Fertility, Fecundity and Twinning:
A Comparison of the Trends in Births and Twinning
in Australia from 1854 to 1982

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Abstract. The trends in births and in twinning in Australia are compared from 1854 to 1982. Until about 1930 the twinning rate increased as births fell. The two rates then became concordant. The relationship of fecundity to twinning is discussed. Comparison with other countries is made. The period embraces the demographic transition when changing contraceptive practices would have had a variable effect on twinning.

Key words: Twinning, Fecundity, Fertility, Contraception, Australia, Secular trend

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INTRODUCTION

What relationship, if any, is there between secular trends in twinning and fertility? This question was first addressed by Sir George Knibbs, the Commonwealth (ie, Australian) Statistician [19]. He analysed the annual ratio of cases of multiple births to total confinements in Australia from 1881 to 1915. From an aggregate of 3,221,594 confinements over the 34-year period, he observed that on the whole the frequency of twins and triplets rose as the frequency of births diminished. In later years it has been shown that the relationship is more complicated.

The concept of the highly fecundable twin prone woman has been used to explain some of the changes in the United States twinning rate [4]. The concept was developed to show that the fertility advantage of these women might be lost with efficient contraception or enhanced by inefficient birth control and further analysed to show its limitations [1,2]. Comparisons of twinning rates and birth

rates have also been reported from Canada [8], Japan [12] and Italy [20,21]. The overall picture is far from complete and no clear pattern emerges.

Australia has the longest historical series of twin rates outside Scandinavia [7]. This study aims to elucidate the secular relationship of twinning and fertility in Australia.

MATERIALS AND METHODS

The data were obtained from the vital statistics published annually by the Australian Bureau of Statistics (ABS), its predecessors, the Commonwealth Bureau of Census and Statistics and the State (Colonial) Statistical Offices. Details of the method of collection have been published [7]. Australia comprises six States and two Territories. Population estimates have been made annually since 1788, at first based on annual "musters". Registration of births was compulsory in Victoria from 1853 and seems to have been reasonably complete by the late 1850s. Publication of twin data began in Victoria in 1853 and New South Wales (including Queensland) in 1857. The other states commenced later. By 1908 all registered Australian births were included apart from full-blood aboriginals who were excluded prior to 1966.

The ABS statistics include crude birth rates for both national and state populations back to 1860. For the earlier years the birth rates were calculated from the registered births and the inter-censal mid-year population estimates. So that the denominator populations for twins and births correspond as closely as possible, combined state birth rates were calculated and utilised. The trends were, in any case, similar in all states [18]. The figure was computer-drawn with single-year intervals.

RESULTS

The secular trend in twinning rate has been more fully described previously [7]. In the Figure, the upper curve shows the crude birth rate per 1,000 mean population. The lower curve represents the crude total twin rate per 1,000 confinements. It has been shown that the variation is due solely to the DZ fraction apart from the 1970s when there was an increase in the MZ twinning rate [7]. Standardisation for maternal age does not alter the general trend except slightly to increase the slope of the long term rise and slightly to decrease the slope of the subsequent decline. In the early years small numbers and incompleteness of registration led to major fluctuations.

In 1855 there were 125 cases of twins from 11,810 confinements (10.58 per 1,000) and by 1865 this had increased to 460 out of 42,681 (10.78 per 1,000). From 1878 there were at least 50,000 confinements in any one year. From the 1870s to the 1950s the twinning rate rose but with large variations. It reached a peak of

12.36 per 1,000 in 1952 and then fell for two decades. It appears to have stabilised or even increased in the most recent years.

