

BIRTH RATES AND THEIR POSSIBLE ASSOCIATION WITH THE PREVALENCE OF INFECTIOUS DISEASE.

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(With 12 Graphs.)

It will, perhaps, be interesting to students of epidemiology to compare with the delicate and complex reactions of an experimental animal population the grosser reactions of a human population. In Australia the materials have been singularly favourable for a demographical study.

A continent, as large as the United States of America, contained an aboriginal population so small as to be without significance, and so absolutely free from infectious diseases as to offer no intrusive disease factors such as in other countries have complicated colonisation. The soil and the waters were virginally unpolluted in the sanitary sense. The only diseases the colonists had they brought with them.

The climate was exceptionally favourable to health, the population for the first seventy years was for all practical purposes of pure British stock and has in fact remained, after 150 years, nearly 98 per cent. British.

Each community in turn was, at its beginning, an official or semi-official settlement small in numbers, trained to orderly public habits, with the result that vital statistics of the most complete and reliable kind are available for all parts of Australia from 1850 onwards. These statistics are so complete that no portion, however small, of the community is omitted. Written records also are available to an extent covering most of the important facts.

For the first period, from 1788 (the year of first colonisation) to 1850, the story is simple. The population at first consisted of transported convicts and military forces living on stores shipped from England. From 1788 to 1800 the typhus of the English gaols, carried into the transport ships, and incubated there by the foul conditions devised by the criminal cupidity of transport contractors, was often seen, and on some occasions most tragically seen, as the old-time ship fever. This cleared up after landing, but was replaced by dysentery and scurvy—both the result of obvious dietetic irregularities. The difficulty in establishing local crops was at first real and the settlement had to depend upon stores brought from England. These were intermittent and sometimes failed. Consequently, the settlement was on reduced rations from November, 1789, until July, 1792 (2½ years); Governor Phillip had to contribute his private stores to the public supply.

Other than these conditions, the young colony steadily grew and flourished from a community of 1035 in 1788 to a total of 44,588 in 1830.

Cunningham, Surgeon of the Royal Navy, lived two years in New South Wales and, in 1827, wrote an account of the colony in which this general description occurs:

The extraordinary healthiness of the climate of New South Wales must be of no trifling importance in the eyes of a European, considering how unhealthy most other countries are. Intermittents, remittents, typhus, scarlet fever, smallpox, measles, whooping-cough, and croup are here unknown. . . on reaching the age of puberty, phthisis is liable to supervene from the rapid sprouting out in stature of our youths at this period: but the European phthisis is uniformly cured, or at least relieved, by a removal hither, if early resorted to.

In 1794 ophthalmia was epidemic, in 1824 mumps appeared, in 1820 and 1826 influenza was prevalent—"fatal chiefly to infancy and old age." In 1828 "a kind of whooping-cough made its appearance in Sydney and spread over the whole colony. It proved fatal to a few children; the numbers are very small, compared to those attacked."

That is the epidemiological story of a considerable community over forty-two years.

The composition of the population showed slow changes. During the convict period there was great excess of males over females. At the commencement of the settlement in Sydney this excess was so great that Governor Phillip had instructions to procure native women from the adjacent islands for the use of the male convicts. This was not done. Very soon after the commencement, in 1797, Phillip reported that "the vast number of women for whom we have very little work are a heavy weight upon the store of Government." Up to 1850 the percentage of children in the population was much lower than in a normal community.

The second period from 1830 to 1850 was characterised by the establishment of the colonies of Victoria, Queensland, South Australia and Western Australia, and by quiet development of the population along agricultural and pastoral lines.

The convicts transported before 1810 began to die in considerable numbers, producing a heavy death rate between 1832 and 1842; but still Governor Gipps could report in 1845 that "the adult males in the Colony are still more than double the females." Between 1838 and 1842 there was a great wave of voluntary immigration, adding in those five years a total of 86,816 persons to the community of New South Wales, which before had comprised only 113,437 persons.

Influenza was very severe in 1836 and 1838: this being the first definite occasion on which Australia shared in a general epidemic manifestation of the disease in several countries.

Scarlet fever made its appearance in Tasmania in 1833 and in New South Wales and Victoria in 1841.

Measles appeared first in the different states between 1850 and 1857.

Whooping cough reappeared for a brief epidemic.

Smallpox, from an unknown source, caused a very high mortality amongst the aborigines inland, but did not attack the white population.

Typhus fever—aptly named the “gaol-fever”—had declared itself severely under the conditions of gross overcrowding and insanitation in the convict establishments of Tasmania; but, as these predisposing conditions were not present in the convict stations in Western Australia, typhus did not occur there.

Such were the conditions in 1850 in Australia. There were six settlements forming the embryonic stages of six great colonies, with populations which were scattered as to space, few as to numbers, and ill-balanced as to age-constitution, which were free for the most part from the commoner epidemics, these appearing intermittently, disappearing totally in the intervals, and which knew two types of pulmonary tuberculosis—the acute, rapidly developing adolescent type of “our youths” and the more chronic “European phthisis.”

After 1850 the whole picture was abruptly changed by the discovery of gold.

