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Interpregnancy interval

Association with birth weight, stillbirth, and neonatal death

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SUMMARY Pairs of first and second births and pairs of second and third births to the same Norwegian mothers were studied to determine the association between interpregnancy interval and birth weight, stillbirth, and neonatal death. Use of the pair approach provides one birth which could possibly have been affected by the length of the interval and one birth which could not. The association of interval and birth weight for births which precede an interval is found to be equivalent to that for births which follow an interval. The data on stillbirth are compatible with higher rates at long intervals while the data on neonatal death are consistent with higher rates at short intervals. However, we conclude that manipulation of the interval between pregnancies is unlikely to have any marked, direct, beneficial effect on outcome of pregnancy.

Many authors have suggested that very short and very long intervals between pregnancies are associated with adverse outcome for the child (for example, Yerushalmy, 1945; Bishop, 1964; Spiers and Wang, 1976). In a review of this topic, Day (1967) proposed that 'an interval of approximately two years between the end of one pregnancy and the beginning of another is associated with the lowest incidence of late fetal and neonatal mortality and prematurity'. Indeed, the implication is that the association is causal (Bishop, 1964; Spiers and Wang, 1976) and it may be suggested that there is an optimum interval for optimum outcome. We report here the results of an investigation into the association between interpregnancy interval and birth weight, stillbirth, and neonatal death. The data used are unique in that they are pairs of births to the same mother; the importance of using such data will become apparent in due course.

Materials and method

In Norway, midwives and physicians are required by law to complete a medical birth registration form for all deliveries they attend of fetuses of 16 or more weeks' gestation. The forms are sent by the county health officers to the Institute of Hygiene and Social Medicine of the University of Bergen for data processing (Bjerkedal and Bakketeig, 1975). During the period from 1967 to 1973 some 464 000 births were so registered, and it was from this sample that we chose a subset to study the effect of interpregnancy interval on pregnancy outcome.

The final study group was selected from the total using the following criteria: 1. Single births only; 2. Gestational age ⩾26 and ⩽45 weeks; and 3. Maternal age, birth order, and sex of child recorded. These data are particularly useful for studying the interpregnancy interval since each Norwegian is provided shortly after birth with a unique national identification number. Using this number, it was easy to select from the file pairs of births to the same mother during the seven-year study period. The 'conception delay' or 'interpregnancy interval'—that is, the number of days between the birth date of the firstborn of a pair and the last menstrual period date of the later born—was computed for each pair of births. The types of pairs selected for study were first and second births (birth order 1 and 2 pairs, n = 73 972) and second and third births (birth order 2 and 3 pairs, n = 29 272). Most of the pairs were derived from mothers who had only two births during the study period. More than one pair of births from the same mother were used in cases where the mother gave birth three or more times during the study period. For example, a mother who had her first, second, and third babies during the study period would contribute a pair of births to the birth order 1 and 2 group and a pair to the birth order 2 and 3 group. However, no groups were formed in which the paired births were not consecutive births.

Other authors have shown that the interval between pregnancies is associated with factors which may influence pregnancy outcome. In such studies the use of pairs of births born to the same mother would have been advantageous. The pairs provide one birth which could possibly be affected by the length of the interpregnancy interval (the second born of a pair) and one birth which could not be directly affected (the first born). Also, some of the other factors which might affect outcome are held constant. Of course it is not possible to control all relevant factors by this approach. Clearly, there is a change in parity and in maternal age between births. There may also be changes in paternity, parental socioeconomic status, habits, and so on.

Results

DISTRIBUTION OF INTERPREGNANCY INTERVALS

The distribution of intervals between birth order 1 and 2 pairs may be found in Fig. 1A; Fig. 1B illustrates the distribution for birth order 2 and 3 pairs. Although we gathered data on interpregnancy intervals for a seven-year period only, Figs 1A and

