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Debate

INFERTILITY TREATMENT AND MULTIPLE BIRTH RATES IN BRITAIN 1938–94

A Comment

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Murphy *et al.* (1997) showed age-standardised twinning rates for Scotland and England & Wales 1952–94. The rates declined to a value of about 9·2 per 1000 around 1978–81 and subsequently increased to about 11·5 per 1000 in 1992–94. The authors conclude their paper with the words: 'perhaps 15% of twins nationally now follow treatment and the natural twinning rate might still be in decline'.

This note questions whether this conclusion is consistent with the data. If one accepts the estimate of Hémon, Berger & Lazar (1981) and Webster & Elwood (1985) that the percentage by which ovulation induction augments singletons is about one-fifth that for twins, then the age-standardised estimated natural twinning rate in England & Wales 1992–94 is

$$11{\cdot}5 \times \frac{85}{100} \times \frac{100}{97} = 10{\cdot}1 \text{ per } 1000.$$

And even if one ignores the adjustment for the iatrogenic singletons, the rate is still estimated at 9·8 per 1000.

This is above the total age-standardised twinning rate estimated for 1978–81. So even if the assumption is made that no twins in 1978–81 followed induced ovulation (which is false) there is still the suggestion that natural twinning rates in the United Kingdom have increased since 1980.

The rate of increase seems to be greater than that of monozygotic (MZ) twinning across this century (James, 1980) which implies that part of the increase is due to a dizygotic (DZ) component. This is important because the DZ twinning rate is proportional to fecundability if the probability of double ovulation is controlled (James, 1981). Hence natural DZ twinning rates are useful as markers of reproductive hazards.

The suggestion that natural DZ twinning rates are increasing (or at least have ceased decreasing) has been made on other grounds in respect of England & Wales and of Belgium (James, 1995).

Studies of hazards to human fertility might usefully concentrate on (a) the causes of the widespread declines in DZ twinning during the 1960s and 1970s (James, 1982, 1986), (b) the suggested cohort effect in the declines in sperm counts and (c) the hypothesis that there is a lagged correlation between DZ twinning rate and sperm counts a generation later, suggesting that they share a common cause of variation in the maternal intrauterine environment (James, 1997).

References

Hémon, D., Berger, C. & Lazar, P. (1981) Twinning following oral contraceptive discontinuation. *Int. J. Epidemiol.* **10**, 319–328.

James, W. H. (1980) Secular changes in twinning rates in England & Wales. *Ann. hum. Biol.* **7,** 485–487.

James, W. H. (1981) Has fecundability been declining in recent years in developed countries? *J. biosoc. Sci.* **13**, 419–424.

James, W. H. (1982) Second survey of secular trends in twinning rates. *J. biosoc. Sci.* **14**, 481–497.

James, W. H. (1986) Recent secular trends in dizygotic twinning rates in Europe. *J. biosoc. Sci.* **18**, 497–504.

James, W. H. (1995) Are 'natural' twinning rates continuing to decline? *Hum. Reprod.* **10**, 3042–3044.

James, W. H. (1997) Secular trends in monitors of reproductive hazard. *Hum. Reprod.* **12**, 417–421.

Murphy, M., Hey, K., Brown, J., Willis, B., Ellis, J. D. & Barlow, D. (1997) Infertility treatment and multiple birth rates in Britain 1938–94. *J. biosoc. Sci.* **29**, 235–243.

Webster, F. & Elwood, J. M. (1985) A study of the influence of ovulation stimulants and oral contraception on twin births in England. *Acta Genet. med. Gemell.* **34**, 105–108.

A Reply

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James questions the validity of the very tentative statement made in the final sentence of our paper. Our claim concerned the proportion of twins in Britain in the 1990s that might have arisen through subfertility treatment and was linked to the suggestion that the natural twinning rate might still be in decline. If this were true, we, like James, would regard that prospect with concern.

