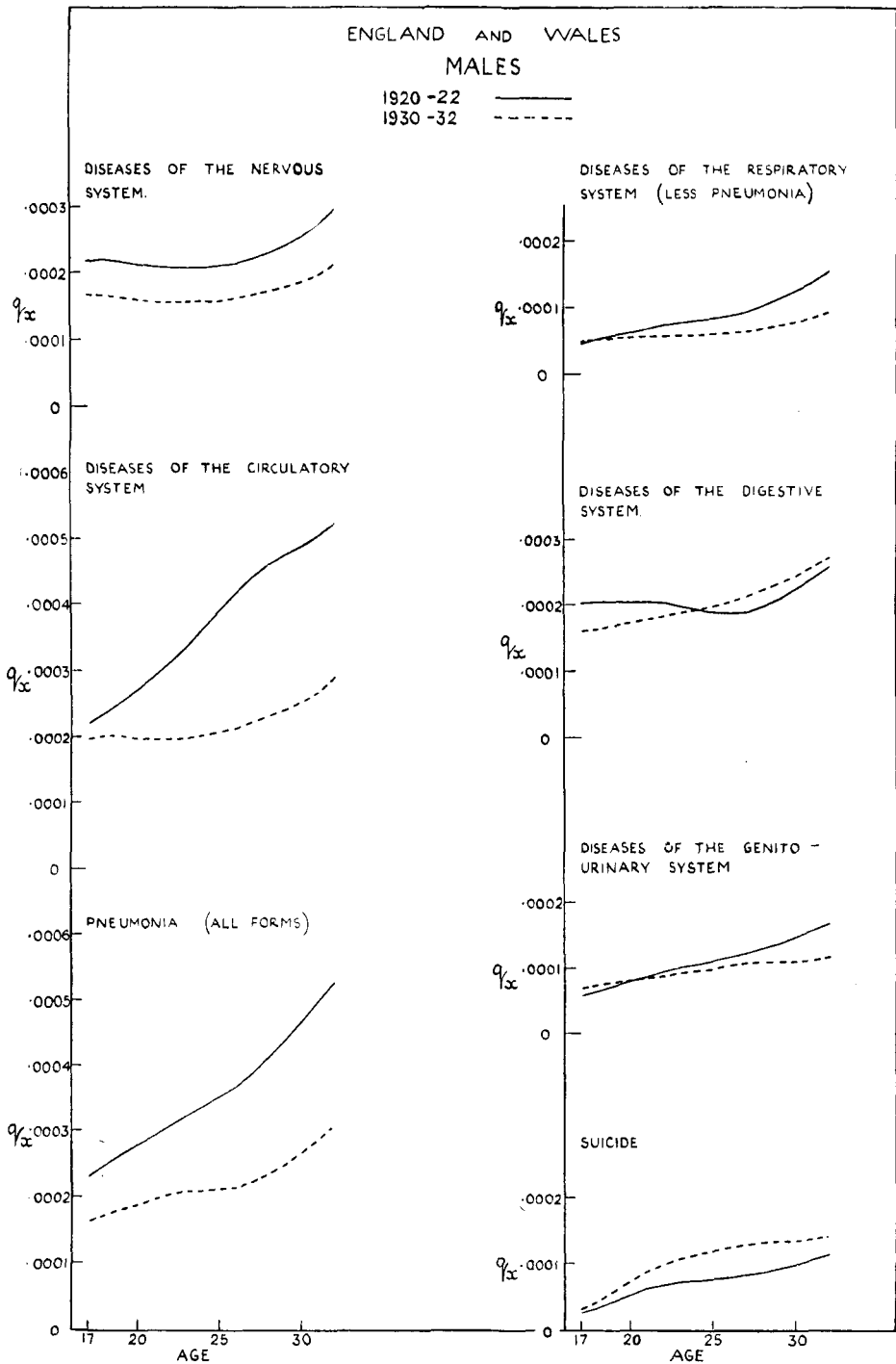
Age	Influenza	Epidemic diseases less T.B. and influenza	Tuberculosis and all forms	Cancer and tumours	General diseases	Diseases of nervous system	Diseases of circulatory system	Pneumonia and all forms	Other diseases of respiratory system	Diseases of digestive system	Diseases of genito-urinary system	Suicide	Accidents and homicide	Other diseases	All causes	Age
17	14.37	12.25	95.01	5.28	14.89	21.83	22.13	22.96	4.56	20.17	5.87	2.69	36.23	6.64	285	17
18	15.29	11.60	109.05	5.66	14.67	22.02	23.69	24.80	5.06	20.37	6.46	3.43	37.82	6.14	306	18
19	15.79	11.17	124.63	6.03	14.30	21.80	25.34	26.37	5.63	20.42	7.19	4.30	38.95	5.47	327	19
20	16.08	10.89	139.77	6.40	13.89	21.38	27.12	27.80	6.22	20.36	7.97	5.21	39.67	4.75	347	20
21	16.42	10.70	152.53	6.78	13.57	20.98	29.05	29.20	6.81	20.25	8.75	6.05	40.06	4.12	365	21
22	17.04	10.56	160.91	7.20	13.46	20.81	31.15	30.70	7.32	20.11	9.45	6.71	40.19	3.72	379	22
23	18.00	10.46	163.41	7.88	13.62	20.81	33.57	32.20	7.69	19.79	10.03	7.12	39.86	3.61	387	23
24	19.14	10.43	161.35	8.25	13.96	20.83	36.29	33.63	7.95	19.28	10.54	7.35	39.02	3.70	391	24
25	20.37	10.48	156.95	8.25	14.41	20.97	39.10	35.11	8.22	18.78	11.03	7.51	37.97	3.89	392	25
26	21.59	10.60	152.47	8.80	14.88	21.33	41.79	36.79	8.61	18.55	11.57	7.70	37.02	4.09	395	26
27	22.70	10.80	150.14	9.65	15.28	22.02	44.16	38.78	9.26	18.80	12.22	8.05	36.48	4.21	402	27
28	23.67	11.09	150.00	10.79	15.59	22.96	46.03	41.17	10.17	19.60	12.97	8.53	36.28	4.21	412	28
29	24.57	11.48	150.54	12.13	15.85	24.09	47.55	43.87	11.25	20.80	13.77	9.08	36.51	4.16	425	29
30	25.44	11.93	151.73	13.70	16.12	25.51	48.97	46.77	12.50	22.30	14.65	9.71	36.83	4.10	439	30