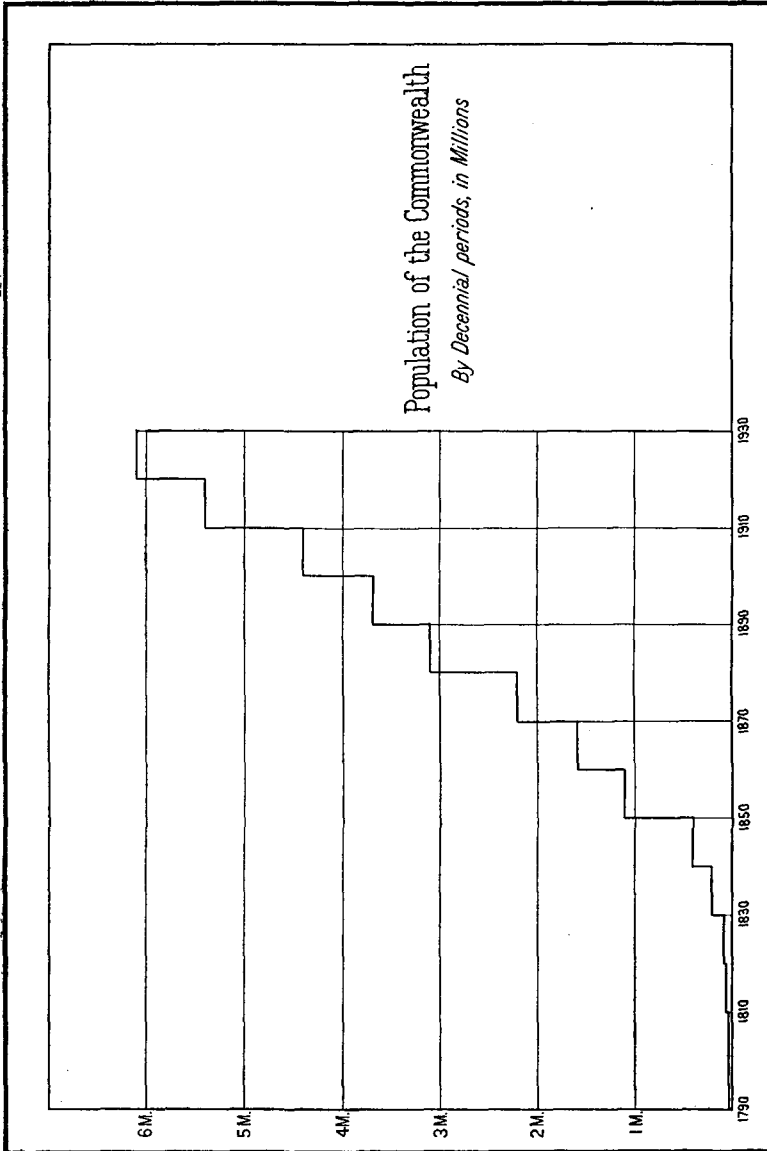
The population of all Australia in 1850 was 405,356, in 1856 it was 876,729, and by 1860 it was 1,145,585. This great human wave was composed principally of young adults who, apart from considerations of economic and social value, distorted the proportional age-constitution of the population by providing a great excess of young adults.

The winning of gold from the ground soon became unreliable as a means of livelihood and other industries were developed. The prosperity attending these became so great that, in the decade 1880–90, another great wave of migration brought to Australia a net immigration total of 382,741 persons. Again, in the five years 1909 to 1913 inclusive, organised immigration added a total of 281,193 persons. The population development of Australia as a continent is shown in Graph I. From this are seen clearly the three great accessions of the “’fifties,” the “’eighties” and between 1910 and 1920. These three waves of the “’fifties,” the “’eighties” and around 1910 were notable points in the population development of Australia.

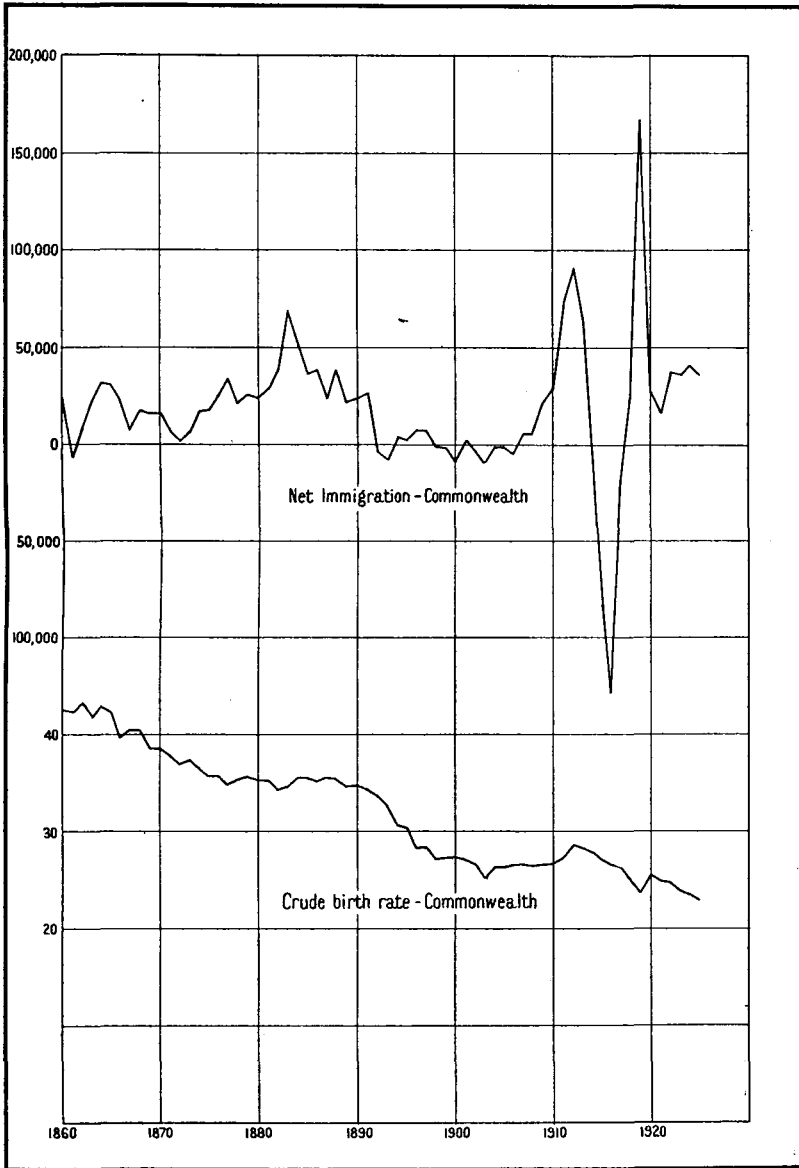
The periods 1860–1920 are shown on Graph II—as comparable statistics are not available for all the Australian States between 1850 and 1860, the graph commences only with the year 1860.

From the same graph it can be seen that these two periods of immigration increment to the population were immediately followed by periods of increased birth rate. Although not shown on the graph, this increase was seen to an even greater extent in the ‘fifties.