The crude birth rate was at a peak of 43.58 per 1,000 in 1862 although only three-sevenths of the population were female. This represents 39,825 births from a mean population of 913,828 (of which 403 of 39,416 confinements were twin). The rate then fell sharply before stabilising during the 1880s and then falling again during the severe economic depression of the 1890s. A twentieth century peak of 28.60 per 1,000 was reached in 1912. During the great depression the rate fell to 16.39 per 1,000 in 1934. The subsequent rise reached a peak of 24.07 per 1,000 in 1947 in the post war "baby boom". The minor boom of the late 1960s and early 1970s had a high point of 21.62 per 1,000 in 1971.
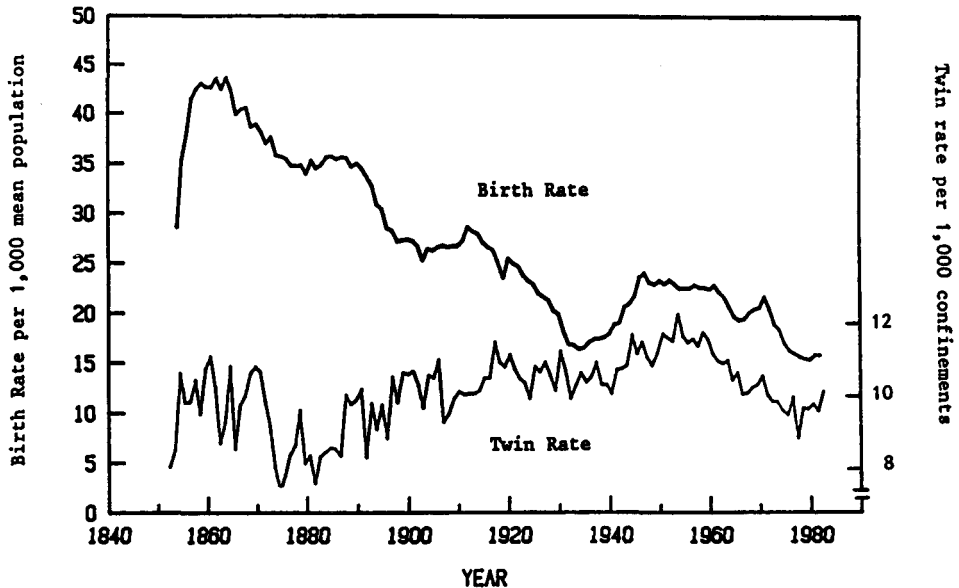

Figure. Birth and twin trends. Australia, 1854-1982.

Before 1875 no real relationship between the two rates can be discerned. From 1875 until about 1930 it can be said, broadly speaking, that as the birth rate fell the twinning rate rose. From then onwards the two rates are seen to be quite closely concordant. The fifty-year rise and fall in the birth rate from the 1930s to the 1980s is paralleled by a similar cycle in the twinning rate. The 1960s upswing in the birth rate, peaking in 1971, is preceded by a similar rise in the twinning rate which peaked in 1970.

DISCUSSION

Secular trends in twinning cannot be accounted for by changes in the demographic variables of maternal age and parity [7,9,11,13, 21,22]. The relationship of twinning to fertility and fecundity adds to, but does not complete, the picture.

Allen and Schachter [3,4] examined the 1946 peak in twinning in the United States which was closely followed by the postwar peak in the birth rate. They explained this as a demonstration of the higher fecundability of twin prone women. They estimated the waiting time to conception to be 2.2 months shorter for mothers of twins. A sharp rise in the birth rate would cause a transient increase in the twinning rate because of the displacement of the twin births to an earlier period. When births are at a stable rate displaced twin births, whether from truncation of pregnancy or shorter waiting time, are in a steady state and so rates are not affected. That ease of conception is greater in mothers of twins was supported by the findings that the twinning rate is higher among early marital and premarital conceptions in England [5] and among illegitimate births in Scandinavia [10]. (Interestingly, these findings had earlier been made by Knibbs [19] on the Australian data but this important contribution to the literature appears to have been overlooked since then.)

If contraception caused twin prone women to lose their relative advantage over the less fecund, then they would not contribute so disproportionately to births and the twinning rate would fall. This may have been a factor in the decline in twin births seen since the 1950s in several countries including Australia and over a longer period in the United States. James [14] has argued that some of the declines are too abrupt to be accounted for in this way and also that coital frequency may influence twinning rates among illegitimate births and prompt conceptions [15]. Allen [2] later cautioned that the evidence for the fecundity hypothesis was weak and capable of other interpretation. He suggested the importance of a psychological effect on the pituitary and the direct effect of parity.