31	26.31	12.40	153.52	15.52	16.46	27.32	50.53	49.74	13.90	24.01	15.60	10.45	37.28	4.10	456	31
32	27.25	12.85	155.85	17.60	16.90	29.61	52.49	52.66	15.43	23.83	16.65	11.30	37.81	4.20	475	32
1930-2.																
17	7.51	14.26	76.42	5.32	12.47	16.38	19.72	16.07	4.80	15.99	6.91	3.13	49.71	6.85	255	17
18	7.76	13.57	87.34	5.84	12.19	16.61	20.14	17.10	5.06	16.42	7.34	4.30	54.22	6.43	274	18
19	7.73	12.89	98.37	6.45	11.67	16.36	20.09	18.05	5.24	16.87	7.70	5.74	58.63	5.99	292	19
20	7.39	12.24	104.07	7.10	11.07	16.00	19.83	18.91	5.38	17.33	8.02	7.27	62.45	5.36	307	20
21	7.39	11.67	117.79	7.74	10.55	15.67	19.60	19.68	5.51	17.81	8.33	8.70	65.24	5.17	320	21
22	7.37	11.20	123.68	8.33	10.27	15.53	19.63	20.35	5.64	18.31	8.68	9.86	66.51	4.84	330	22
23	7.49	10.84	125.75	8.77	10.29	15.56	19.91	20.77	5.75	18.79	9.08	10.70	65.74	4.58	334	23
24	7.66	10.56	124.70	9.10	10.51	15.67	20.27	20.93	5.81	19.25	9.50	11.35	63.26	4.38	333	24
25	7.88	10.36	121.99	9.46	10.82	15.87	20.76	21.08	5.88	19.76	9.93	11.87	59.83	4.22	329	25
26	8.15	10.25	119.10	9.97	11.15	16.19	21.39	21.42	6.02	20.36	10.32	12.33	56.24	4.11	327	26
27	8.47	10.20	117.50	10.80	11.38	16.67	22.22	22.19	6.29	21.14	10.66	12.71	53.37	4.03	327	27
28	8.83	10.30	117.12	11.88	11.49	17.23	23.10	23.36	6.65	22.09	10.84	13.02	50.78	4.00	330	28
29	9.22	10.49	116.98	13.11	11.56	17.85	24.01	24.78	7.06	23.17	10.88	13.19	48.26	4.02	334	29
30	9.66	10.75	117.18	14.58	11.60	18.64	25.15	26.48	7.58	24.37	10.94	13.34	45.91	4.07	340	30
31	10.19	11.03	117.81	16.38	11.68	19.71	26.74	28.50	8.25	25.69	11.15	13.57	43.93	4.15	348	31
32	10.83	11.29	118.98	18.58	11.84	21.17	28.98	30.86	9.13	27.12	11.69	13.98	42.53	4.23	361	32



