# THE LIVES OF OUR CHILDREN: A STUDY IN CHILDHOOD MORTALITY.

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# THE LIVES OF OUR CHILDREN

In the early 1930's, 27,000 children died each year. By 1960, the number had fallen to 5,000. Over 380,000 people now alive would have died in childhood if the death rates of the early thirties had not improved. This study describes the recent achievements in the saving of child life, concentrating upon the rapid improvement in the past thirty years. From the late 1930's, childhood mortality has declined faster than ever before, and this dramatic improvement over the long-term trend of slowly diminishing mortality can account for half the substantial saving of young lives.

The study first reviews the general picture; it indicates the contributions of the medical profession and the role of social and biological factors; it illustrates the importance of drugs in those diseases where mortality has fallen most dramatically; and finally, it evaluates some of the social and economic gains from this reduction in child death rates.

The study concerns death in children between the first and fifteenth birthdays. It excludes consideration of infant mortality (death before the first birthday), where great advances have also been achieved and which requires a separate study.

## THE GENERAL PICTURE

Childhood death rates have fallen gradually for much of the past century. The history of this improvement is well known. In the nineteenth century disease flourished in the slums of the industrial revolution. Many of those infected lacked immunity and effective medical care was rarely available. In such surroundings Dickens could draw from everyday experience when he recounted the lachrymose deaths of children in his novels. He was the second child in a family of eight; his brother Alfred and sister Henrietta had died as children. Society ignored the special needs of children, treating them simply as miniature adults (1). One out of every five children who survived infancy died before they were fifteen. Those who survived, however, probably built up a hereditary immunity. This, together with the development of a public health service and better medical and social conditions, brought a slow improvement in the death rate.

In the late 1930's, the speed of improvement abruptly changed (Figure One and Table One). From 1938, childhood death rates fell more rapidly than ever before. Had this sudden improvement not taken place child mortality would be almost three times as high as it is at present. Currently, child deaths average just over 5,000 a year, in a population of 9¾ million children (2). Had the decline in mortality been no more rapid than it was before the late thirties (i.e. by the 1900 to 1935 trends) the number of deaths would be 14,570. The remarkable improvement over the long-term rate of decline means approximately 9,500 more child lives saved each year. This is illustrated diagramatically in Figure Two, and the calculation of the saving described in the Appendix.

TABLE ONE

AVERAGE ANNUAL PERCENTAGE DECREASE IN CHILD MORTALITY RATES

| PERIOD | AGES | | |
|---|---|---|---|
| | 1-4 | 5-9 | 10-14 |
| 1861/1900 ... ... | 1·1 | 1·9 | 1·9 |
| 1901/1935 ... ... | 3·6 | 1·7 | 1·4 |
| 1935/1960 ... ... | 6·4 | 5·5 | 4·9 |
| 1938/39 and 1942/1954 | 9·8 | 8·5 | 7·5 |

*Source:* Registrar General's Statistical Review England and Wales (Part One Medical) 1960.

(1) Pre 1930 rates for ages 1-4 are estimates, calculated from 0-4 death rates less infant mortality figures.

Table Two sets out five yearly averages since 1931 for the major primary causes of death. Classification of death by primary cause is in a sense an over-simplification because death often results not from the primary cause, but from a secondary infection. For example, death from measles is often due to a secondary broncho-pneumonia. Therefore, a decline in death rates for primary causes often results from control of complications.

TABLE TWO

CHILDHOOD DEATHS BY CAUSES: ENGLAND & WALES 1931/5 to 1956/60

| | *Annual Death Rates per Million Living* (2) *Ages* 1 *to* 14 *years* | | | | | |
|---|---|---|---|---|---|---|
| | 1931/ 1935 | 1936/ 1940 | 1941/ 1945 | 1946/ 1950 | 1951/ 1955 | 1956/ 1960 |
| 1. Pneumonia ... | 561 | 376 | 220 | 111 | 63 | 53 |
| 2. Tuberculosis ... | 332 | 231 | 256 | 149 | 38 | 6 |
| 3. Diphtheria ... | 304 | 299 | 160 | 18 | 2 | 0 |
| 4. Measles ... | 241 | 118 | 48 | 24 | 13 | 4 |
| 5. Non-Traffic Accidents ... ... | 142 | 168 | 187 | 120 | 92 | 83 |
| 6. Road Deaths ... | 134 | 118 | 145 | 99 | 73 | 62 |
| 7. Whooping Cough | 132 | 81 | 65 | 27 | 8 | 1 |
| 8. Bronchitis ... | 79 | 58 | 47 | 23 | 16 | 14 |
| 9. Gastro-Enteritis | 72 | 52 | 39 | 21 | 11 | 9 |
| 10. Appendicitis ... | 71 | 65 | 48 | 30 | 15 | 8 |
| 11. Influenza ... | 67 | 42 | 24 | 11 | 6 | 11 |
| 12. Neo-Plasms ... | 64 | 67 | 74 | 82 | 86 | 85 |
| 13. Mastoiditis ... | 61 | 36 | 22 | 9 | 3 | 2 |
| 14. Rheumatic Fever | 51 | 40 | 27 | 18 | 9 | 3 |
| 15. Meningitis ... | 49 | 38 | 28 | 13 | 7 | 6 |
| 16. Scarlet Fever ... | 49 | 24 | 10 | 2 | 0 | 0 |
| 17. Meningococcal Infections ... | 49 | 46 | 49 | 17 | 12 | 6 |
| 18. War (3) ... ... | | (297) | 119 | | | |
| 19. All other causes | 559 | 451 | 364 | 273 | 200 | 170 |
| Total Crude Death Rate per Million Children 1-14 ... | 3,017 | 2,368 | 1,932 | 1,047 | 654 | 523 |

