The Cause of the Increased Frequency of Death from Heart Disease

By Maurice Campbell

The large increase in the number of deaths from coronary heart disease since about 1924 is widely recognized. Its consideration cannot be taken alone but must be taken with the increase in deaths from all diseases of the heart, for two reasons.

Firstly it was only in about 1922-27 that the diagnosis of coronary thrombosis began to be widely recognized, and that angina pectoris which had been known since Heberden's description in 1768 was firmly related to disease of the coronary arteries.

Secondly because all the increase in deaths from coronary heart disease since 1950 is balanced by a decrease in deaths from other myocardial degenerations. The balance is so exact that it is almost certainly due to a change in the doctor's method of certification of death. Presumably this change had been taking place gradually during 25 years but doctors who were well established in practice then had been slow to change their methods in something they took as seriously as death certification.

The Number of Deaths: 1891-1965

In my original work on this subject (Campbell, 1963 a and b) the death rates as reported by the Registrar-General in England and Wales from (1) all diseases of the circulatory system, (2) all diseases of the heart, (3) coronary heart disease (angina pectoris and coronary

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thrombosis), and (4) vascular lesions of the central nervous system (mainly strokes) were considered, fully from 1891 to 1959 and more shortly from 1876 to 1890. Only (2) and (3) are considered here.

Unless otherwise stated death rate means the crude annual death rate per million living persons (men and women combined) as reported by the Registrar-General in his Annual Reports and Statistical Reviews. The death rate is, therefore, independent of the size of the population but dependent on its age distribution.

I have not studied the similar records in the United States of America. The dates at which the changes took place may well differ by a few years but it seems most unlikely that there are fundamental differences.

The death rate from all diseasesof the heart changed very little from 1876 to 1920 and probably from about 1850. It averaged 1500 in the years 1891 to 1920 with no regular tendency to rise or fall (Table I). The reported death rate from angina pectoris (coronary heart disease) was small, less than 2% of the total, being 24 in the first half and 29 in the second half of this period. In describing the changes that took place in later years, a death rate of 1500 is used as a base line of 100% for all disease of the heart and one of 26 as a similar 100% base line for coronary heart disease.

The death rate from all diseases of the heart began increasing rapidly from 1924. It has risen from 100 to 149% by 1930, to 198% by 1940, to 232% by 1950, and to 263% by 1953, since when it has tended to settle and was 261% in 1957-59 (see Table and Figure). This levelling off has been confirmed by later figures.

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The Registrar-General in his Statistical Review for 1965 (the last one published, in 1967) gives the following proportional death rates from all cardiovascular diseases in the years 1961 to 1965: males only, 86.4, 87.7, 89.7, 80.9, and 84.4. There has, therefore been a slight fall of just over 2%.

The death rates from all diseases of the circulatory system and from vascular lesions of the central nervous system (mainly strokes) behaved in the same general way; but the increases were less, to 242 and 220%, respectively.

The reported death rate from coronary heart disease behaved differently, though it started increasing about the same time. It was just noticeable in 1922 and from then on increased in every year but one till 1939. It had risen from 100 to 146 by 1924, to 212 by 1927, to 465% by 1930, to 1473% by 1940, to 3604% by 1950 and to 6204% by 1956, but not by so much in 1957 to 1959. Put in another way, it had doubled by 1927 after being steady for 50 years, doubled again by 1929, again by 1933, again by 1939, again by 1948, and again for the sixth time by 1956.

The amazing rise in reported coronary heart disease.

Such an extraordinary increase, in almost geometrical rather than arithmetical progression, is not so difficult to maintain at first when the number is very small initially but becomes increasingly difficult as the numbers grow. The cases of coronary heart disease (then angina pectoris) were so small that the curve in the Figure showing their increase hardly leaves the base line till 1927 and did not form one tenth of the deaths from all diseases of the heart till 1936-40: by 1959 they were nearly half.

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An increase in geometrical progression is not common in medical or biological statistics. It may occur in the early spread of an infectious disease among a population with little immunity, and for a time in the growth of a small number of animals with a rapid rate of reproduction and an almost unlimited food supply.

Coronary heart disease has little resemblence to either of these conditions, but the spread of new knowledge, i.e. the diagnosis of coronary thrombosis, though the medical community does resemble them closely. This is the most likely explanation of the astronomical increase, since changes in the Registrar-General's methods of classification do not seem to be important.

The diagnosis of coronary thrombosis was rarely made before 1924-27 and this fits in well with the time when the increase was first observed. It should have been made after Herrick's paper in 1912 but even in America little attention was paid to it until Herrick spoke on the subject again ten years later. In Britain it did not become widely known till the papers of Gibson (1925), McIlee (1926, after a visit to America), and Parkinson and Bedford (1928). Thus, Sir Humphrey Rolleston in an interesting address on "Changes in the Clinical Aspects of Disease" in 1927 did not mention coronary thrombosis or coronary heart disease.

