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Incidence of Twinning in London from 1581 to 1760

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Abstract. Baptism records of parishes in London and its vicinities from 1581 to 1760 (168,238 maternities) were investigated to estimate the twinning rate and its secular and seasonal variations. Total, estimated dizygotic (DZ), and estimated monozygotic (MZ) twinning rates were 1.1%, 0.8% and 0.3%, respectively. MZ twinning rate varied during the 18 decades, with a significantly low rate (0.11%) in the early 17th century (1621-1640). Significant seasonal variations of the twinning rate according to the month of baptism was observed in both DZ and MZ twins. DZ twins were born more frequently in spring and fall in general. Parish records obtained from four parishes near Manchester in England showed an inversed seasonal variation with peaks in winter and summer. An interpretation of this difference was discussed in a context of environmental factors. In the low MZ period, 1621-1640, MZ or like-sexed twins were apparently less frequent in summer (April to October). This result could be explained by a decrease of MZ twins and/or a greater loss of like-sexed DZ twins.

Key words: Baptism records, Twinning rate, Secular trend, Seasonal variation, Prenatal loss

INTRODUCTION

In recent years, secular changes of the twinning rate have been studied with a special attention to the decline of the dizygotic twinning rate after the late 1950s [3-5,8,9,13-17, 19,20]. Some authors have reported fluctuations in the twinning rate before the 20th century [3,6,15,19,21]. Richter et al [21] reported secular cyclic variations in the twinning rate in the 17-19th centuries in Görlitz, east Germany, suggesting that seasonal environmental factors may have changed the incidence of twinning. To find out the incidence of

twinning in old times, baptism records in older centuries may be useful, in spite of their limitations in the quality of data. We investigated old baptism records in some parishes in London and other four parishes in England to estimate the secular and seasonal changes in the twinning rate.

MATERIALS AND METHODS

Baptism records in parishes in London and its vicinities were investigated from a series of genealogical books published by Harleian Society of London [6]. Data on the monthly number of the baptized, the number of twins, and the sexes of twins, were collected. Those baptism records described as twins (twins, twines, twinnes, twynes, tweins, gemelli, gemellae, and so on) were generally regarded as twin births. Foundlings and adult persons such as negro servants were excluded from the analysis.

Baptism may have occurred at more or less later dates than birth. The interval between these two dates should be reasonably short in order to investigate the seasonal variation of births. Since dates of births were also given in some volumes, the interval between these two dates was checked. Fig. 1 shows the increase of cumulative percentage of those baptized after the date of birth (baptism rate). During the period until 1760, the baptism rate reached more than 95% at 30 days after birth. After 1761, the baptism rate began to decrease: it was less than 70% at 30 days after birth in 1761-1800, and less than 40% after 1801. In the present analysis we confined the data by using only the records

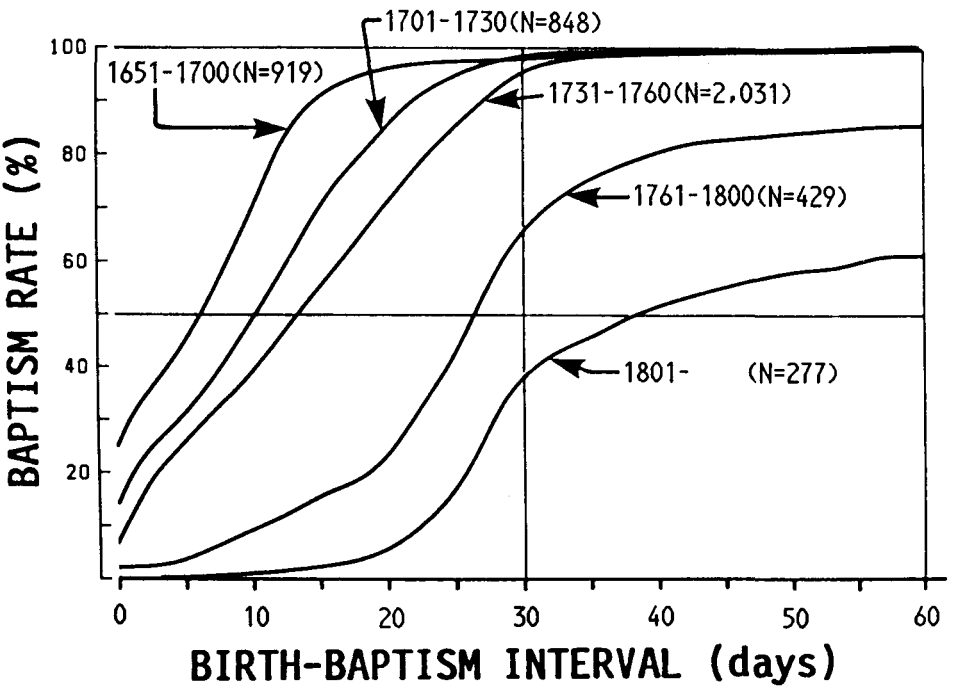

Fig. 1 - Baptism rates in different periods, London.