Graph 2.

Table III. *England and Wales. Males. Probability of dying from each cause expressed as a percentage of all causes*

Cause of death	Age														31	32
	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
1. Influenza	5.1	5.0	4.8	4.6	4.5	4.5	4.6	4.9	5.2	5.5	5.6	5.7	5.8	5.8	5.8	5.7
2. Epidemic diseases (less influenza and T.B.)	4.3	3.8	3.4	3.1	2.9	2.8	2.7	2.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
3. Tuberculosis (all forms)	33.4	35.7	38.1	40.3	41.8	42.5	42.2	41.3	40.0	38.6	37.4	36.4	35.4	34.5	33.6	32.8
4. Cancer and tumours	1.9	1.9	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.4	2.6	2.9	3.1	3.4	3.7
5. General diseases	5.2	4.8	4.4	4.0	3.7	3.6	3.5	3.6	3.7	3.8	3.8	3.8	3.7	3.7	3.6	3.6
6. Diseases of the nervous system	7.7	7.2	6.7	6.2	5.8	5.5	5.4	5.3	5.3	5.4	5.5	5.6	5.7	5.8	6.0	6.2
7. Diseases of the circulatory system	7.8	7.7	7.8	7.8	8.0	8.2	8.7	9.3	10.0	10.6	11.0	11.2	11.2	11.1	11.1	11.0
8. Pneumonia (all forms)	8.1	8.1	8.1	8.0	8.0	8.1	8.3	8.6	8.9	9.3	9.6	10.0	10.3	10.6	10.9	11.1
9. Other diseases of respiratory system	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.3	2.5	2.6	2.8	3.0	3.2
10. Diseases of digestive system	7.1	6.7	6.2	5.9	5.6	5.3	5.1	4.9	4.8	4.7	4.7	4.6	4.9	5.1	5.3	5.4
11. Diseases of the genito-urinary system	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
12. Suicide	0.9	1.1	1.3	1.5	1.7	1.8	1.8	1.9	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.4
13. Accidents and homicide	12.7	12.4	11.9	11.4	11.0	10.6	10.3	10.0	9.7	9.4	9.1	8.8	8.6	8.4	8.2	8.0
14. All other diseases	2.3	2.0	1.7	1.4	1.1	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9
14. All other diseases	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1930-2																
1. Influenza	2.9	2.8	2.6	2.5	2.3	2.2	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.0
2. Epidemic diseases (less influenza and T.B.)	5.6	5.0	4.4	4.0	3.6	3.4	3.2	3.2	3.2	3.1	3.1	3.1	3.1	3.2	3.2	3.1
3. Tuberculosis (all forms)	30.0	31.9	33.8	35.5	36.8	37.5	37.6	37.4	37.1	36.4	35.9	35.5	35.0	34.5	33.9	33.0
4. Cancer and tumours	2.1	2.1	2.2	2.3	2.4	2.2	2.6	2.7	2.9	3.0	3.3	3.6	3.9	4.3	4.7	5.1
5. General diseases	4.9	4.4	4.0	3.6	3.3	3.1	3.1	3.2	3.3	3.4	3.5	3.5	3.5	3.4	3.4	3.3
6. Diseases of the nervous system	6.5	6.1	5.6	5.2	4.9	4.7	4.7	4.7	4.8	5.0	5.1	5.2	5.3	5.5	5.7	5.9
7. Diseases of the circulatory system	7.7	7.4	6.9	6.5	6.1	5.9	6.0	6.1	6.3	6.5	6.8	7.0	7.2	7.4	7.7	8.0
8. Pneumonia (all forms)	6.3	6.2	6.2	6.2	6.2	6.2	6.2	6.3	6.4	6.6	6.8	7.1	7.4	7.8	8.2	8.5
9. Other diseases of respiratory system	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.4	2.5
10. Diseases of digestive system	6.3	6.0	5.8	5.6	5.6	5.5	5.6	5.8	6.0	6.2	6.5	6.7	6.9	7.2	7.4	7.5
11. Diseases of the genito-urinary system	2.7	2.7	2.6	2.6	2.6	2.6	2.7	2.9	3.0	3.2	3.3	3.3	3.3	3.2	3.2	3.2
12. Suicide	1.2	1.6	2.0	2.4	2.7	3.0	3.2	3.4	3.6	3.8	3.9	3.9	3.9	3.9	3.9	3.9
13. Accidents and homicide	19.5	19.8	20.1	20.3	20.4	20.5	19.7	19.0	18.2	17.2	16.3	15.4	14.4	13.5	12.6	11.8
14. All other diseases	2.7	2.3	2.1	1.8	1.6	1.5	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2
14. All other diseases	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100