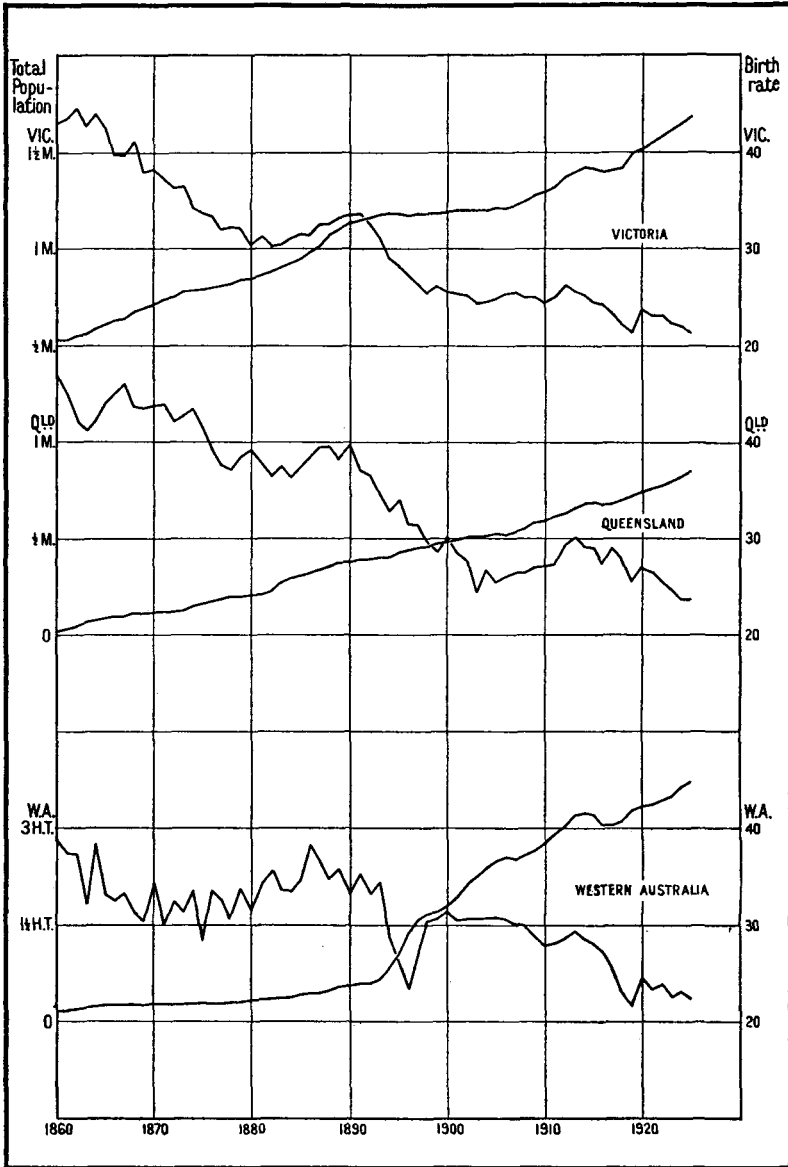
These periods illustrate the results accompanying immigration from outside Australia. Two other occasions also illustrated the same association of events following internal migration. In the early ‘eighties gold was discovered in Queensland, and in the early ‘nineties in Western Australia. Graph III shows the population and birth rate in each of these two states and illustrates the



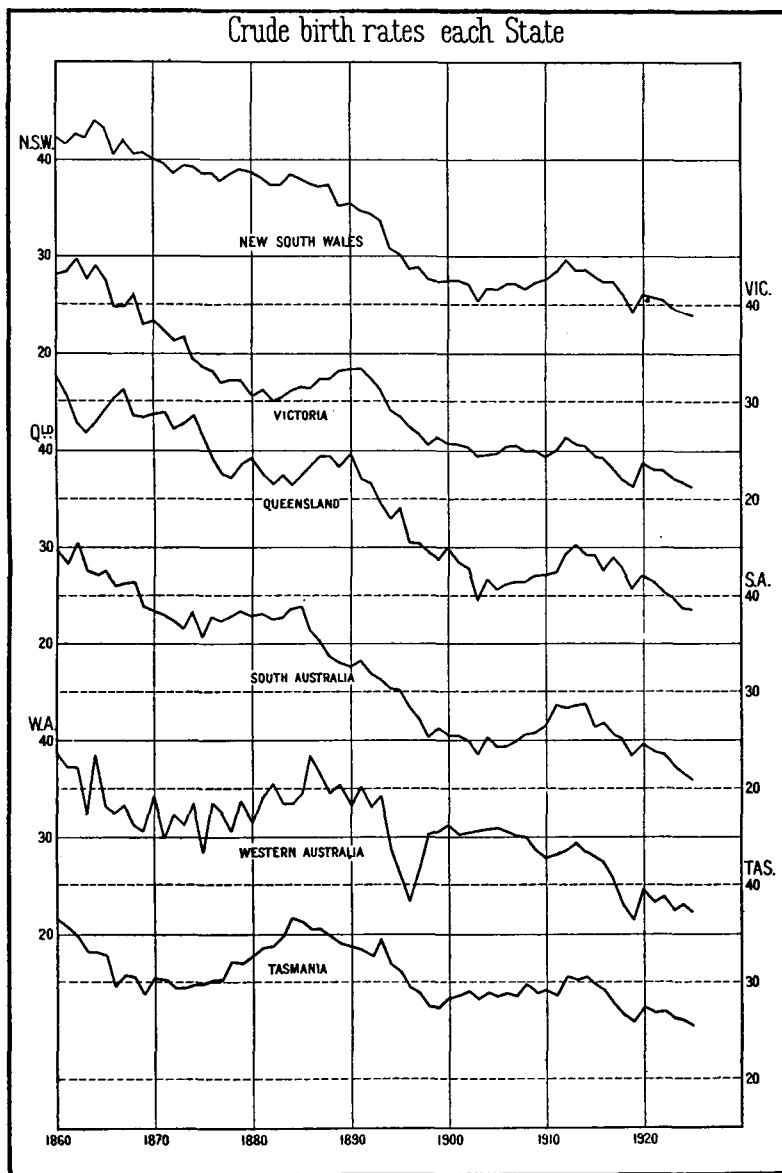
Graph I. Population development in Australia as a whole.