There is more direct evidence that most of the increase in coronary heart disease is due to changes in medical diagnosis and certification. 1940-49 was the first decade since 1921 when the increase in deaths from coronary heart disease could be shown to be due to this change in certification since it was accompanied by a fall in deaths from

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myocardial diseases. Ryle and Russell (1949) were the first to show that four-fifths of the registered increase (in deaths from coronary heart disease) was due to a change of certification from the decrease in the deaths registered as due to other myocardial diseases.

In the next decade the registered increase in deaths from arteriosclerotic, including coronary, heart disease (group 420 a change in classification) was exactly balanced by the registered decrease in deaths from other myocardial degeneration.

Registered deaths from:-	1949	1954	1959
(1) arteriosclerotic, including coronary heart disease	1114	1532	1871
(2) other myocardial degeneration	1789	1358	1079
Total deaths	2903	2890	2950

The agreement is too close to be due to anything but a change in methods of certification and it continued in 1960 -61. (In his Statistical Review for 1961) (published in 1964), the Registrar-General wrote "In spite of the rising death rate from coronary heart disease the total number of deaths from heart disease has not increased if allowance is made for the increase in the number of elderly persons in whom most of these disease occur. Based on the years 1950-52 as 100, the standardized mortality ratios (S.M.R.) for all diseases of the circulatory system in 1961 were 98 for males and 88 for females. Certain forms of disease have increased but others have decreased, the biggest decrease being in other myocardial degeneration, the S.M.R. of which is now 52 for males and 56 for females. What has

happened to this vague amorphous group of myocardial degenerations?" He goes on to say that there have been no medical advances in the treatment or in prevention that would explain the decrease; but has been a widespread dissemination of new ideas and knowledge that could alter the terminology used by doctors certifying the causes of deaths from heart diseases.

We know therefore that since 1940 most of the recorded increase in deaths from coronary heart disease is quite artificial and due to a change in the doctor's knowledge and certification. Probably this was true in 1924-1939 but then the increase in deaths from all forms of heart disease was large enough to mask the certainty of this. The increase in deaths from all forms of heart disease must therefore be considered and I hope to show that this was due to the increasing age of the population caused by the young lives that had been saved by the better control of infections diseases and tuberculosis.

II The Main Cause of the Increased Deaths from All Disease of the Heart

The increase in the deaths from all diseases of the heart is mainly due to the older age of the population. The death rate from all causes showed little change from 1830 to 1880 and averaged about 21.5 per 1000 living with no general tendency to rise or fall. In 1881 it fell to about 18.7 per thousand and remained near this till 1895. From the quinquennium 1891-95, it fell faster and fairly steadily to 10.9 in 1921-25 and to 10.3 per 1000 living in 1926-30, since when it has fallen more slowly. Nor do the smaller changes after 1930 affect our arguments about the rise in deaths from heart disease in the period under consideration.

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The lives that were saved were in the main young people, mostly infants and young children who had previously died from various infectious diseases and young adults from tuberculosis. They must die sometime and so the initial fall must be followed by an increase in deaths among older population from conditions like heart disease and cancer for which no preventive treatment has been found. From various data I concluded that the average age of those whose lives had been saved was about 16 to 22 years.

From the fall in the death rate, one knows the number of lives saved in each year. I assumed their average age was 20 and that one quarter of them died later from diseases of the heart at an average age of 60, i.e. 40 years later. These assumptions were reasonable for the early period though now much more than a quarter die from diseases of the heart and the average age is nearer 69 years.

This means that about 40 years after 1880 there must be an increase in the deaths from heart disease and other causes like cancer. Spreading the deaths of those whose lives had been saved over the years when they were 40 to 80 with the greater number about 60, the expected deaths can be calculated. They are shown in the Figure and agree closely with what has in fact happened from 1920 to 1960. These calculations could have been made any time after 1910, though the levelling off of the rise could not have been predicted till the relative stabilization of the death rate after 1921-26. Fuller details of the method of calculation were given by Campbell (1963b).

The main cause of the increased number of deaths from all heart disease is, therefore, the older age of the population due to the lives of the younger patients saved from an early death. The main cause of

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the greatly increased deaths from coronary heart disease is the advance of our knowledge with its consequent change in methods of certification of death. In looking for the causes of coronary and other heart disease there is no occasion to look for a cause that has been increasing during this same period.

To say that coronary heart disease has been caused by smoking because both have increased during the same period is wrong: smoking might equally well be replaced by motor cars or divorce.

Age itself is probably not the main cause of heart disease, though it is very important: we do not know what is. A particular sort of mental stress, overeating, too much animal fat or sugar or cigarette smoking, and lack of exercise have all been under suspicion. All or most of these may be provoking causes. I suspect the constitution that has been inherited from one's parents is one of the most important causes.

Much work is being carried out to try and find the main cause or causes of heart disease and of cancer, but so far no final conclusion can be reached. It is most important work for these are now the cause of most deaths: so until it succeeds we are not likely to be able to produce another general fall in the death rate comparable with that achieved by the better control of infectious diseases.