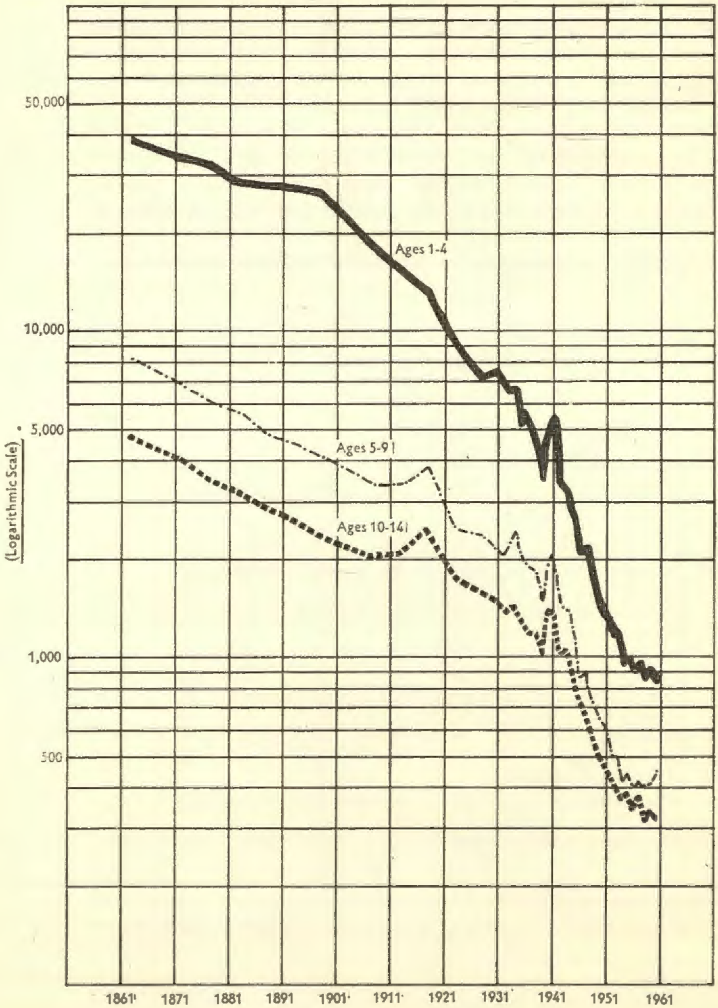
*Source:* Registrar General's Statistical Review of England and Wales (Part One Medical) 1931 to 1960.

*Notes:*

1. Deaths are classified so far as possible to correspond to the International Statistical Classification of Disease, Injuries and

## *Fig.* 1 Child Death Rates per Million; England and Wales 1861-1960.

**Source: Registrar General Statistical Review Part One (1960).**




Note: Quinary Averages 1861 to 1930: annual rates 1931 to 1961.

Cause of Death (Seventh Revision, 1955). During the period under review there were three revisions of this code: Fifth Revision (1938), Sixth Revision (1948), and the Seventh Revision (1955). In some cases comparability factors published at the time of revision were used to adjust the earlier figures; for certain causes not peculiar to childhood, comparability factors for childhood ages were worked out from figures published on the new and old basis in the year a change was made.
2. Death rates are crude rates per million living calculated from mid-year population estimates.
3. The figure for War deaths 1936/1940 is the 1940 rate and not a five-yearly average.

The decline in the primary causes set out in Table Two accounts for nine-tenths of the total fall since 1931/35. Over half this total reduction has come from a decline in mortality from five diseases; pneumonia, tuberculosis, diphtheria, measles and whooping cough. By 1960, apart from pneumonia, these diseases had virtually ceased to cause childhood deaths. They had been particularly lethal to young children, and therefore the greatest reduction in death rates has been between the ages of one and four (Figure One).

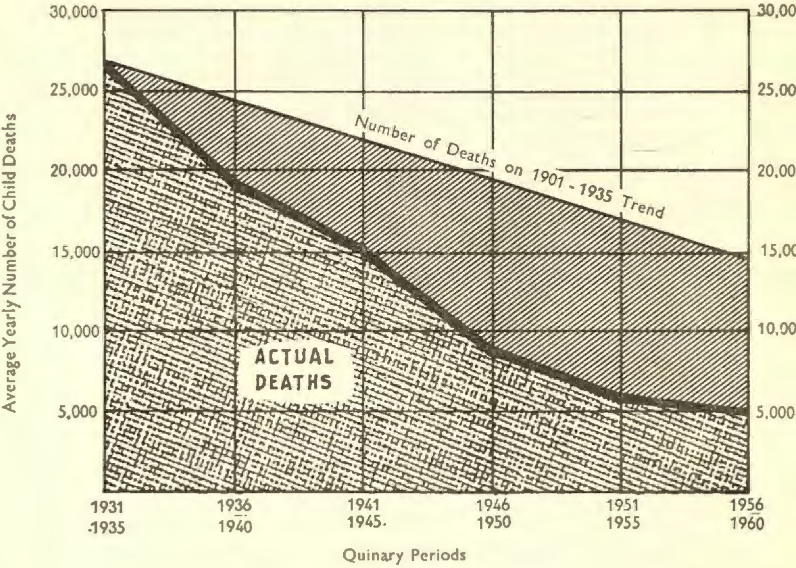
A substantial reduction in death rates from nine other diseases accounts for a further fifth of the total reduction. In order of their contribution they are bronchitis, appendicitis, gastro-enteritis, mastoiditis, influenza, scarlet fever, rheumatic fever, meningitis and meningococcal infections. Excluding meningococcal infections early in the war, the rate and extent of improvement in death rates from these diseases are remarkably uniform, probably because similar secondary complications occur in each of these causes of death.

The dramatic decline of all these childhood diseases has radically altered the pattern of child mortality. The control of traditional infections has left accidents and cancer as the major causes of death in childhood.

## THE WAR YEARS

The early war years were an exception to the downward trend. However, enemy action can explain little more than one third of the rise which occurred. 4,700 children were killed in the air raids of 1940 and 1941, but a further 7,875 childhood deaths resulted from a rise in mortality from tuberculosis, pneumonia, diphtheria and other infective diseases. Evacuation of the cities disrupted family life and intermingled the rural and urban popula-

*Fig.* 2 **Number of Child Deaths Each Year; England and Wales; Actual and Projected; 1931-1960**
**Source: Registrar General Statistical Review Part One (1960); and Appendix Table A.**




tions. This altered the pattern of disease and immunity. The child evacuated from the crowded city, carrying but possibly immune to pulmonary tuberculosis, could infect the more susceptible country child (3), although the city child could offer little resistance to bovine tuberculosis of the glands and bones. The crowded air-raid shelters increased the transmission of bacteria, probably making them more virulent. On a smaller scale, the war produced dangerous conditions similar to those in the industrial revolution. It was not surprising that natural deaths increased in such circumstances.

War time experience illustrates some of the difficulties of relating cause and effect in the natural history of disease. The influence of social and economic conditions, medical services and care and public health programmes, can rarely be measured independently. The spread of infection can be reduced in several ways; better housing relieves overcrowding; strict public health measures ensure isolation; effective medical care shortens the illness. There is probably never one simple explanation for the rise or fall of a disease (4). However, this does not imply that one factor may not be more dominant than others.