We agree with James that, taking the single estimate we gave at precisely face value as he has done, and using the more precise figure for the average of the age-adjusted rates in 1978–80 (since 1981 was an interpolated value) of 9·4 and 11·4 in 1992–94, does

lead to the conclusion that a 15% reduction in the 1990s figure of 11·4 still puts the natural twinning rate at about 10 per 1000 which is noticeably higher than 9·4, the upper limit of the natural twinning rate in 1978–80. We should have been as cautious as we were in an earlier report when we suggested a range of about 15–20% in which the national proportion of twin births following subfertility treatment might fall in the 1990s (Murphy, 1995). This would have reflected better the considerable uncertainty with which our conservative estimate had been made. It depended on extrapolating from characteristics of births in part of Oxfordshire defined from a computer database, to twin rates in Oxfordshire and West Berkshire as a whole, and thence to a national figure.

However we are now in a position to offer a more precise estimate of the proportion of twins following subfertility treatment throughout Oxfordshire/West Berkshire combined in 1994, and hence of the national proportion so arising, and we are pleased that James has prompted us to do so.

Following a small pilot study of twin births at the John Radcliffe Hospital in Oxford in 1990, from which we reported in our earlier paper that about 40% of residents delivering twins had received ovulation induction (OI) agents or undergone more advanced assisted conception (AC) techniques we are conducting a further case-control study of factors affecting twinning. This study includes all women delivering twins in the hospitals in Oxfordshire and West Berkshire in 1994, 1995 and 1996 and control women delivering singleton babies only. For 1994 twin births we have ascertained from the women themselves, or for non-responders/exclusions from their general practitioner/hospital case-notes, whether their twin births followed subfertility treatment. Whether considering the 160 residents of Oxfordshire/West Berkshire only or all 183 women delivering twins irrespective of their place of residence, about 25% reported use of ovulation induction agents or assisted conception techniques to conceive their twins. We have assumed that all women delivering twins who underwent assisted conception techniques were treated with ovulation induction agents, whether or not they answered the question to provide this additional information on our questionnaire.

Figure 1 shows the crude twin rates in England and Wales for 1938–95 and the indirectly age-adjusted twin rates (using the 1970 twin rates as standard) for comparison. It is evident that the decline in twin rates is lessened by age-adjustment. It is not easy to say when the decline in natural twinning started but ovulation induction started to be used in this country on any kind of scale only between 1966 and 1970. If we take either 1951 or 1957 as the start of the decline in both the crude and age-adjusted rates and either 1966 or 1970 as the point in the decline before which (nearly) all twinning must have been natural, then fitting regression lines predicts a 1994 crude rate of between 6·3 and 7·8 and a 1994 adjusted rate of between 8·1 and 8·9. The observed national 1994 rates were crude 12·8 (1995, 13·6) and adjusted 11·6 (1995, 12·3). These were higher then than the corresponding Oxfordshire/West Berkshire twin rates in 1994. If we assume the crude proportion of twins following OI/AC nationally in 1994 was the same as Oxfordshire/West Berkshire at 25% then the crude natural twinning rate was then 9·6 which is about the same or slightly lower than the average for 1973–80 when the graph can be seen to be flat. For comparison with the age-adjusted twin rates, a kind of age-standardisation of the 1994 crude proportion