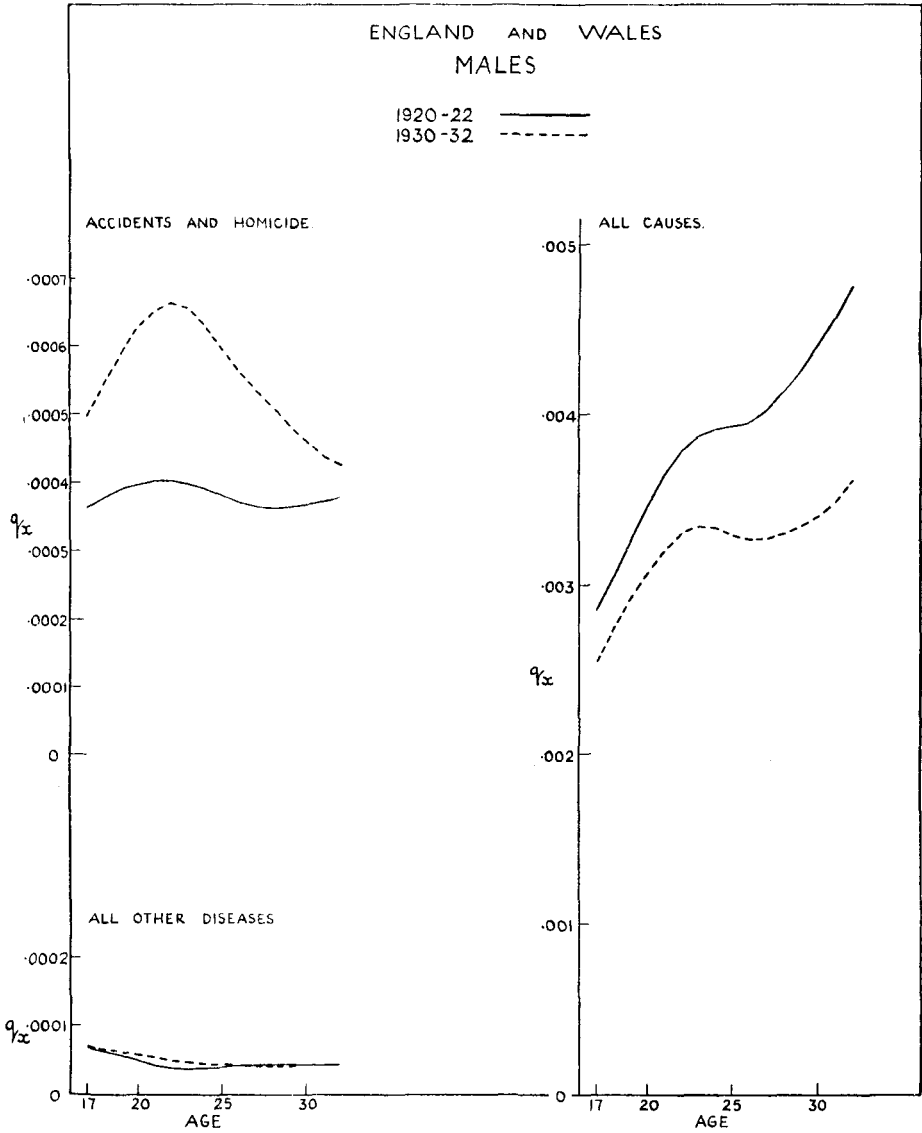
Graph 3.