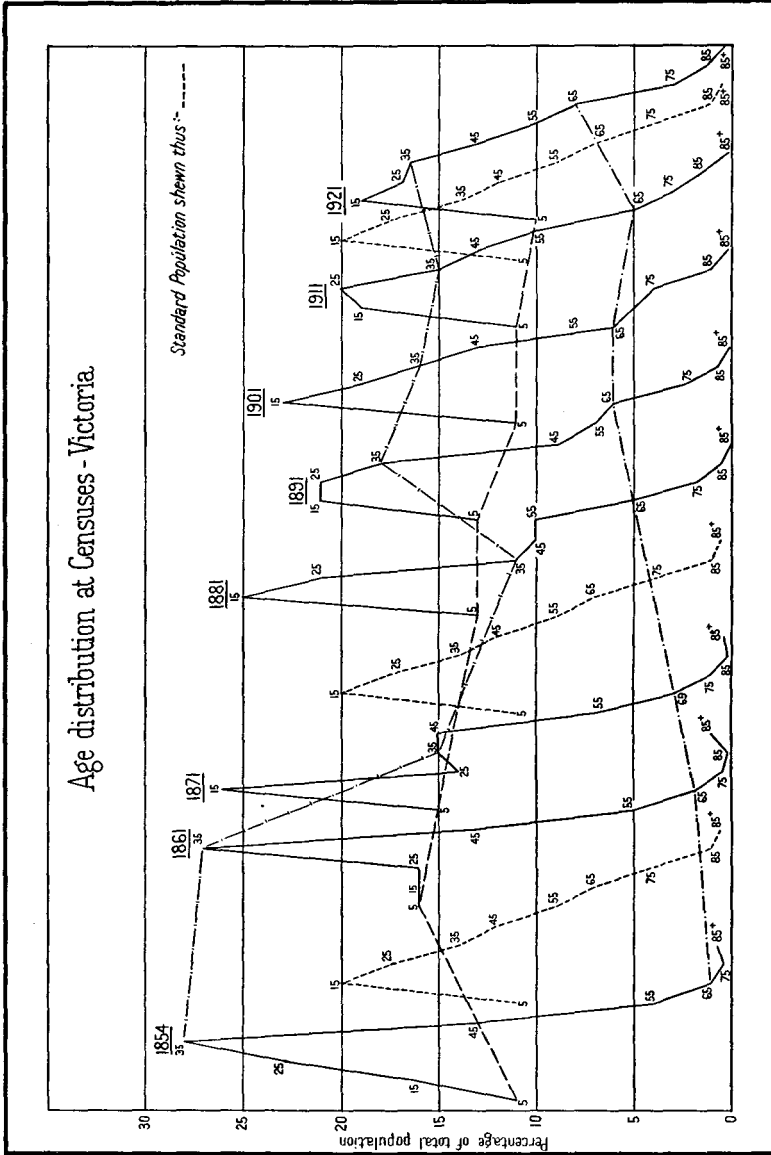
Graph II. Absolute net immigration and crude birth rates, for the years shown, for Australia as a whole.



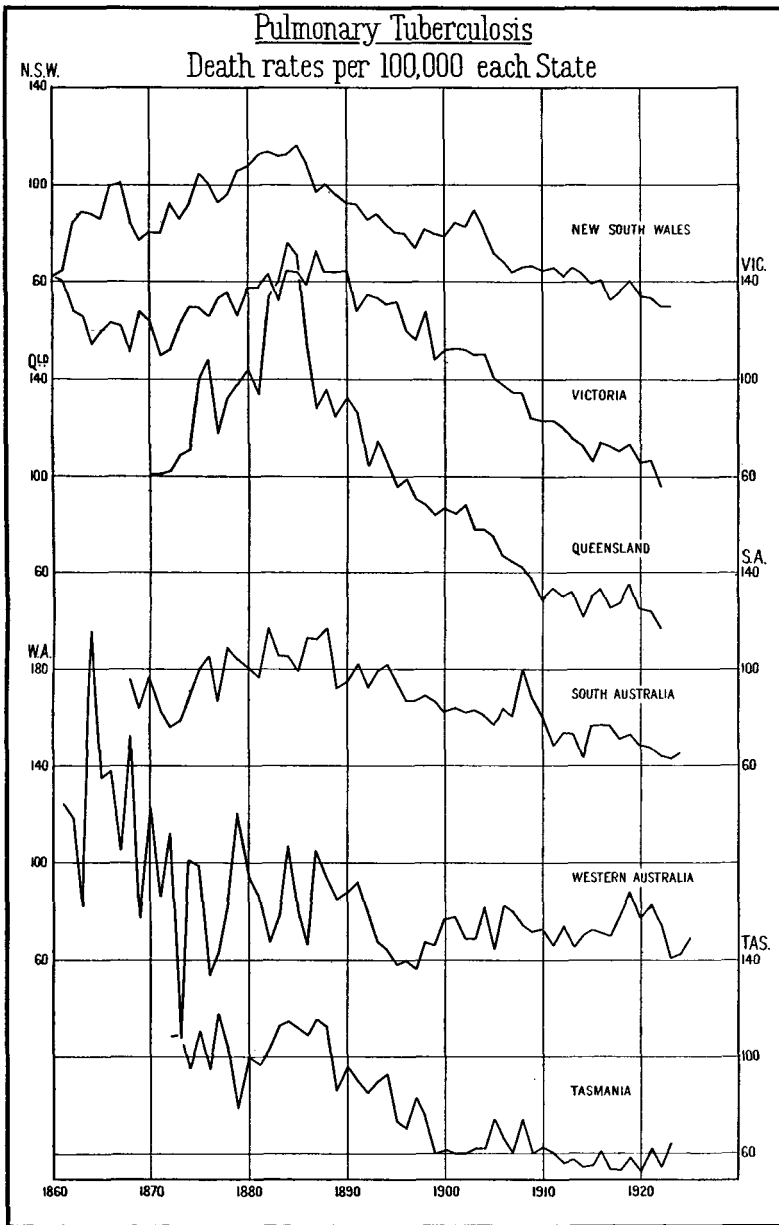
Graph III. Population and birth rates for the years shown in Victoria, Queensland and Western Australia.