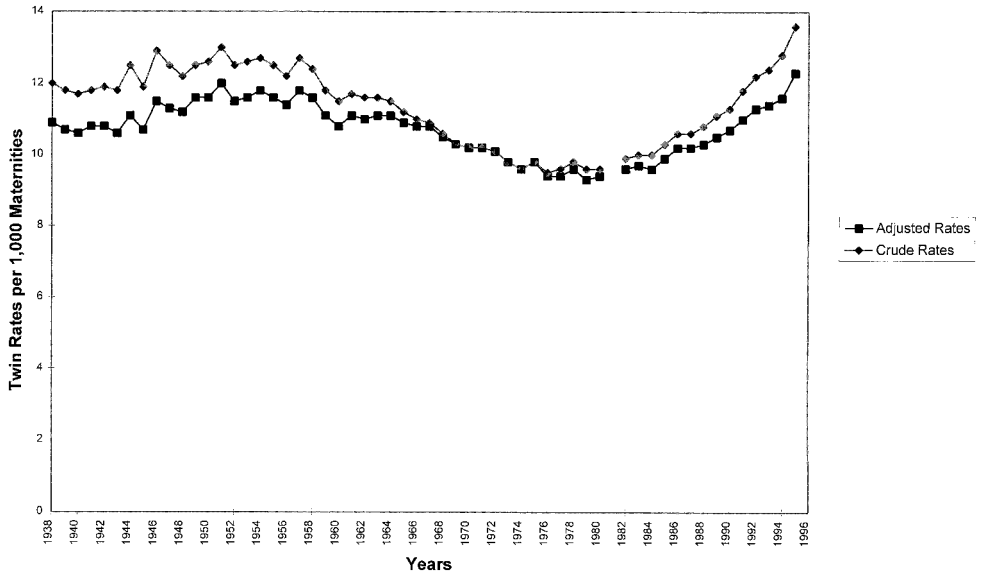

Fig. 1. Total twinning rates, England & Wales, 1938–95 (1981 rates are unreliable and omitted).

following treatment in Oxfordshire/West Berkshire (25%) can be performed by weighting the age-specific proportions of twins following treatment locally by the age-specific numbers of twins nationally in, say, 1970 or 1994, to give 18% and 22% respectively. Using an average age-adjusted reduction of 20% suggests the age-adjusted natural twinning rate in 1994 was 9·3, again the same or slightly lower than the plateaued age-adjusted rates in the 1970s.

So the available data suggest that while the national natural twin rate in 1994 was far higher than would have been the case if a linear decline in the 1950s and 1960s had persisted, it may now have levelled out at the value it reached 25 years ago or still be in slow decline. Certainly it shows little sign of being restored to the higher rate which prevailed before the 1970s.

With regard to the final point made by James, one further comment is offered. He has elsewhere considered the evidence from Finland that sperm counts have apparently remained stable there for some time (James, 1997). However, twinning rates plummeted there, as elsewhere, in the period 1950–75, having been stable or slowly increasing for the previous 100 years (Fellman & Eriksson, 1993). This seems to be one piece of evidence against the notion of a lagged correlation between detrimental exposures in utero (marked by declining twinning rates), and subsequent reduced sperm counts in those men conceived during the time of declining twin rates/adverse environmental exposures, although it might be argued that Finnish sperm counts have yet to fall.

Acknowledgments

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References

FELLMAN, J. O. & ERIKSSON, A. W. (1993) Biometric analysis of the multiple maternities in Finland 1881–1990 and in Sweden since 1751. *Hum. Biol.* **65**, 463–479.

JAMES, W. H. (1997) Secular trends in monitors of reproductive hazard. *Hum. Reprod.* **12**, 417–421.

MURPHY, M. F. G. (1995) The association of twinning with long term disease. In: *Multiple Pregnancy. Proceedings of the Thirtieth Study Group of the Royal College of Obstetricians and Gynaecologists*, Chap. 2, pp. 14–29. Edited by R. H. Ward & M. Whittle. RCOG, London.

COITAL FREQUENCY AMONG MARRIED AND COHABITING COUPLES IN THE UNITED STATES

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Rao & DeMaris (1995) suggest that when age is controlled, cohabiting partners have higher coital rates than married partners. Their sample was restricted to couples whose relationships were of 5 years' duration or less. This restriction, according to the authors 'circumvents the confounding problem of age with duration of relationship'.

However, coital rates have been shown to correlate much more highly (admittedly non-linearly) with duration of relationship than with the age of either partner. Mean coital rate roughly halves across the first year of marriage (James, 1981a, 1983) whereas mean marital coital rate roughly halves from age 20 to age 40 (Kinsey *et al.*, 1953). These two findings are reconciled by the very large variance, across couples, of coital rates (James, 1981b), and the fact that different couples marry at different ages.