## THE CONTRIBUTION OF MEDICAL AND SOCIAL ADVANCES

The social environment of childhood has changed radically during the last thirty years. With full employment, living standards have risen from the depression of the thirties to the relative affluence of the sixties, bringing better nutrition and clothing, and to many areas better housing. The establishment of the National Health Service in 1948 removed the final economic barriers to medical care, and the Welfare Services, school milk, lunches and medical inspections, infant and child welfare foods, were made available nationwide.

Biological factors also affect trends in mortality. There have been marginal changes in the family pattern during the last thirty years. Marriage ages have fallen and the pattern of child bearing has altered. The first child is now delayed, but the second apparently tends to follow more closely while on average the size of the family is now larger than it was 30 years ago (5). These factors can bear on the family pattern of disease. The second child is a little older and possibly less vulnerable when the eldest brings home infections from school.

The standards of medical knowledge and skill have also risen impressively this century. There is a greater understanding of the cause of sickness, and diagnosis is now more rapid and precise. In child surgery, too, there have been great advances. All this is reflected in the longer and better medical training which doctors now receive.

Against this background, the virulence of infections can also inexplicably change. For example, no satisfactory explanation has been found for the attenuation of scarlet fever. Even before the introduction of antitoxin treatment towards the end of the last century it had already declined from a major epidemic of the whole population to a diminishing childhood affliction.

By the 1930's this disease had already ceased to be a major cause of childhood death.

Social and biological factors bearing on child mortality during the last thirty years are however the continuation of a long-term trend. They are unlikely to have changed sufficiently rapidly to explain the sudden and dramatic down turn in mortality dating from the late thirties. The rise in living standards is one stage in the process of economic growth, and part of the long term rise from the poverty of pre-industrial England. The establishment of the National Health Service was, in the context of child health, the consolidation of a movement dating at least from 1740 when Coram established the Foundling Hospital in London.

## THE CONTRIBUTION OF DRUGS

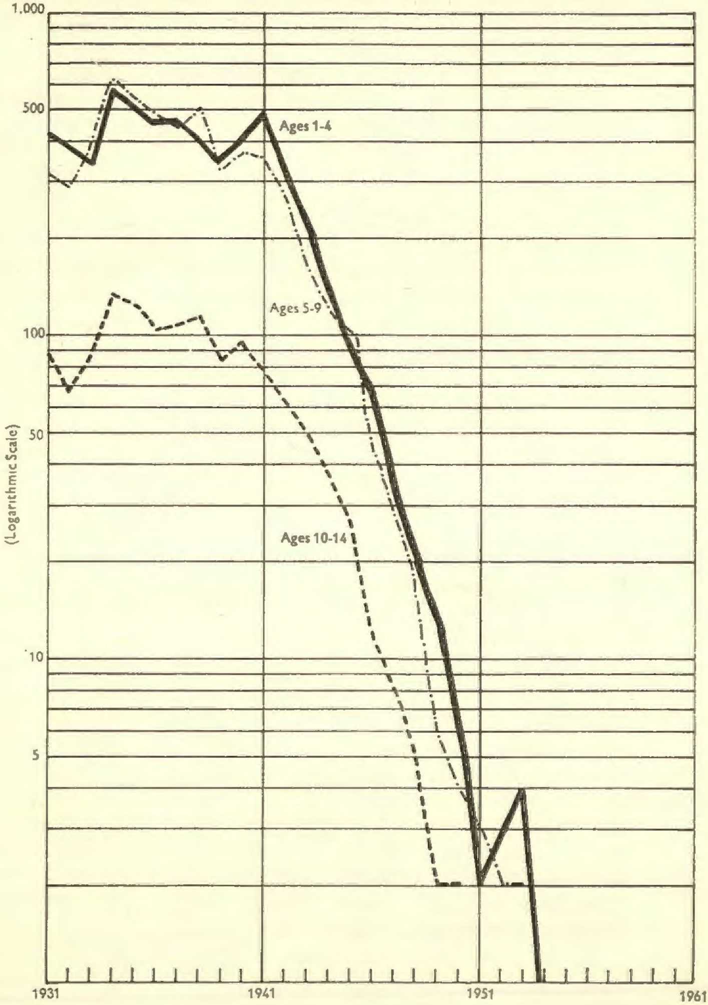
The sudden improvement in the mortality rate coincides with the introduction of new drugs and vaccines. Doctors who have been practising medicine over the past 30 years have witnessed a therapeutic revolution. Modern drugs and vaccines developed since 1930 have enabled them to cure or prevent many diseases which were fatal only 30 years ago. The diseases which have contributed most to the reduction in mortality illustrate the roles played by new medicines. These may act in several ways; they may stop an infection developing; they may cure the disease; or they may control dangerous complications. A single drug, of course, may act in more than one of these ways, but for convenience, their contribution is discussed as either prevention, cure, or control.

## PREVENTION OF DISEASE

The most dramatic element in the decline of child mortality has been the elimination of diphtheria as a cause of death and morbidity. Although a diphtheria anti-toxin was first produced in 1890, and the diagnostic Schick test and active immunisation date from the early part of this century, it was not until the late thirties that a national immunisation campaign was attempted. Between 1940 and 1943 nearly 5,000,000 children were protected, and the results were impressive. Apart from the early war years mortality declined swiftly and constantly. The experience on the continent of Europe made

## *Fig.* 3 Diphtheria. Child Death Rates per Million; England and Wales 1931-1960.

**Source: Registrar General Statistical Review. Part One.**



a dramatic contrast to this. They had no effective universal immunisation campaign before the late 1940's and a rising incidence of diphtheria culminated in a major epidemic. This reached a peak between 1943 and 1946 (6) whereas in Britain the disease was cut short from 1941 (Figure Three).

By the 1950's immunisation against diphtheria was combined with protection against tetanus and whooping cough and more recently polio has been added to form a quadruple vaccine.

## THE CURE OF DISEASE

The reduction in tuberculosis deaths among children is the most striking instance of mortality declining following the introduction of drugs which directly terminate a dangerous illness. Until the late 1940's, miliary tuberculosis and broncho-tuberculosis were almost invariably fatal. Treatment did not significantly influence the course of these diseases and drugs played little part. Death rates had been declining as part of a long term trend at just over four per cent. per annum. The introduction of streptomycin late in 1946 was the first major step in curative treatment. With the addition of para-aminosalicylic acid (PAS) and later of isoniazid (INH), the treatment of tuberculosis was revolutionised. In the years following 1946/47 mortality decreased by 25 per cent. per annum, and had reached negligible amounts by 1960 (Figure Four).