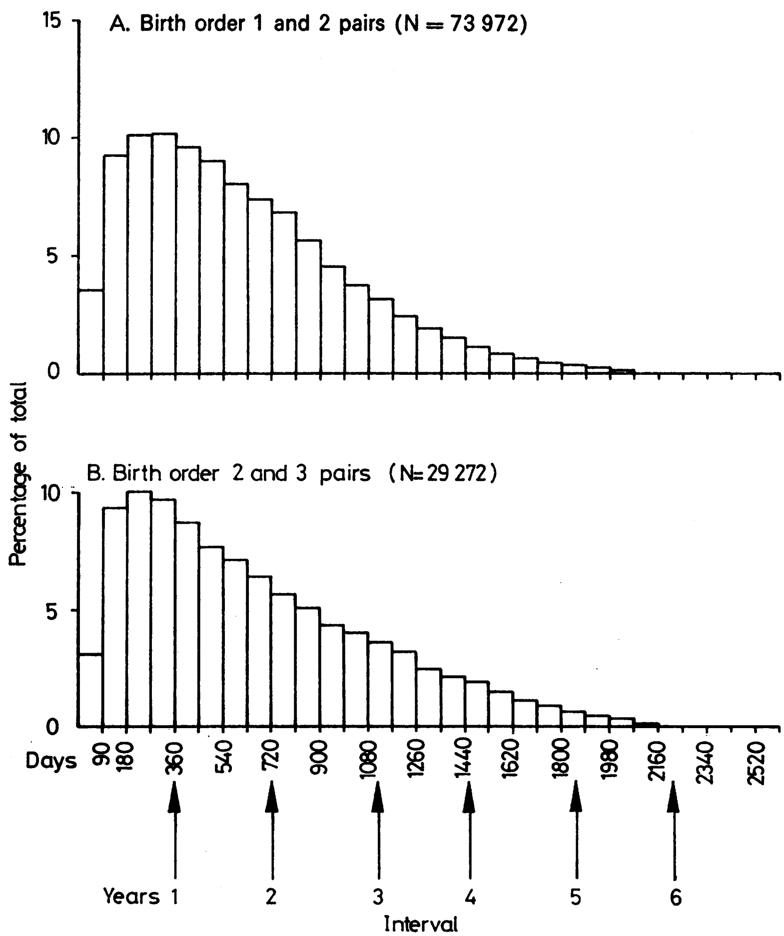

Fig. 1 *Percentage of pairs of consecutive births to same mother, by interpregnancy interval.*

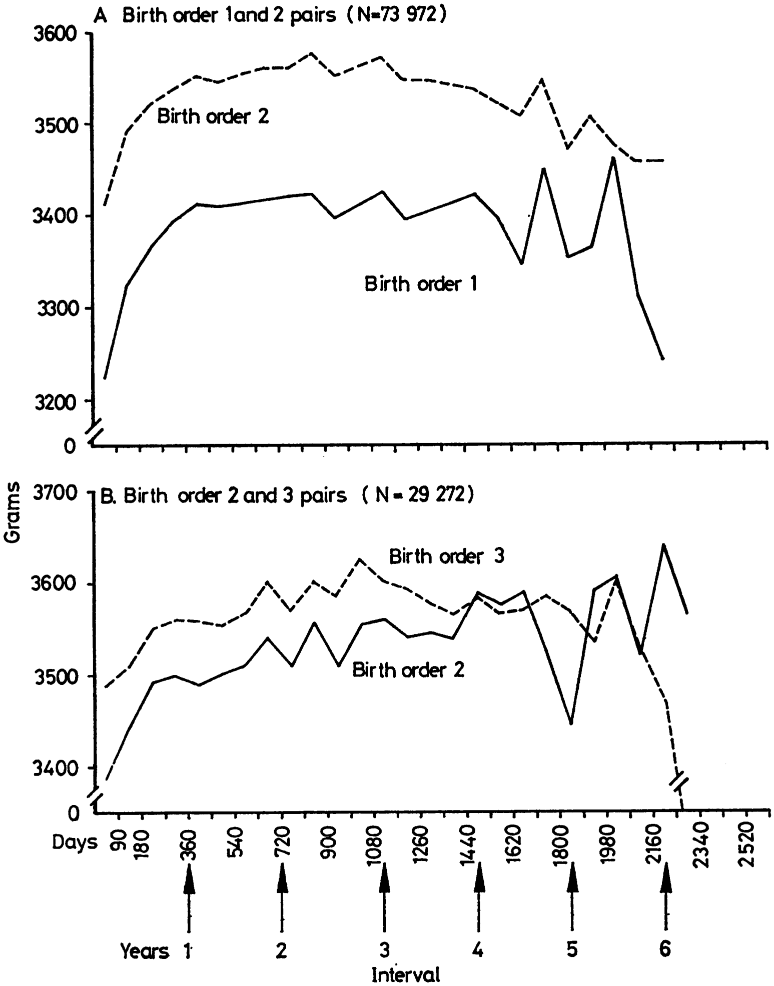

Fig. 2 *Mean weights of first and second members of pairs of consecutive births to same mother, by interpregnancy interval.*

1B show that the distributions would probably change very little with a longer study period since so few births took place at the longer intervals.