Because of this substantial correlation of coital rate with duration of relationship, it follows that if marital status (married or cohabiting) varies with duration of relationship, the authors' conclusion is put in doubt. But the rate of dissolution of cohabiting relationships (either by marriage or by separation) must be greater than the rate of dissolution of marriages. In other words, the mean duration of cohabiting relationships is less than that of marriages (even when restricted to durations of less than 5 years). This therefore may be the explanation for the higher coital rates reported in the cohabiting relationships of Rao & DeMaris (1995). The point could be tested by re-matching (by both age and duration) each cohabiting couple with control married

couples. Matching by coarse age categories (e.g. of intervals of 5 years) should be sufficient. But duration-of-relationship categories should be much finer (e.g. by month or 2-month intervals).

Another point is worth mentioning. Some married couples who had previously cohabited might (for the sake of respectability) estimate the duration of their relationship from the date of marriage rather than from the initiation of the relationship. So, as contrasted with cohabiting couples, there might be a tendency for married couples to underestimate the duration of the relationship, thus producing the reported result.

References

James, W. H. (1981a) The honeymoon effect on marital coitus. *J. Sex Res.* **17**, 114–123.

James, W. H. (1981b) Variation between couples of human coital rates. *J. biosoc. Sci.* **13**, 151–156.

James, W. H. (1983) Decline in coital rates with spouses' ages and duration of marriage. *J. biosoc. Sci.* **15**, 83–87.

Kinsey, A. C., Pomeroy, W. B., Martin, C. E. & Gebhard, P. H. (1953) *Sexual Behavior in the Human Female*. Saunders, Philadelphia.

Rao, K. V. & DeMaris, A. (1995) Coital frequency among married and cohabiting couples in the United States. *J. biosoc. Sci.* **27**, 135–150.

PRIOR AND PROXIMATE CAUSES OF INFANT SURVIVAL IN GHANA, WITH SPECIAL ATTENTION TO POLYGYNY

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Amankwaa (1996) gives data on infant mortality in monogamous and polygynous families. However he does not categorise his data by sex. This is important because one might expect infant mortality to vary by sex; moreover the offspring sex ratios of polygynous and monogamous women reportedly differ.

In Thomas's (1913) Nigerian data, offspring sex ratio (proportion of boys) varied positively and significantly with the number of co-wives. Similarly Mealey & Mackey (1990) reported that in Mormon marriages, later wives bear a significantly higher

proportion of boys than earlier wives. In contrast, Whiting (1993) reported a lower sex ratio in the offspring of Kenyan polygynous marriages than in monogamous marriages.

Following Perret's (1990) data on mouse lemurs, it has been suggested that the sex ratio of offspring of polygynous marriages varies as a hormonal consequence of the domiciliary arrangements of the wives (James, 1995). If the wives live together in a harem (as in Nigeria or among the Mormons) they have a high offspring sex ratio: if they live in separate dwellings and are visited by their husband in turn (as in East Africa) they have a low offspring sex ratio.

These points may not be of immediate consequence to the conclusions of Amankwaa (1996), but the offspring sex ratios of his monogamous and polygynous women are relevant. It would also be interesting to know whether polygynously married women in Ghana usually share a household with their co-wives (as in Nigeria).

References

Amankwaa, A. A. (1996) Prior and proximate causes of infant survival in Ghana, with special attention to polygyny. *J. biosoc. Sci.* **28**, 281–295.

James, W. H. (1995) What stabilizes the sex ratio? *Ann. hum. Genet.* **59**, 243–249.

Mealey, L. & Mackey, W. (1990) Variation in offspring sex ratio in women of differing social status. *Ethol. Sociobiol.* **11**, 83–95.

Perret, M. (1990) Influence of social factors on sex ratio at birth, maternal investment and young survival in a prosimian primate. *Behav. Ecol. Sociobiol.* **27**, 447–454.

Thomas, N. W. (1913) *Anthropological Report on the Ibo-Speaking Peoples of Nigeria. Part 1: Law and Custon of the Awka Neighbourhood, S. Nigeria*. Harrison, London.

Whiting, J. W. M. (1993) The effect of polygyny on sex ratio at birth. *Am. Anthropol.* **95**, 435–442.