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from 1581 to 1760. The number of baptized children selected was 168,238 (a pair of twins was regarded as one).

Parish records in four parishes near Manchester or Birmingham in England were also obtained at the Yale University. There were 17,636 cases in four parishes (Wolverhampton, Leigh, Kirkham, and Pattingham) from the 16th to 19th centuries.

Twinning rate was expressed as the number of pairs of twins (including triplets and quadruplets) per 100 total births (%). Monozygotic (MZ) and dizygotic (DZ) twinning rates were estimated by Weinberg's difference method: the number of MZ pairs was estimated as the number of like-sexed pairs subtracted by the number of unlike-sexed pairs; the number of DZ pairs was estimated as twice the number of unlike-sexed pairs.

SPSS-X package programmes were used for computation on M-240D (Hitachi Co. Ltd.) at Teikyo University.

RESULTS

Secular Changes in the Twinning Rate

Among 168,236 cases, there were 166,375 singletons, and 571 M-M, 593 F-F, 675 M-F, 4 sex-unknown pairs of twins, 17 sets of triplets and 1 set of quadruplets. Among 18 sets of triplets and quadruplets, 7 sets were like-sexed, 7 sets unlike-sexed, and 4 sets unknown. Total twinning rate over the period was 1.10% in 1581-1760 in London (1,861/168,236). The estimated DZ and MZ twinning rates were 0.81% (1,364 DZ) and 0.29% (489 MZ), respectively.

Twinning rate in each decade from 1581 to 1760 is shown in Fig. 2. DZ and total twinning rates seemed to have fluctuated in the 17th century with apparent peaks having 20-30 year intervals. This variation during the 18 decades was statistically significant ($\chi^2 = 35.3$, df = 17, $P < 0.01$). MZ twinning rate also showed a significant secular variation ($\chi^2 = 53.3$, df = 17, $P < 0.01$) among these 18 decades, with a significant decrease

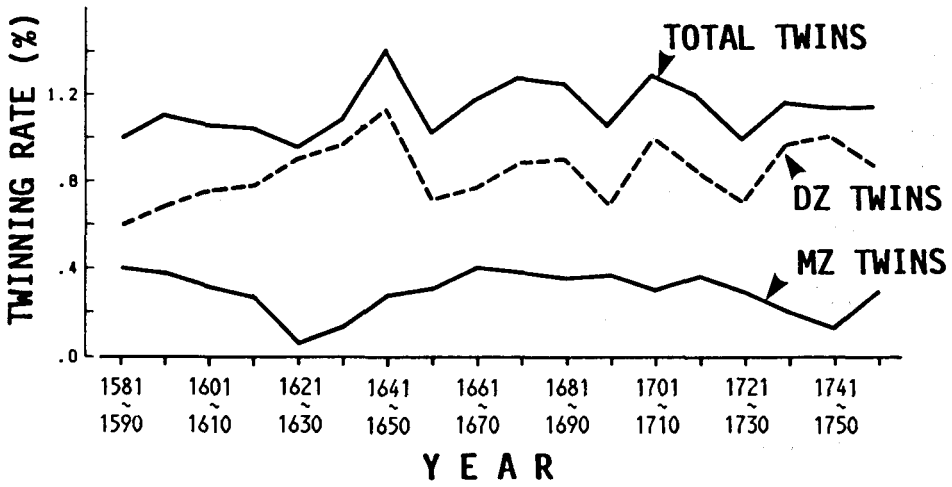

Fig. 2 - Secular changes in total, estimated DZ, and estimated MZ twinning rates, London, 1581-1760.

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in 1621-1640 (26 MZ pairs/22,878 cases, 0.11% ; $\chi^2 = 28.6$, df = 1, $P < 0.01$ with the other decades).

Seasonal Variation

Twinning rates showed a highly significant variation according to the month of baptism. Fig. 3 shows the monthly variation in total, DZ and MZ twinning rates. Total twinning rate varied almost identically to the DZ twinning rate. The DZ twinning rate was high in spring (1.10% , 152/13,866 in April) and in fall (0.88%, 374/42,295 in August-October), and the monthly variation was highly significant ($\chi^2 = 29.6$, df = 11, $P < 0.01$).

The MZ twinning rate also showed a significant variation among the 12 months of baptism ($\chi^2 = 35.4$, df = 11, $P < 0.01$), though peak and trough months differed from those of the DZ twinning rate. The low MZ twinning rate in 1621-1640 was associated with a low rate around the summer. In April-October in 1621-1640, the number of unlike-sexed twins (N = 73 pairs) even exceeded that of like-sexed twins (N = 70), and thus the number of estimated MZ twins had a minus value (Table).