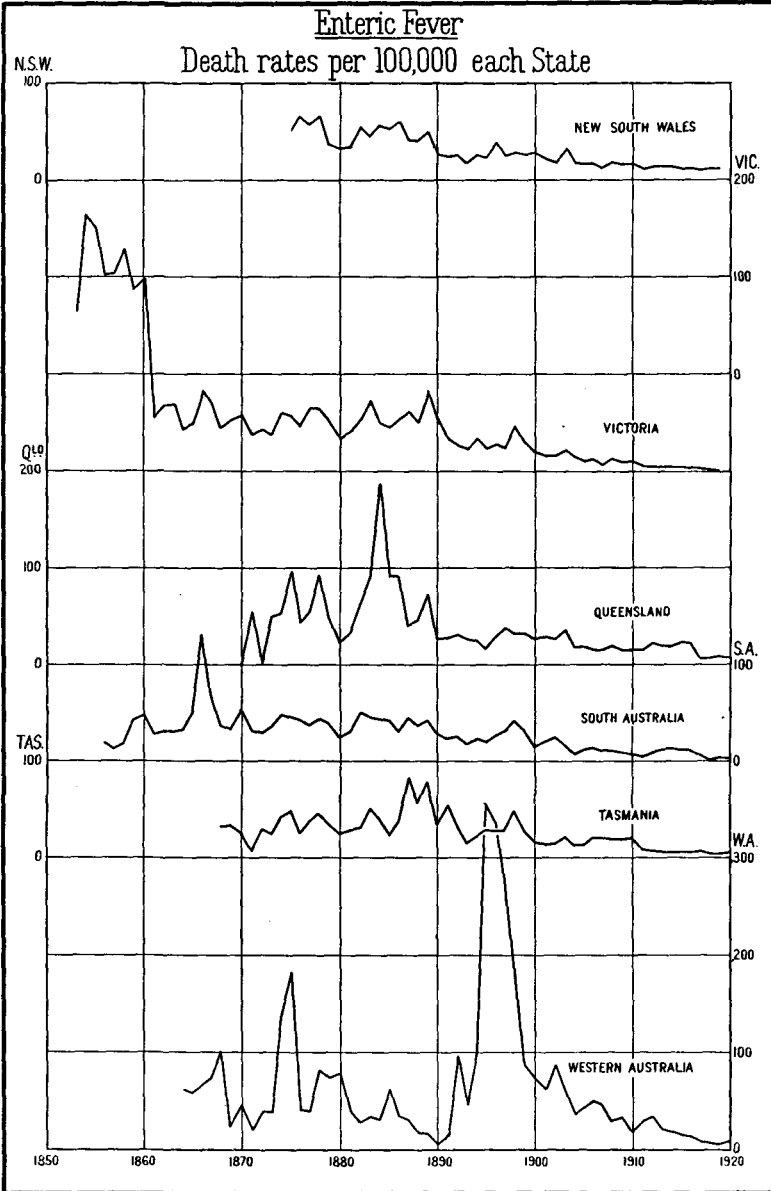
Graph IV. The course of the birth rate in each State showing the high level in the 'sixties, the rise in the 'eighties and again around 1910.



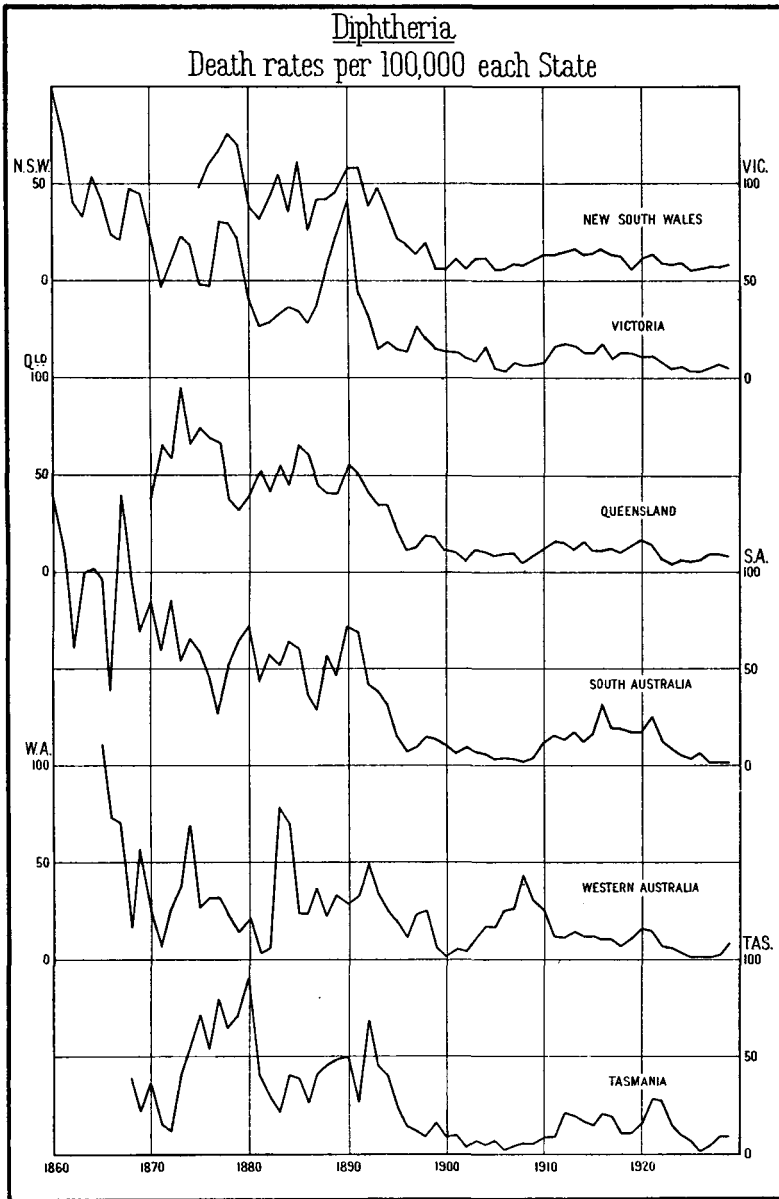
Graph V. Percentage age-composition of the population of Victoria at each Census 1854-1921. The percentage age-composition of the "standard" population is shown for comparison in three places.