The fall in child mortality from pneumonia has been less dramatic than the decline in tuberculosis. The majority of deaths are due to broncho-pneumonia which may be caused by a wide range of infective organisms. Although some yielded to the sulphonamides and others to penicillin, many responded to neither. However, in the last few years there has been a flood of new drugs developed by the pharmaceutical industry; the tetracyclines, chloramphenicol and the polymixins. The disease has yielded slowly before this growing range of antibiotics (Figure Five).

In the early 1930's all forms of acute meningitis had a high mortality, in many instances amounting to 95 per cent. of cases. The sulphonamides offered the first really effective treatment, and a decline in deaths dates from their introduction (Figure Six).

*Fig.* 4 **Tuberculosis; Child Death Rates per Million. England and Wales 1931-1960.**

Source: Registrar General Statistical Review. Part One.

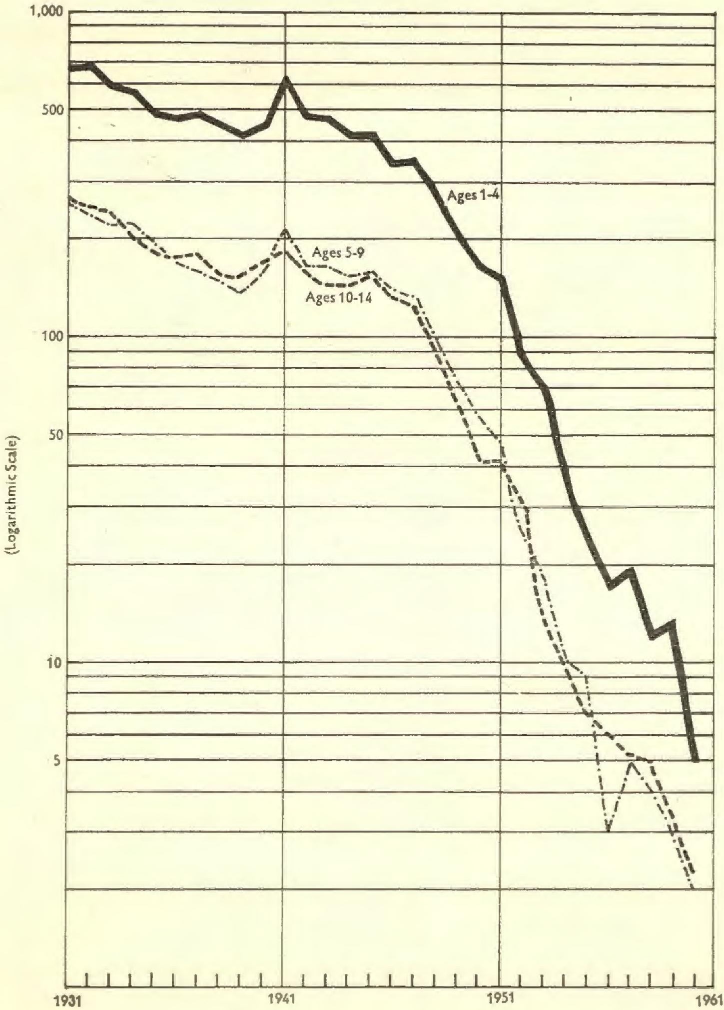


***Fig.* 5 Pneumonia; Child Death Rates per Million. England and Wales 1931-1960.**

**Source: Registrar General Statistical Review. Part One.**

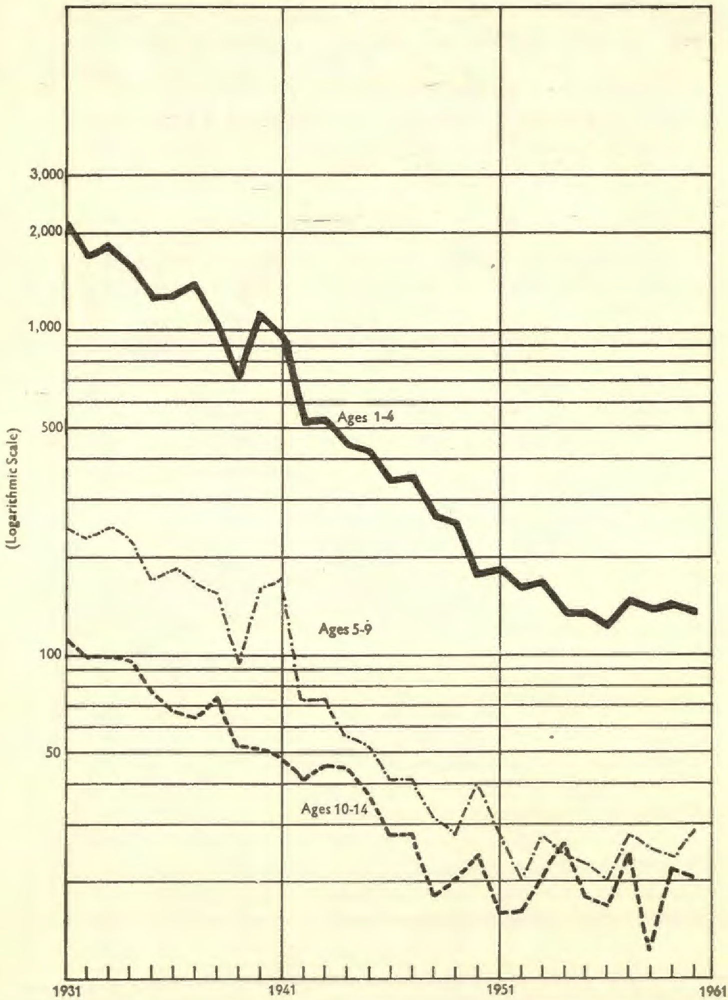
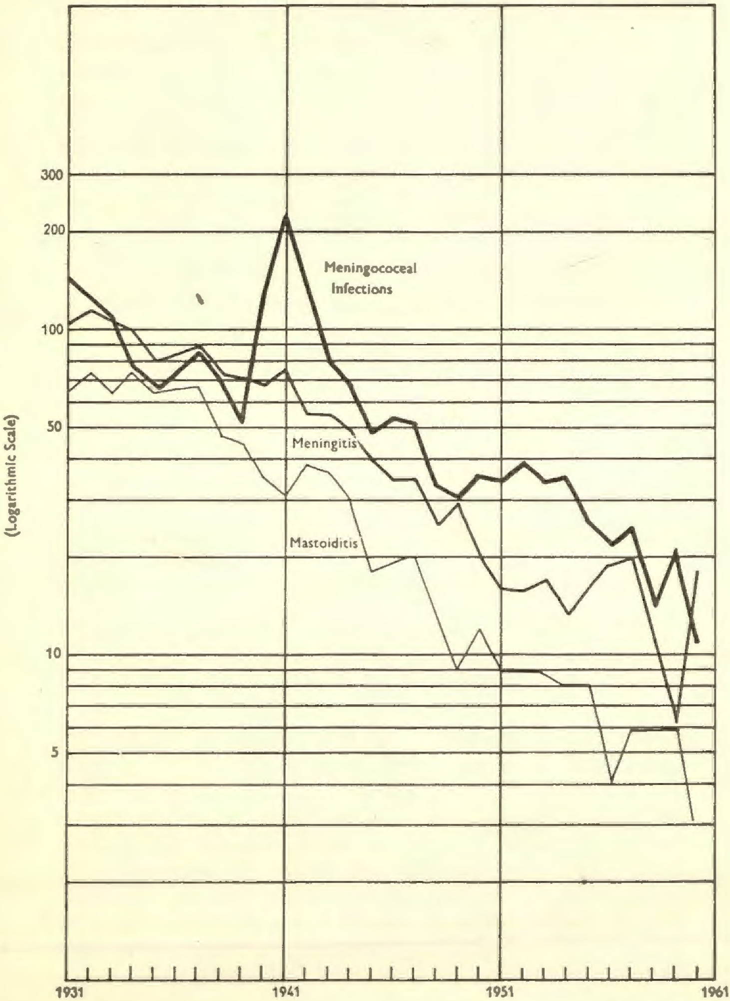