Table IV. *England and Wales. Females. Probability of dying per 100,000*

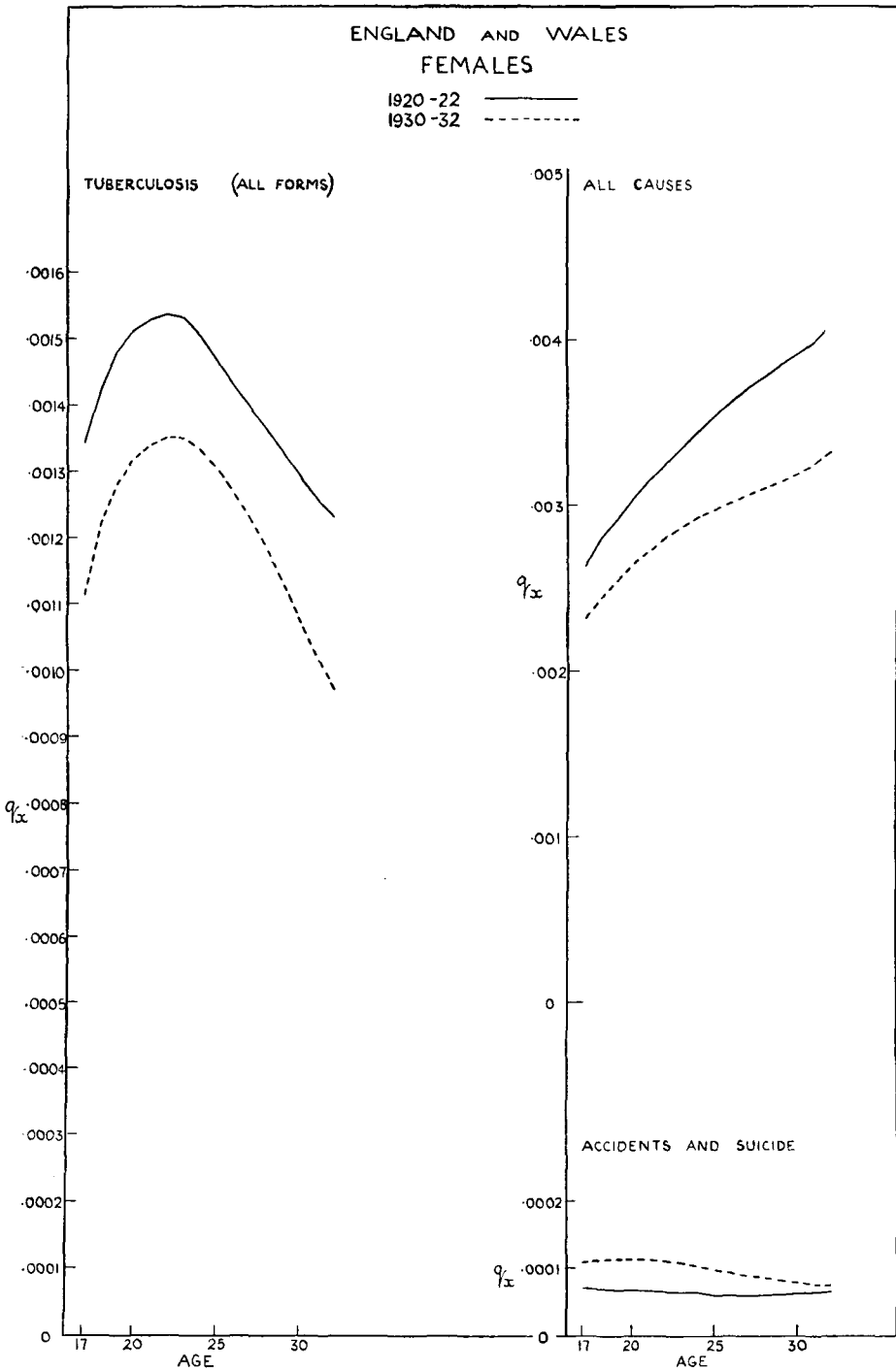
Age	1920-2			1930-2		
	Tuberculosis all forms	Accidents and homicide	All causes	Tuberculosis all forms	Accidents and homicide	All causes
17	134.46	7.02	266	113.34	10.75	231
18	142.80	6.90	280	122.28	11.03	244
19	148.23	6.76	292	128.24	11.15	255
20	151.41	6.61	304	131.89	11.15	265
21	153.02	6.46	315	133.95	11.06	273
22	153.73	6.33	325	135.10	10.89	281
23	153.04	6.19	335	135.01	10.61	287
24	150.50	6.05	345	133.20	10.20	293
25	146.87	5.92	354	130.20	9.72	297
26	142.91	5.82	363	126.51	9.23	301
27	139.38	5.80	371	122.64	8.82	306
28	136.10	5.86	378	118.20	8.45	310
29	132.56	5.98	385	112.84	8.08	314
30	129.04	6.14	391	107.16	7.74	319
31	125.82	6.32	398	101.78	7.46	325
32	123.18	6.50	408	97.28	7.28	332