BIRTH WEIGHT

A clear association between interpregnancy interval and mean birth weight is apparent for both types of pairs (Figs 2A and 2B). There is a fairly marked deficit in average weight at the shortest intervals and a less pronounced deficit at the longer intervals. A similar association has been reported by other writers. To the best of our knowledge, however, previous reports have dealt only with births which follow, and never with births which precede, an interval. Previous studies have dealt with births equivalent to birth order 2 in Fig. 2A and birth order 3 in Fig. 2B. However, as is readily apparent from Figs 2A and 2B, the form of the association between interval and weight of the earlier born members of a pair is nearly identical with the association for the later born. Since the interval which follows first births among birth order 1 and 2 pairs cannot itself affect the weight of the firstborn, the association reported by others must, in large measure, be due to other causes. The same may be said of the earlier born among birth order 2 and 3 pairs (Fig. 2B). We note, without further comment, that the well-known

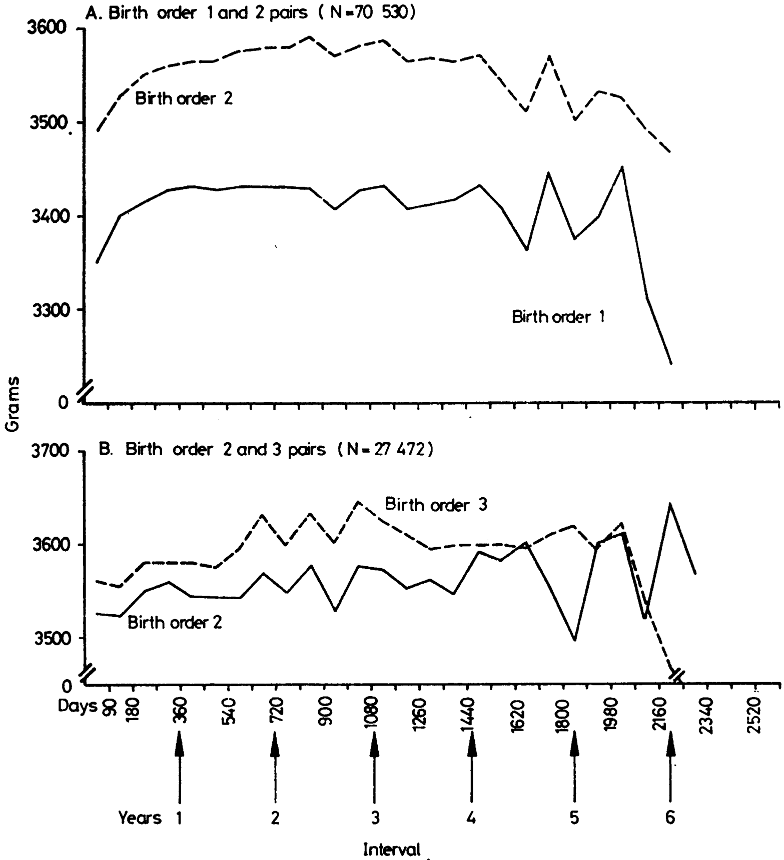

Fig. 3 *Mean weights of first and second members of pairs of consecutive births to same mother by interpregnancy interval (All pair members live born, still living).*

association between weight and birth order is readily apparent in Fig. 2.

The association between weight and interpregnancy interval among pairs in which both members were live born and were still living on 1 January 1975 is shown in Figs 3A and 3B. Elimination of stillbirths and postnatal deaths substantially diminishes the deficit of mean weight at the shortest intervals. Even so, the function of mean weight on interval is still similar for births which precede and births which follow an interval.

STILLBIRTH AND NEONATAL DEATH

We have shown that the removal of stillbirths and postnatal deaths from the data changes the degree of the association of interval with birth weight. We now illustrate how rates of stillbirth and neonatal death vary with interval.

The rate of stillbirth for births in birth order 1 and 2 pairs is shown in Fig. 4A and in birth order 2 and 3 pairs in Fig. 4B. Clearly there is a higher rate of stillbirth among the earlier born members of a pair for both types of pairs. But note that the rates at short intervals for birth order 2 births ascertained as being from birth order 2 and 3 pairs are much higher than the rates for birth order 2 births from birth order 1 and 2 pairs. In addition, the rates for the earlier born members of a pair seem to reach a minimum when the interval which follows it is relatively long. On the other hand, the rates for the later born of both pair types seem to reach a maximum at longer intervals; caution in the interpretation of the data from these longer intervals is required because of the small numbers involved (Figs 1A and 1B). The same features are apparent for neonatal death rates (Figs 5A and 5B) except that the rates for later born of pair members also seem to be high at short intervals, particularly for the later births from birth order 1 and 2 pairs.