In four parishes other than London, total twinning rate was slightly higher (1.2% , 206/17,636) than in London, and showed elevations in the total twinning rate in winter (December-January) and in summer (June) (Fig. 4).

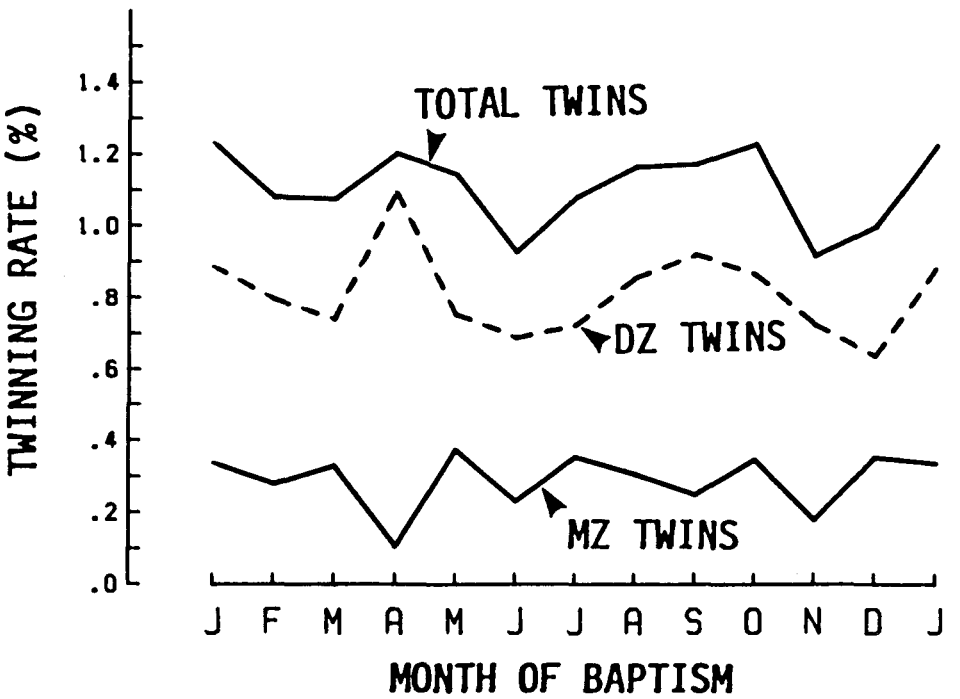

Fig. 3 - Seasonal variation in total, estimated DZ, and estimated MZ twinning rates, London, 1581-1760.

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Table - Twinning rate according to season of baptism

Year period	Items	Season of baptism	
		Apr-Oct	Nov-Mar
1581-1620	Singleton	(15,073)	(11,953)
	MM pairs	0.32% (48)	0.26% (31)
	FF pairs	0.30% (45)	0.33% (40)
	MF pairs	0.34% (51)	0.32% (38)
	Total[a]	0.99% (149)	0.95% (113)
1621-1640	Singleton	(12,793)	(9,853)
	MM pairs	0.26% (33)	0.38% (37)
	FF pairs	0.29% (37)	0.22% (22)
	MF pairs	0.56% (72)	0.30% (30)
	Total[a]	1.12% (143)	0.90% (89)
1641-1760	Singleton	(66,427)	(50,253)
	MM pairs	0.36% (237)	0.37% (185)
	FF pairs	0.41% (274)	0.35% (175)
	MF pairs	0.41% (275)	0.42% (209)
	Total[a]	1.19% (793)	1.14% (574)

Number of cases is in parentheses.

[a] Cases with unknown sex included.

DISCUSSION

The actual twinning rate in older centuries may have been lowered by the probably higher perinatal deaths of twins than nowadays. The rate estimated, however, was virtually at the same level as that of the European countries in the 20th century [14,15,19]. We suppose that the old baptism records hold relatively reliable information on twins.

Richter et al [21] showed a secular variation in the twinning rate in Görlitz, east Germany, in the 17th-19th century. The present data in London did not show such a clear cyclic variation, though decadal twinning rates seemed to have fluctuated with intervals of 20-30 years, particularly in the 17th century. The difference between these two data may be due to some different environmental conditions which secularly changed more in Görlitz than in London. Richter et al [21] suggested that the factors influencing the twinning rate might be associated with season. In Görlitz, the decades with a high twinning rate (more than 1.5%) showed summer and winter elevations and the decades with a low-twinning rate (less than 1.0%) showed, in contrast, summer and winter reductions. The twinning rate in 1581-1760 in London, 1.1%, was nearly as low as the twinning rate in Görlitz, and the shape of seasonal variation in London was similar to that of decades with a low twinning rate in Görlitz. The results from England other than London showed a slightly higher twinning rate and, in contrast, winter and summer elevations. These results suggest that the factors related to the variation in the twinning rate were not genetic but environmental, and that they were not restricted to the city of Görlitz or to