It is tempting to ascribe the twinning peaks in the early 1940s and in 1970 to the concurrent rapid increase in the birth rate mediated through the same mechanism as the 1946 USA peak. However, there is too much random variation and too many other unexplained peaks to warrant any confident interpretation. The 1952 peak cannot be due to this mechanism as the birth rate was falling slightly. While mathematical smoothing of the curve would reduce random variation and emphasise the long-term trend, it would eliminate the transient peaks which reinforce the fecundability hypothesis.

If inefficient birth control increases the fertility advantage of the highly fecundable [1], then a resultant falling birth rate may be associated with an increased frequency of twins. This argument could be used to explain the long-term increase in the twinning rate as the birth rate fell from the 1870s to the 1930s. Why then did both rates rise sharply together in the 1940s? A somewhat similar pattern was seen in Canada after 1945 which Elwood [8] attributed in part to an over-representation of highly fecundable women at a time of rapid family building.

Parisi and Caperna [20,21] have shown distinct regional patterns in Italy from

1870 to 1979. In the South of Italy the rise and fall of the twinning rate corresponds closely to the pattern in Australia. In the North the twinning rate fell continuously. In both areas the birth rate fell consistently. A temporal link is shown to the spread of industrialisation in the regions. The decline in twinning, early in the North and late in the South, is attributed to a concomitant of industrialisation. The long-term rise in twinning rate in the South is taken as confirmation of the fecundability advantage of twin prone women under conditions of inefficient birth control.

In Japan from 1960 to 1975 the DZ twinning rate and the standardised birth rate declined and both were shown to follow the same pattern when stratified by maternal age [12]. For younger mothers the rates were constant but fell for mothers over 30. The fall in age-specific fertility in older mothers may have had a common basis with the decline in polyovulation. When twinning rates are stratified by age, this pattern is also seen in Australian [7], United States [2,4] and Canadian [8] data. Elwood [8] points out that this would be expected when the differential conception effect is being lost. In Italy [21] younger mothers also experienced a substantial fall in twinning which suggests an additional influence.

The decline in the birth rate was not an isolated event but formed part of the demographic transition. This phenomenon was a universal experience in Western Civilisation. The transition began in France and, by a process of cultural diffusion, spread throughout the developed world [23]. The English speaking world of Australia, New Zealand, the United States, Canada and Great Britain displayed striking similarities but, also, important differences [18]. From 1890 to 1936, overall fertility was almost identical in the United States and Australia though this was the product of higher marital fertility in Australia and higher proportions married in the United States [18]. In Australia, from 1850 to 1880, both female age at marriage and marital fertility increased, while the proportion marrying decreased [6]. At the turn of the century Australia was following 5 to 10 years behind Great Britain in the demographic transition. This was presumably a consequence of the diffusion of knowledge and attitudes regarding fertility control from British immigrants to the native born. In this century, Australian demographic trends have included: fluctuating immigration, an increasing proportion of women ever marrying, a falling female age at marriage since the 1930s and postponement of first marital births in the 1970s [6].

How can twinning be linked to this intricate tapestry? Examining age-specific twinning rates is only a small step and is not possible before 1907 in Australia [7] and usually later elsewhere. The two elements of birth control, birth spacing and family limitation, may have different effects on the twinning rate. Birth spacing may either increase or remove the fertility advantage of the twin prone each time a pregnancy is envisaged, depending on contraceptive efficiency. Family limitation might decrease twinning by lowering the age at final pregnancy or, on the other hand, increase it if pregnancies are postponed to later in marriage.

Despite considerable recent increases in understanding, there remains much to be learned about the demographic transition and its sequelae [23]. There might be much advantage in including an examination of twinning in any analysis of the transition. There will certainly be advantage in relating secular changes in twinning

to the broader historical context. Further national and international comparisons of fertility, fecundity and twinning in relation to the transition may disentangle their complex interplay.

If it is argued that the association of twinning and fertility may be modified in either direction by contraception (if practised efficiently, both rates fall; practised inefficiently, twinning increases as births fall) then it is only necessary to postulate changes in birth control efficacy to explain any positive or negative correlation of trends. The argument therefore can neither be proved nor disproved for any one country. However, evidence may be inferred from international comparisons over time which include social as well as demographic data.

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