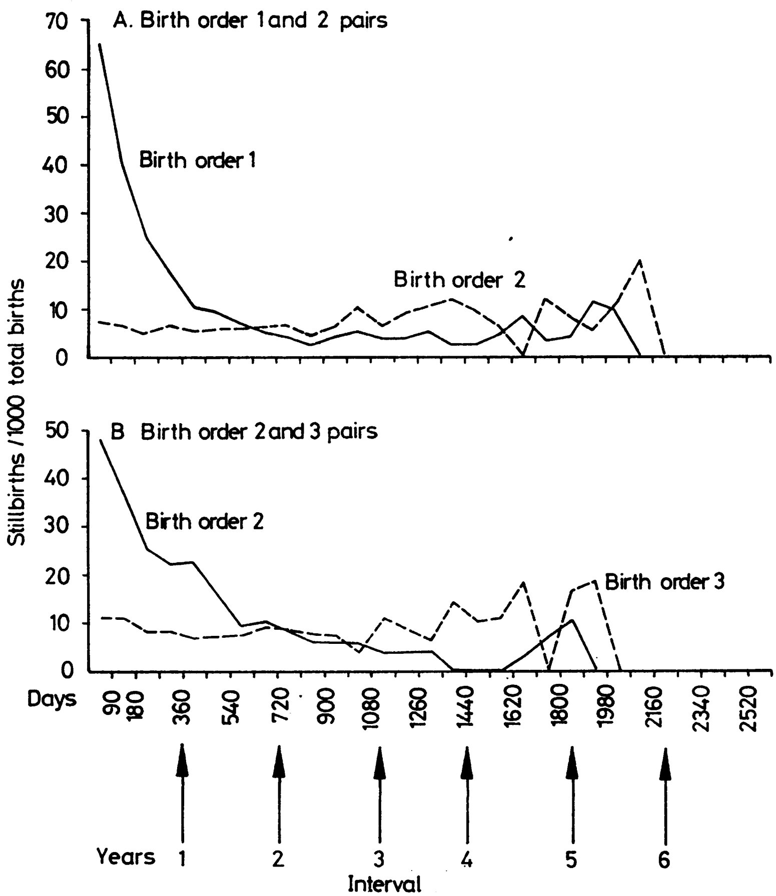

Fig. 4 *Stillbirth rates of first and second members of pairs of consecutive births to same mother, by inter-pregnancy interval.*

Discussion

The notion that there is an optimum interval for spacing pregnancies seems well established in the obstetric literature; it has been suggested that interpregnancy interval is associated with fetal death, postnatal death, and low birth weight. Spiers and Wang (1976) proposed that short interpregnancy intervals affect 'all death rates in infancy through growth retardation or shortened length of gestation'. They also said that one could reduce 'the overall prematurity and infant death rates among later-born singletons' by elimination of interpregnancy intervals of less than six months.

We have shown here that the association of birth weight and interval for the first born of a pair is similar to the function for the later born. The exclusion of all pairs except those in which both members were live born and still living reduced the strength of the association. This is not surprising, since the study of Fedrick and Adelstein (1973) showed that interpregnancy interval was related to several factors, including the outcome of the previous delivery.

Other factors shown by Fedrick and Adelstein (1973) to be associated with interval were maternal age and socioeconomic status. We were unable to stratify our sample by socioeconomic status. Also it is not possible to control completely for maternal age using the paired-birth approach since small increases in maternal age are inextricably linked with the interpregnancy interval. But limiting the analyses to mothers of restricted age at the time of birth of the firstborn of a pair changed the form of the association between interval and birth weight very little.