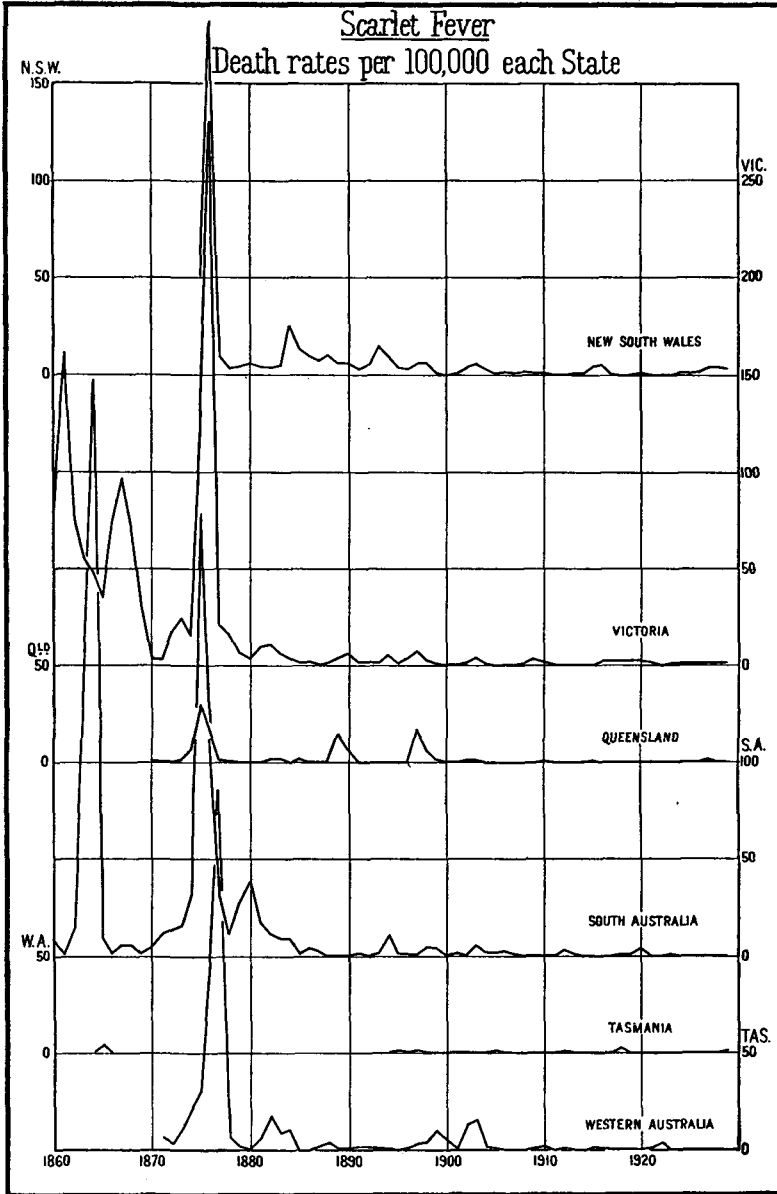
Graph VI. Death rates from pulmonary tuberculosis in each State.



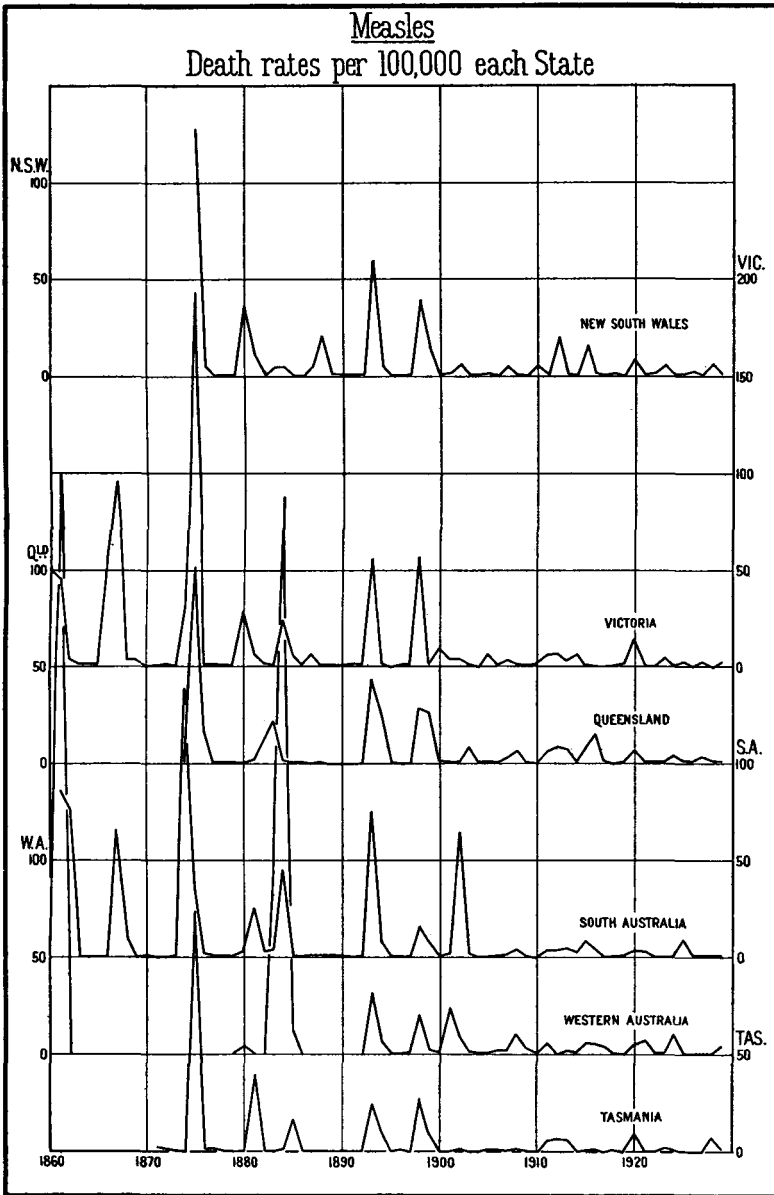
Graph VII. Death rates from enteric fever in each State.