***Fig.* 6 Meningitis, Meningococcal Infection and Mastoiditis. Child Death Rates Ages 1-4 per Million: England and Wales.**

**Source: Registrar General Statistical Review. Part One.**



## THE CONTROL OF COMPLICATIONS

Whooping cough mortality had declined rapidly since the turn of the century. The advent of antibiotics accelerated the decline (Figure Seven). The first improvement came with penicillin to control fatal complications; then in the late forties, short courses of chloramphenicol were found to have a specific effect. The tetracyclines added to the range of treatment and whooping cough vaccine became generally accepted in the early fifties. From the notification rate it appears that up till 1950 deaths were becoming fewer despite an increasing incidence. Since 1950, however, vaccination has apparently also reduced the incidence.

The danger of death from otitis media and mastoiditis resulted from the possibility of meningitis or brain abscess and when this did not occur many cases of permanent deafness resulted. The only effective treatment of acute mastoiditis before the introduction of the sulphonamides was major bone surgery and the long and painful drainage of the infected area. Sulphonamides cut short the infection and considerably reduced the chance of fatal complications. Mortality fell from the time they were introduced (Figure Six). Although in practice otitis media is one of the commonest childhood conditions a doctor sees, the use of antibiotics means that the development of acute mastoiditis is now rare (7).

The decline of measles as a primary cause of death is the clearest illustration of drugs reducing death by controlling complications. A common and most dangerous complication is broncho-pneumonia, which before the development of sulphonamides caused the majority of fatalities. There has been but little change in the treatment of the primary disease itself but with sulphonamides and later antibiotics, it is no longer dangerous. Death rates in each measles cycle have declined persistently, although basing the assessment on notifications, there has been a slight rise in incidence (Figure Eight). Possibly measles is now more common because parents give less attention to quarantine since drugs have robbed the disease of danger.

**Fig. 7** **Whooping Cough, Child Death Rates, Ages 1-4 and total child notifications. England and Wales, 1931-1960.**

**Source: Registrar General Statistical Review. Part One.**

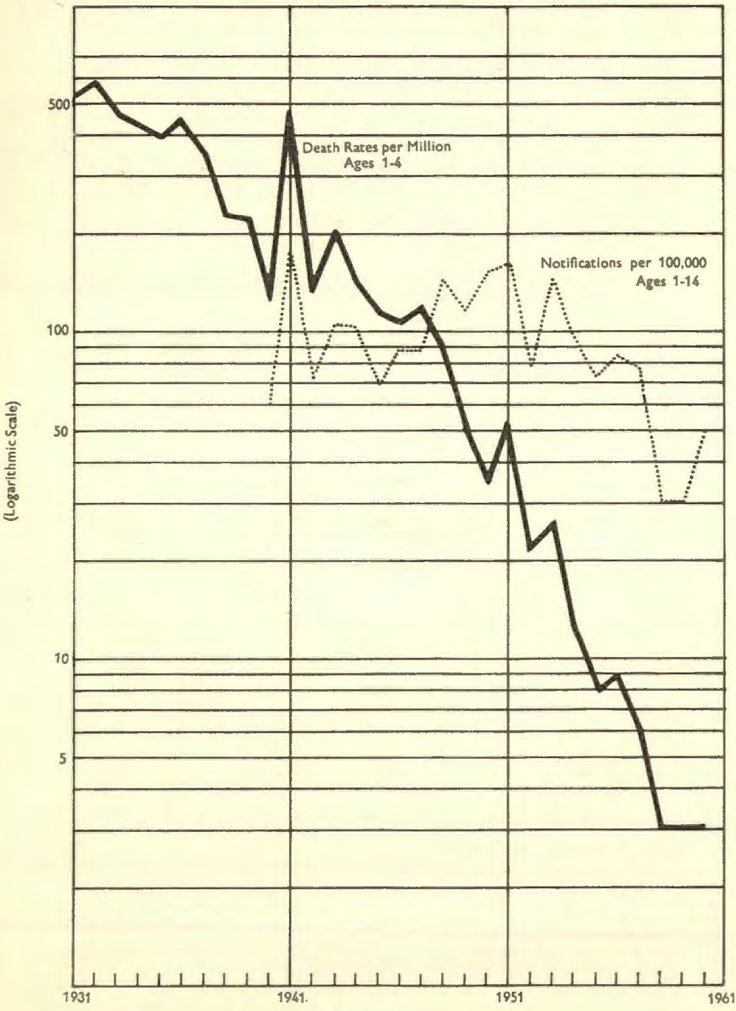
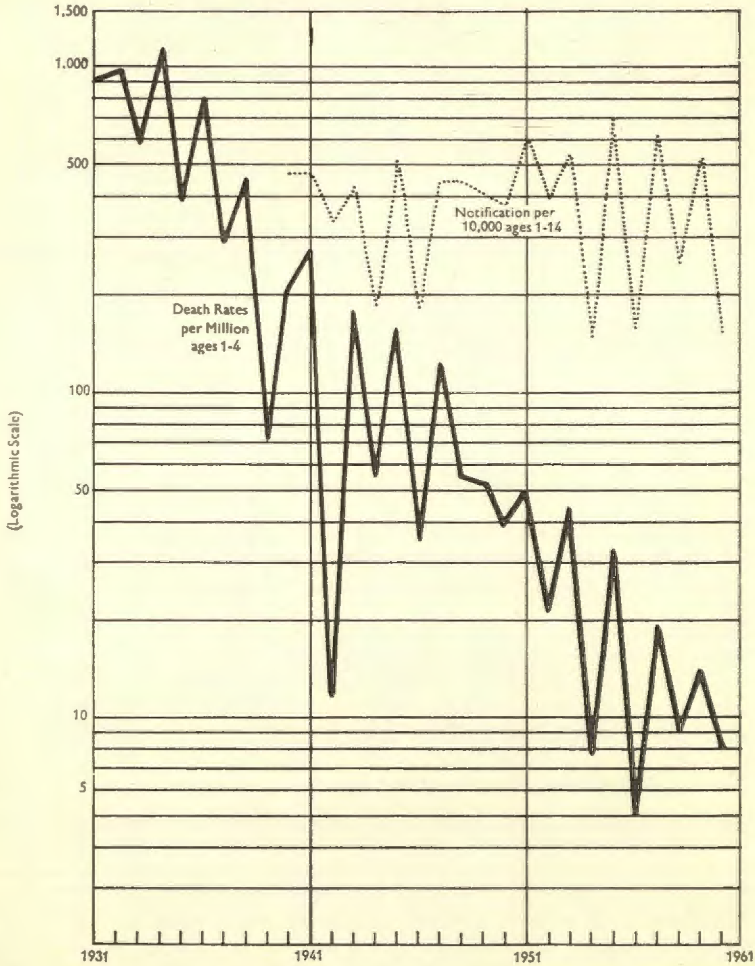