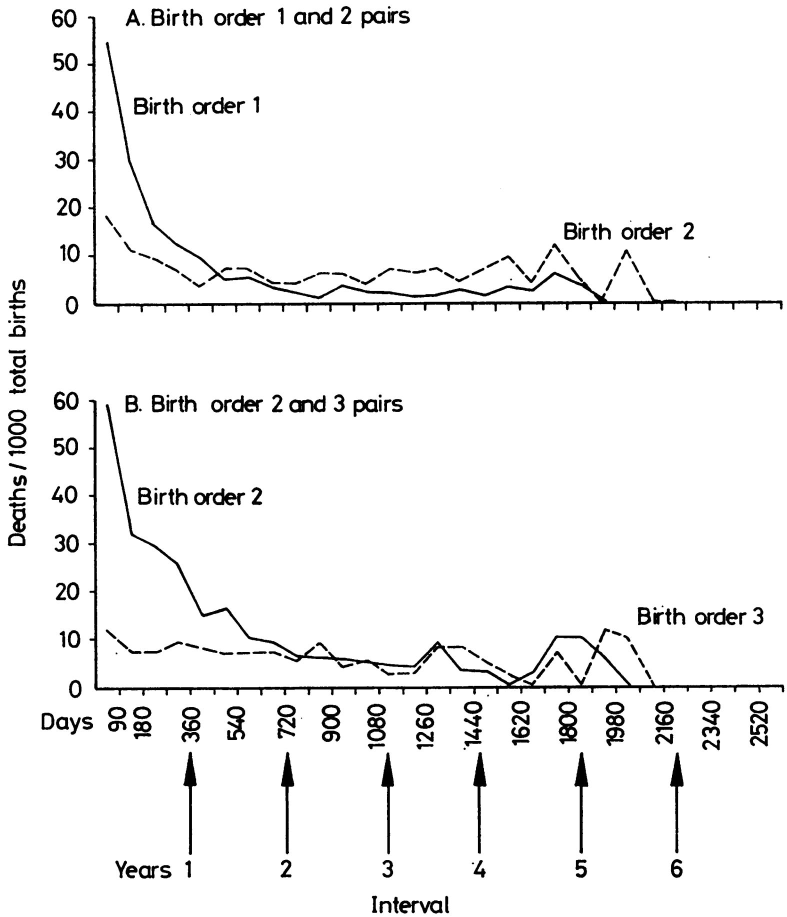

Fig. 5 *Neonatal death rates of first and second members of pairs of consecutive births to same mother, by interpregnancy interval.*

We therefore believe that the association of birth weight and interpregnancy interval is not direct. It is more likely that there are factors associated with a propensity both to have babies at very short or very long intervals and also to have babies of low weight; we have shown that removal of babies who were stillborn or who died after birth markedly altered the association between weight and interval.

The association between interval and the rates of stillbirth and neonatal death may be interpreted as a 'replacement' phenomenon (Newcombe and Rhynas, 1962). This is plainly shown in Figs 4 and 5. The rates are very high at short intervals for the firstborn of both pair types. But the rates for second births (birth order 2) depend upon the mode of ascertainment and suggest that there is a tendency to replace a lost child by conceiving rapidly after the loss. The contrast between the rates at short intervals for the earlier births among birth order 1 and 2 pairs and the rates for the earlier births among birth order 2 and 3 pairs is interesting in this regard. The rates are higher for first births (Figs 4A and 5A) than for these second births (Figs 4B and 5B). Second births (birth order 2) ascertained as being members of birth order 2 and 3 pairs were of course preceded by a first birth and most of these would have been live born. Thus the 'replacement' urge among women who have lost a second child may not be as strong as among women who have lost a firstborn, since the mothers of lost second children would in all probability have a living child.

The rate of stillbirth for the later born members of a pair is lowest at short intervals and increases about twofold at longer intervals. On the other hand, the rates for firstborns among pairs reach their lowest when they are ascertained as being followed by a longer interval. This feature of stillbirth has been reported before by James (1968) and is consistent with an effect of the conception delay itself; James (1968) also proposed several other possible explanations. Nevertheless, it is evident that a stillbirth can markedly alter reproductive behaviour. A pattern like the one shown in Figs 4A and 4B may also be explained quite simply by a model which proposes a certain difficulty in becoming pregnant (or in carrying a baby to delivery) among a small proportion of women who are at high risk of having a stillborn child.

James (1968) suggested an association between short intervals and higher neonatal death rates, but thought the relationship to be in part due to statistical artifact. The Norwegian neonatal death rates for the later born members of a pair, unlike those for stillbirth, seem somewhat higher at short intervals than at longer intervals. The material used by James (1968) was limited to births in which the previous delivery resulted in a live born child. If the present data are limited to neonatal deaths preceded by a live born child, the excessive rates at short intervals are reduced but not completely eliminated.

Conclusion

We have shown that the association between interpregnancy interval and the weight of the later born of a pair is of nearly the same form as the association with the weight of the earlier born. Thus both interval and a tendency towards lighter weight may be associated with other factors; stillbirth and neonatal death may be examples of such factors. In any case, it seems to us highly unlikely that manipulation of the interval between pregnancies will have any marked, direct, beneficial effect on pregnancy outcome.

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