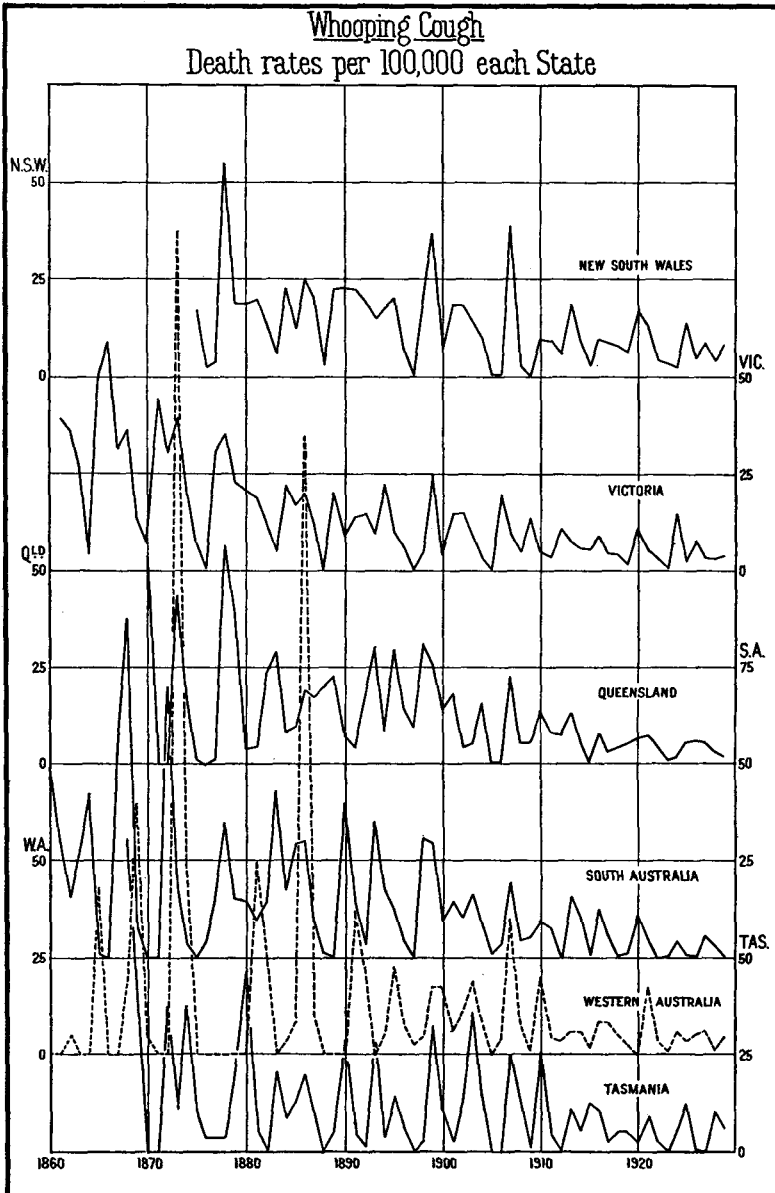
Graph VIII. Death rates from diphtheria in each State.



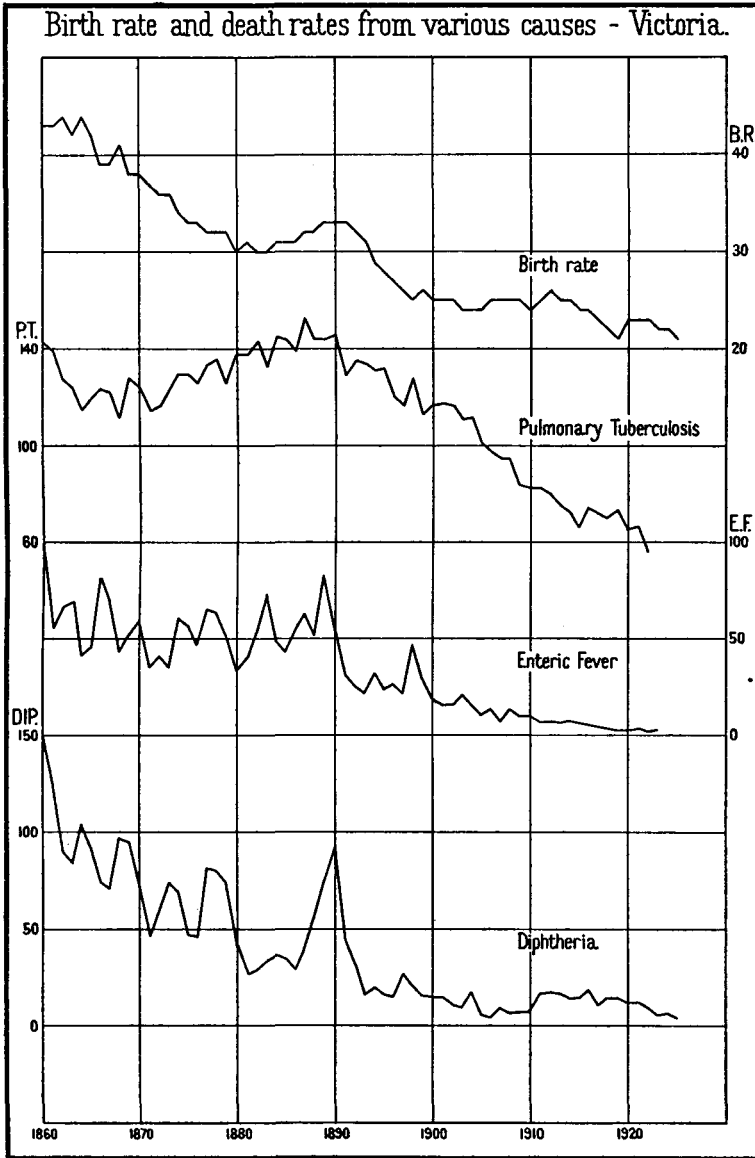
Graph IX. Death rates from scarlet fever in each State.



Graph X. Death rates from measles in each State.



Graph XI. Death rates from whooping cough in each State.