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TABLE

Summary of Crude Death Rates per Million

Living 1891-1959

Years	Deaths from all heart disease	From all diseases of circ. system	From coronary heart disease
1891 - 1900	1543	2460	23
1901 - 10	1445	2308	25
1911 - 15	1472	2544	31
1916 - 20	1555	2616	23
Basis (1891-1920)	1500 (100)	2449 (100)	26 (100)
1921 - 24	1508 (101)	2870 (117)	38 (146)
1925 - 27	1711 (114)	3220 (131)	55 (212)
1928 - 30	2230 (149)	3825 (156)	121 (465)
1931 - 35	2404 (160)	3710 (151)	207 (796)
1936 - 40	2970 (198)	4442 (181)	383 (1473)
1941 - 45	3202 (215)	4937 (202)	548 (2108)
1946 - 50	3481 (232)	5302 (216)	937 (3604)
1951 - 55	3938 (263)	5817 (237)	1399 (5380)
1954 - 56	3947 (263)	5939 (242)	1614 (6208)
1957 - 59	3912 (261)	5929 (242)	1818 (6992)

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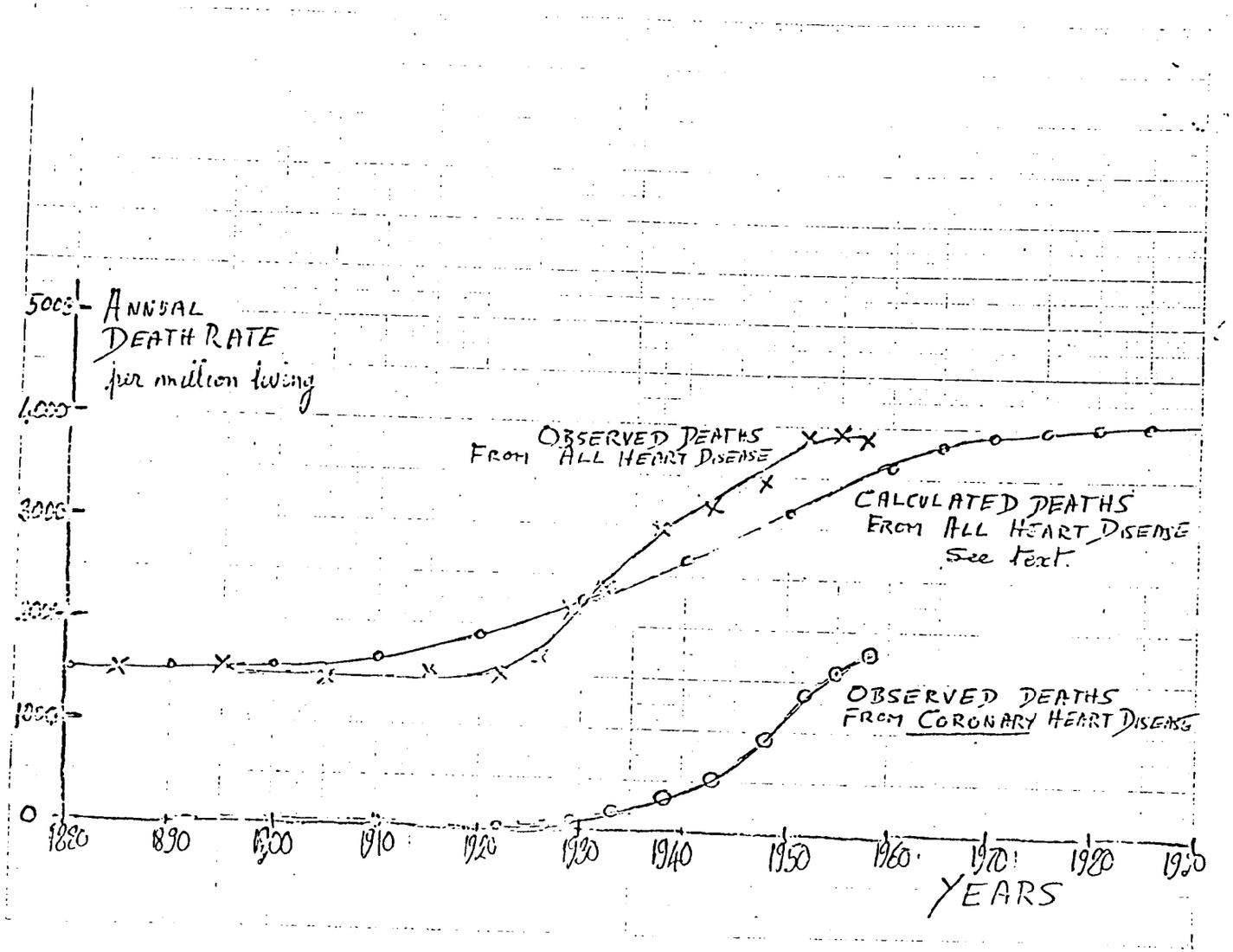
ANNUAL
DEATH RATE
per million living
5000
4000
3000
2000
1000
0
OBSERVED DEATHS
FROM ALL HEART DISEASE
CALCULATED DEATHS
FROM ALL HEART DISEASE
See text.
OBSERVED DEATHS
FROM CORONARY HEART DISEASE
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
YEARS

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