***Fig.* 8 Measles, Child Death Rates Ages 1-4 and total child notifications. England and Wales 1931-1960.**

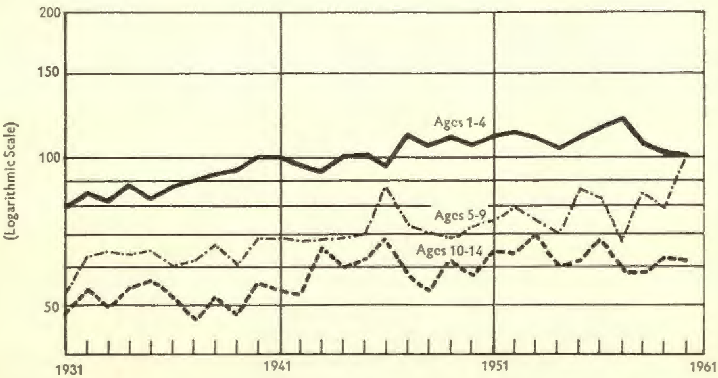
**Source: Registrar General Statistical Review. Part One.**



## CANCER—NO MAJOR THERAPEUTIC BREAK-THROUGH

Unlike other childhood diseases deaths from cancer (mainly leukaemia) have risen rather than fallen, although with improved diagnostic facilities this rise may be more apparent than real. Cancer, despite the fact that it is a comparatively rare childhood disease, is now the most frequent cause of natural death in children. It is interesting to note that there has been no major therapeutic breakthrough in the treatment of cancer. The contrast between the apparent increase in deaths from cancer and the reduction in those from other diseases is further evidence of the contribution of effective modern medicines (Figure Nine).

***Fig.* 9 Cancer, Child Death Rates per Million. England and Wales 1931-1960.**
Source: Registrar General Statistical Review. Part One.



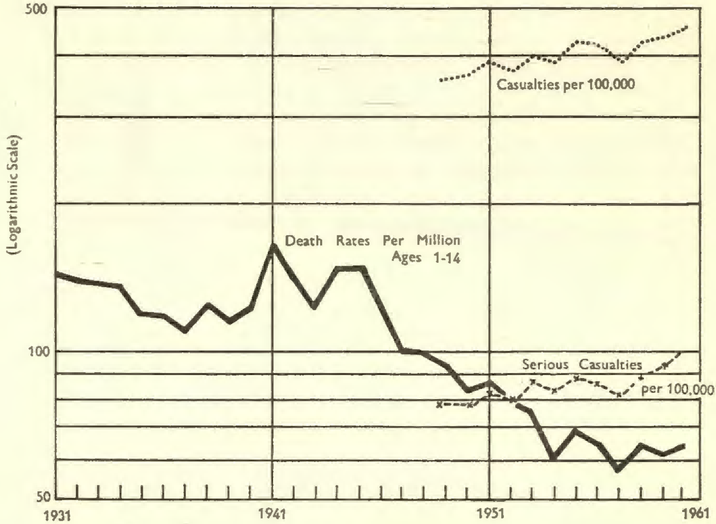

The numbers of children dying of cancer are only a fraction of the numbers formerly dying from other diseases; nevertheless, a cure for cancer could save an additional 800 children's lives each year.

## ACCIDENTS

Accidental deaths amongst children are now only half as frequent as in 1930, and this contributes about one tenth to the total reduction in child mortality. However, as accidental deaths have declined more slowly than

***Fig.* 10 Road Accidents, Child Death Rates and Casualties 1931-1960.**

**Source: Registrar General Statistical Review. Part One. R.o.S.P.A. Road Accident Statistics (1960).**




Note: Death Rates England and Wales Ages 1-14. Casualty Rates Great Britain Ages 0-14.

natural deaths, they are now proportionately more important than ever before. 28 per cent. of all child deaths are the result of an accident, nearly half of which occur on the roads (Figure Ten).