Graph XII. The course of the birth rate and of the death rates from pulmonary tuberculosis, enteric fever and diphtheria in Victoria.

rise in the birth rate following on the increase in population. In Western Australia the sudden fall in the birth rate caused by the abrupt introduction of a large numerical mass of adults is very striking. The course of the birth rate for each State is shown in Graph IV.

The effect of these changes upon the age-constitution of the population is well seen in Graph V. Here the percentage age-composition of the population of Victoria at each census is shown, the composition of the international standard population being inserted three times for comparison.

In 1854 and 1861 the 15–25 and 25–35 groups are greatly in excess of other ages and of their percentage status in the standard population: the 55–75 group was much below its normal place; and the 0–5 group had increased in relation to other age-groups and had reached a point well above its normal position in the standard population.

The immigration wave of the 'eighties saw the same changes to a less degree, while in the period 1909 to 1913 these changes are barely visible on the graph.

Simply told, this is the story of an exodus of young people to a new land where they had children and these children grew up.

Experience in Australia indicates pulmonary tuberculosis and enteric fever as the two great diseases of young adult life and the respiratory infections, diphtheria, scarlet fever, measles and whooping cough as the diseases of childhood. In this respect experience is similar to that in other countries.

On this we should expect to find enteric fever and pulmonary tuberculosis causing deaths in definite relationship with the presence in the community of persons at susceptible ages. The recorded experience prior to 1850 has been quoted.

Reference to Graph VI will show the death rates from pulmonary tuberculosis in the various states. Omitting from consideration the immigrants themselves, their infants—the 1850 to 1860 group—would be growing during the susceptible ages for both enteric fever and pulmonary tuberculosis during the years prior to 1890—the enteric fever prevalence (see Graph VII) attacking the group at younger ages than the pulmonary tuberculosis. Graphs VI and VII show the very special prevalence of enteric right up to 1890 in New South Wales and Victoria and the notable rise in pulmonary tuberculosis in New South Wales, Victoria, Queensland and South Australia. The immigrants themselves suffered from enteric fever, as is seen by reference to Graph VII: the excessive mortality of the 'fifties in Victoria, of the 'eighties in Queensland, and of the 'nineties in Western Australia being, in fact, part of the familiar history of Australia.

To be consistent this association should be seen in the minor waves as well as in the major. To some extent this was so, as evidenced by the minor enteric wave culminating in 1889 in Victoria and by the suggestive halt in the decline of the curve in tuberculosis mortality between 1915 and 1921 which followed the birth rate rise of the 'eighties after an interval comparable with that

between the birth rate rise of the 'fifties and the tuberculosis mortality rise of the 'eighties.

When the respiratory infections are considered, the course of the diphtheria rate presents some interesting features. As in England, diphtheria was for all practical purposes unknown in Australia before 1860. On its introduction it found an abundant susceptible population of the most suitable age and struck hard. Thereafter it declined until, in consonance with the rise in the birth rate in the 'eighties, it showed a further definite rise in Victoria, South Australia and Tasmania and to a less extent in Queensland. The course of the death rate is shown in Graph VIII. The rise in the death rate in consonance with the rise in the birth rate around 1910 is also evident in most of the states.

In Western Australia, however, the course of events is somewhat different, although still significant. After the gold rush of the 'nineties, large new populations in large new centres had developed. In these young adult populations many children had been born, but these centres were separated by long distances often with infrequent communication. The slow rise in the diphtheria death rate between 1900 and 1910 is consistent with these conditions.

The rise in the diphtheria death rate in all the states between 1910 and 1925, even with the general use of antitoxin, specially calls for consideration in view of the rise in the birth rate at this period.

Scarlet fever has followed a striking course in Australia. This course is shown in Graph IX. In Queensland and Tasmania it has never called for any serious attention. In Victoria and South Australia it was a serious disease between 1850 and 1876, but in New South Wales and Western Australia it was not an important disease until 1875-6. In those two years the states of New South Wales, Victoria, South Australia and Western Australia experienced scarlet fever in epidemic form of tragic extent and virulence. Since 1890 the disease has not been a serious cause of death in Australia, although it continues to prevail with disabling complications.

Measles has shown a definitely epidemic course in Australia. In Western Australia, especially, there was a great epidemic in 1860-1 after the subsiding of which no death from this disease was recorded until 1884 when the disease appeared producing a severe mortality in a population, both black and white, which seemed to be quite unprotected. Graph X shows how, in each state, the disease appeared in epidemics, dying out completely in the intervals, until 1900 when the disease became stabilised at a very low death-rate level. When this course is compared with the course of the birth rate, it is obvious that the high mortality levels prevailed while the birth rate was high and as soon as the birth rate fell below 30 the death rate was stabilised at the low level. The minor variations in accord between the two rates even at these lower levels are seen in New South Wales between 1910 and 1920, in Victoria in 1920, and in Queensland and South Australia between 1910 and 1915.

Whooping cough has exhibited a less characteristic course. The behaviour of the disease is seen in Graph XI. It is difficult to say more than that, while

the birth rate was high, the death rate was also high and, after 1900, when the birth rate was lower, the death rate was also generally at a lower level.

In Graph XII the course of the birth rate and the death rates from pulmonary tuberculosis, enteric fever and diphtheria in Victoria have been brought together so that the course of the events above narrated may be more clearly seen.

This brief survey has been prepared with the object of presenting the picture of a human population under closely observed conditions during eighty years. This population has been affected by fluctuations of a magnitude only possible in a young country with a small initial population. Australia now has a stable population of such a size that immigration is not likely to affect its quality to any material extent and its age-constitution is now approximating the standard.

All the evidence here presented indicates that the stage of the wide-amplitude variations in birth and death rates is, for this population, now over and it must be studied on the facts available, no new opportunity for recording and studying similar phenomena being likely.

In considering the story the other factors, such as social, dietetic and sanitary conditions in a new country, especially during a gold rush, as well as the specific attributes of the diseases mentioned, etc., have not been overlooked. They could have been discussed at great length without much profit. It has seemed well to present the facts here assembled as, perhaps, at least a suggestive contribution to the discussion on influences associated with epidemics now somewhat inconclusively proceeding.

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