Table V. *England and Wales. Females. Probability of dying from tuberculosis, and accidents and homicide expressed as a percentage of all causes*

Cause of death	Age							
	17	18	19	20	21	22	23	24
1920-2								
Tuberculosis	50.5	51.0	50.7	49.9	48.6	47.3	45.7	43.7
Accidents and homicide	2.6	2.5	2.3	2.2	2.1	1.9	1.8	1.8
1930-2								
Tuberculosis	49.1	50.1	50.3	49.8	49.1	48.1	47.0	45.5
Accidents and homicide	4.7	4.5	4.4	4.2	4.1	3.9	3.7	3.5
Cause of death	Age							
	25	26	27	28	29	30	31	32
1920-2								
Tuberculosis	41.5	39.4	37.6	36.0	34.5	33.0	31.6	30.2
Accidents and homicide	1.7	1.6	1.6	1.5	1.6	1.6	1.6	1.6
1930-2								
Tuberculosis	43.8	42.0	40.1	38.1	35.9	33.6	31.3	29.3
Accidents and homicide	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.2



Graph 4.



Graph 5.

These rates are set out in Table IV, and the values of tuberculosis and accidents expressed as a percentage of all causes are given in Table V. The curve of the tuberculosis rates for 1930-2 is similar to that of 1920-2 but lower. Mortality from accidents has increased and the values of 1930-2 show a rise to a maximum followed by a steady decline as did the males but on a much smaller scale. The rates for accidents are too small to affect the total death-rate to an appreciable extent, forming in 1930-2 approximately only one-twentieth of the deaths from all causes at the age when the probability of dying from this cause was at its maximum, whereas for males accidents accounted in 1930-2 for one-fifth of the total mortality at ages 19-23. From this analysis I think we may conclude that the indentation in the curve of the probability of dying from all causes, for males, between the ages 24 and 28 in 1930-2 is due to the trend of mortality from accidents. If accidents be excluded then the probability of dying, for males, steadily increases with increasing age and the indentation is absent.

Since it is of interest to determine what type of accident has been responsible for the greatly increased rate of mortality from this cause, the rates for the principal categories, for the age group 20-25, have been found. They are:

	Death rates per million	
	1920-2	1930-2
Drowning	79	52
Fall	32	31
Mines and quarries	61	36
Machinery	14	12
Railways	32	14
Road and air transport	96	432
Other accidents	85	77
Total...	399	654

Accident mortality from every cause except road transport in 1930-2 shows a decrease on the 1920-2 value. Road accidents with a 450 per cent. increase accounted for more deaths in 1930-2 than did all forms of accidents in 1920-2.

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