This decline in child deaths from accidents has taken place in an increasingly dangerous world. On the roads, the number of vehicles has more than trebled in the past decade, impact speeds are greater and the number of child casualties has risen—although not so fast as vehicle ownership. At home and at play, the picture is the same. Although the open fire is passing, electric points and domestic gadgets are more numerous. Deaths from falls and burns have declined to about the same extent as those from road accidents. Some part of this no doubt arises from parents' greater awareness of danger in the home, the guarding of fires and the avoidance of inflammable clothing. The small number of deaths from electric shock, however, has doubled in the last thirty years.

In the early 1950's, death occurred in 8.8 per cent. of serious and fatal road accidents to children; by the end of the fifties the proportion had fallen to 5.9 per cent. The reduction in accidental deaths, despite increasing dangers can be explained by improved medical services, blood transfusions and antibiotics to control infection. More efficient ambulance and casualty reception facilities, improved surgical techniques and modern anaesthetics have also contributed to the improvement.

## ECONOMIC AND SOCIAL IMPACT

The implications of the greatly accelerated improvement in child mortality are far reaching. The death of a child is now an uncommon event, and the tragedy surrounding it no longer a frequent feature of family life. With this too has come the relief of suffering which accompanied many childhood diseases. Although the assessment of social gains must necessarily be in terms of numbers and statistics, the greatest achievement is the incalculable addition to human happiness that has flowed from modern drug therapy. This cannot be measured mathematically or valued financially.

This accelerated improvement in child mortality can be quantified. The additional reduction in mortality (over and above that which would have resulted naturally from increasing living standards and child welfare) is responsible for the saving of approximately 9,500 more child lives annually. In all, 174,000 people now alive would have died before their fifteenth birthday. (Referring back to figure two, this total number of extra lives saved is represented by the area between the 1901 - 1935 trend line, and the line showing the actual numbers of deaths.) Through this additional saving of life during childhood ages, one in 83 of the present child population owe their lives to the chemotherapeutic revolution. This covers the saving during childhood alone and takes no account of lives saved during infancy.

This saving of life has an even greater significance for the future. Each child now surviving can reasonably expect a further 58 years life at the age of 15, and many of them will live well into the next century.

## ECONOMIC GAINS

Economics or costs may not enter into the question of treating an individual child. Nevertheless, it is true that economic considerations do determine the scope and availability of medical facilities for treatment of the child population. Is it therefore important to evaluate the economic gains which have resulted from improved medical care. Unless this is done, health expenditure is thought of simply as a burden on the economy, when in fact economic gains from improved care can outweigh their costs.

However, the difficulty of calculating economic benefits is the principal problem of all questions of health economics. There is no wholly satisfactory way of gauging concisely the economic effect of saving of child life. Its influence on the economy is diffused, but this does not mean that it is any the less real. The decline in child mortality makes an impact in two ways; first by adding to the labour force and consequently increasing the national income; and secondly by avoiding the economic waste consequent upon the death of a child.

## CONTRIBUTION TO THE NATIONAL INCOME

The extra reduction in child mortality attributable to drugs has increased the working population and through this has contributed to national income. One way of estimating this contribution is to calculate the total earnings of survivors. Of the 175,000 survivors, 117,000 have not yet reached working age, since the improvement in mortality is greatest in the lowest age groups; of the 58,000 of working age, 33,000 still only receive juvenile rates of pay. (See Appendix Table A.) Allowing for these factors and for the differences of employment and earnings between the sexes, the total earnings of the survivors are calculated to be £19 million per annum.

An alternative approach is to calculate their total output. This is less reliable because output figures are not available broken down by age and sex and the age structure of the survivors differs substantially from the age structure of the total working population. But using average output per employee as the basis for the calculation, the contribution of the survivors would amount to over £40 million.

A third and possibly most satisfactory way of estimating the impact on national income of this saving in child life is to calculate the present value in terms of expected income throughout life of each year's group of survivors (8). The extra decline over the natural fall in child mortality brought about through vaccines and drugs means a further 9,500 child lives saved annually; what is their value? The calculation requires many conceptual assumptions. A choice for example must be made between *gross* or *net* value (i.e. their total contribution or their total contribution less consumption).

Their expected earnings must also be discounted to give their present value; the discount rate chosen can substantially affect the answer particularly as there is a time lag between "saving" the child and his starting work. Choosing *gross* value, since the increase in the size of national income is being measured (not its distribution) and 5 per cent. as representing a long-term discount rate, the annual value of the 9,500 survivors works out to £35 million. This is the present value of the potential earnings of each year's group survivors. Each year a further group of survivors will add a similar sum to the total annual value.

A note on the methods used to calculate each of these figures is given in the appendix.

The results of any of these three approaches provides no more than a general impression of value. But even so, any of these figures is greater than the total annual cost of drugs and vaccines prescribed to children under the National Health Service, estimated at between £12 million and £14 million.

## AVOIDING WASTE OF SOCIAL CAPITAL

The decline in child mortality has a more precise effect in avoiding the waste of social capital invested in a child. If a child dies before reaching maturity, this investment is abortive. The initial investment is the cost of birth, followed by payments of family allowances. The major investment comes with education. Taking education alone at 1960 levels of expenditure, the yearly abortive investment now amounts to £1.1 million. But for the extra improvement in mortality rates since the 1930's this figure would work out to £3.3 million. The difference of £2.2 million represents the annual waste of social capital now avoided. If this figure appears small, it is more a measure of the low level of capital investment in state education, than of a lack of saving in life. Had investment been at Eton or Harrow (or Borstal) levels, the annual saving would be £11.6 million.

## ECONOMIES IN MEDICAL CARE

The development of drugs and vaccines has made it possible to obtain the current high levels of child health with a consequent saving on other types of medical expenditure. Prophylactic measures against diphtheria and polio have been estimated to save the health service in the region of £9 million per annum in treatment costs.* Drugs can avoid the cost of hospital treatment, which now averages £28 per child per week (10), and totals £53 for an average stay in hospital. Surgery too may often be avoided; for example mastoidectomy is now a rare operation. The pressure on the general practitioner would be greatly increased if the traditional childhood infections were still widespread, and if he still had to attend the long drawn out illnesses such as pneumonia which he can now rapidly terminate with sulphonamides and antibiotics.

## THE PAST AND THE FUTURE

In the early 1930's almost 27,000 children died each year; by 1960 this had fallen to only 5,000. Over 12,000 of the child lives saved each year by this reduction must undoubtedly be attributed to greater medical skill and knowledge, to improving welfare services, and to better social conditions. However, the sharp change in trends, and the history of individual diseases suggest that about 9,500 further child lives are saved each year by modern drugs and vaccines. The benefits from this saving cannot easily be measured. Nevertheless, its value is unquestionable because of the vital role which the children of today must play in the future of the nation.

* It has been estimated that in Scotland (9) diphtheria immunisation saves in treatment costs £900,000, and polio vaccine £200,000. Applying the same estimate to England and Wales, prophylactic measures against these two diseases saves the health services approximately £8·7 million per annum.

Even the tremendous achievements of the past 30 years leave many problems in child health still to be solved. Accidental deaths and cancer have yet to be controlled; and now that child mortality has been so far reduced, more intensive research is needed into the prevention and early treatment of childhood illness. Not only must the suffering be avoided, but diseases like muscular dystrophy must be understood and controlled. An early illness can cripple a child for the rest of its life. This emphasises the importance of continued improvement in child health, for that lays the foundation of a healthy society.

Great progress has already been made in the prevention and conquest of childhood disease. It should not be too long before the shadow of death and sickness recedes from the lives of our children, bringing in turn the promise of a healthier adult society.

REFERENCES


1. Craig, W. S., *Child and Adolescent Life in Health and Disease.* Livingstone, Edinburgh, 1946.
2. Registrar General. *Statistical Review of England and Wales. Part One: Medical Tables.* 1931 to 1960. H.M.S.O.
3. Hall, C. M., *Lancet*, 1943, ii, p. 35.
4. Dubos, J. B., *The Mirage of Health.* Allen and Unwin, London, 1960.
5. Registrar General. *Census* 1951, *England and Wales Fertility Report* (1959). *Statistical Review of England and Wales, Part Two: Civil Tables.* 1960. H.M.S.O.
6. Stuart, G., *A Note on Diphtheria Incidence in Certain European Countries.* Brit. Med. Journal 1945, ii, p. 613.
7. Registrar General. *Morbidity Statistics from General Practice.* Vol. III (Disease in General Practice). 1962. H.M.S.O.
8. Weisbrod, B. A., *Economics of Public Health.* University of Pennsylvania Press, Philadelphia (1961).
9. MacQueen, I., *Medical Officer*, November, 1961.
10. Ministry of Health. *Hospital Costing Returns:* Part I, H.M.S.O., 1961.

## APPENDIX

## CALCULATION OF NUMBERS SAVED

TABLE A sets out actual childhood death rates since the 1930's and death rates for the same period calculated by projecting the 1901-35 trends (projected rates). Allowing for the smaller child population if death rates were higher, the projected death rate would mean a total of 14,570 deaths a year. In fact they numbered 5,029. The difference, approximately 9,500, represents the extra saved per annum as a result of the sharp increase in the rate of improvement dating from the late thirties.

TABLE A

*Actual and Projected Death Rates Per Million Child Population*
1931/35 *to* 1956/60

| PERIOD | Ages | | | | | |
|---|---|---|---|---|---|---|
| | 1–4 | | 5–9 | | 10–14 | |
| | Actual Rates | Projected Rates | Actual Rates | Projected Rates | Actual Rates | Projected Rates |
| 1931/35 ... | 6,561 | 6,561 | 2,178 | 2,178 | 1,407 | 1,407 |
| 1936/40 ... | 4,698 | 5,375 | 1,835 | 1,990 | 1,200 | 1,309 |
| 1941/45 ... | 3,497 | 4,400 | 1,498 | 1,819 | 1,084 | 1,218 |
| 1946/50 ... | 1,768 | 3,606 | 767 | 1,662 | 619 | 1,131 |
| 1951/55 ... | 1,139 | 2,957 | 471 | 1,519 | 410 | 1,052 |
| 1956/60 ... | 907 | 2,420 | 412 | 1,389 | 339 | 977 |

This calculation rests on the assumption that apart from the improved medical care, the long-term trend would have remained constant. This assumption is an important qualification. The long-term or "natural rate" of decline may have accelerated with better living and social conditions, or equally probably may have deteriorated with a rise in epidemics (e.g. diphtheria).

The two sets of figures in Table A make it possible to calculate (on the assumption) the total numbers saved, the ages at which they were saved and their ages now. These figures are given in Table B. (The final line of the table allows for death rates later in life.) Thus the numbers saved since the 1930's total 174,000, and at the present rate a further 9,500 are added annually to this total.

TABLE B

*Ages of Survivors 1960, and Ages when Saved*

*Numbers*

| Ages when Saved | Birthday Occurring 1960 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1–4 | 5–9 | 10–14 | 15–20 | 21–25 | 26–30 | 31–34 | Totals |
| 1– 4 | 20,150 | 24,900 | 25,900 | 10,400 | 7,700 | — | — | 89,050 |
| 5– 9 | — | 16,500 | 18,250 | 13,050 | 4,400 | 2,350 | — | 54,550 |
| 10–14 | — | — | 11,150 | 9,300 | 7,050 | 1,900 | 1,700 | 31,100 |
| | 20,150 | 41,400 | 55,300 | 32,750 | 19,150 | 4,250 | 1,700 | 174,700 |
| Died Later | — | — | — | 100 | 400 | 150 | 100 | 750 |

## CALCULATIONS OF ECONOMIC GAIN

These figures form the basis of calculating the economic gains resulting from the sharp improvement in mortality dating from the late 1930's. Table B shows that 58,000 of the survivors are of working age. In calculating the earnings of this group, allowance must be made for the proportion of the survivors gainfully employed, their sex and age distribution and the effect of this distribution on their earning power. Based on the adult and juvenile rates of pay for males and females, the total earnings of those employed is estimated as £19 million.

When looking at the economic gains of this improvement in terms of average output per employee, it is not possible to refine the calculation in this way as figures on age and sex distribution of output per employee are not available. This figure is therefore a simple multiplication of the number of survivors employed (still excluding those below working age, students, housewives, etc.), and the average output per employee giving a total of £40 million.

The third approach used in looking at the economic gains is calculation of the present value of potential earnings of each year's new group of survivors, i.e., the 9,500. Table A provides data to calculate the present age breakdown of this group giving in turn the period of waiting before they start earning. In discounting their future earnings, allowance must be made for, *inter alia*, age patterns of earnings, proportions gainfully occupied in different age groups, chances of death at different ages, unemployment, sex differences in earnings, and so on.

**Office of Health Economics**

The Office of Health Economics was founded in 1962 by the Association of the British Pharmaceutical Industry with the following terms of reference:

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2 To investigate, from time to time, other health and social problems.

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