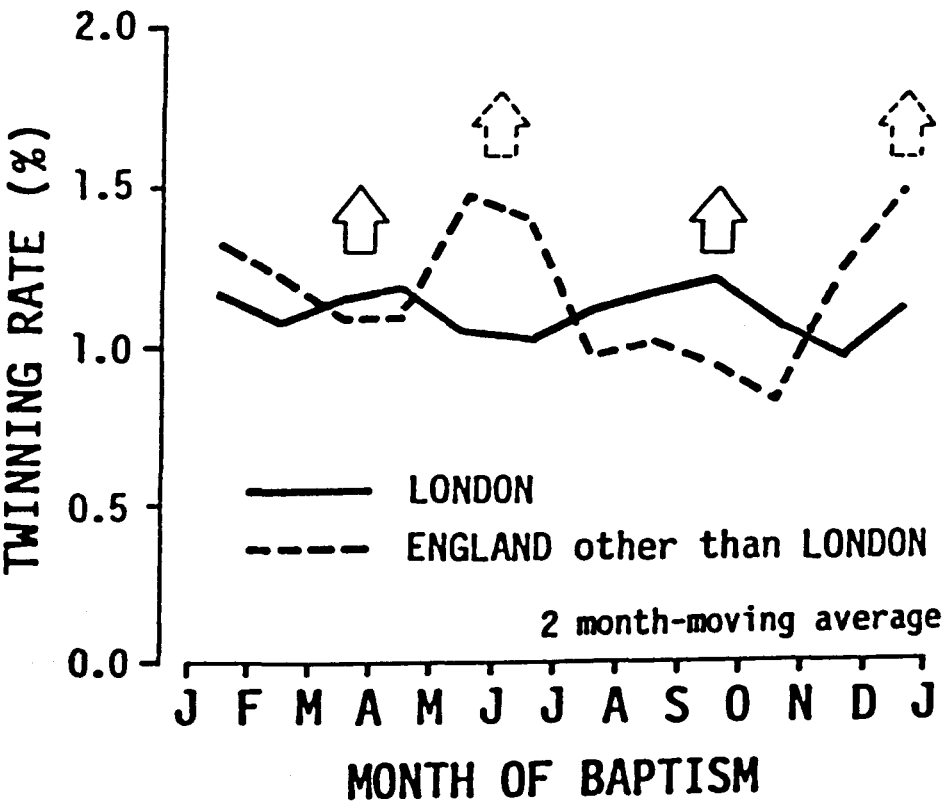

Fig. 4 - Seasonal variation in total twinning rates in London and rest of England.

east Germany.

We may explain the results obtained so far as follows: Twin births occurred with a given basic probability, which did not change secularly so much, especially in spring and fall. This resulted in the about 1.0% level of the twinning rate. When some environmental factors appeared in summer and winter in given areas (such as in Görlitz or England other than London), they continued to operate over a given range of decades and elevated the twinning rate up about 2.0% . When they disappeared, the twinning rate in summer and winter decreased. Since the rates in summer and winter decreased to less than 1.0% in London or Görlitz during the periods with a low twinning rate, active twin-reducing factors may also be supposed.

Maternal age and/or birth order, which changed greatly in recent years, have been known to affect the twinning rate [16,18]. Although we could not obtain the information on these variables, their effects may not fully explain the seasonal variation in our data. Use of oral contraceptive [15], or pesticide [13], which have been considered as possible causes of the recent decline in the twinning rate, can neither be applicable to our old-time data.

From the present data, it was suggested that the MZ twinning rate could also be changed in some particular years. The decrease of the MZ twinning rate in 1621-1640 in

London was associated with a seasonal (summer) reduction. We do not have a convincing explanation for the increase of unlike-sexed and the unexpected decrease of like-sexed twins in this season. Since the assumption in Weinberg's difference method that like-sexed and unlike-sexed pairs were equally distributed among DZ pairs has been challenged [1,2, 11], we cannot conclude that the apparent MZ reduction was an actual one. If like-sexed DZ pairs were selectively lost among DZ twins, the MZ rate should be underestimated by Weinberg's difference method. Suggestion that DZ twins originally include more like-sexed pairs [10] cannot explain the present result. There are two major possibilities, therefore, for the reduction in the estimated MZ twinning rate: 1) the frequency of successful pregnancies of MZ twins was reduced; 2) like-sexed pairs were selectively lost among DZ twins.

Although the MZ twinning rate is believed to be more stable than the DZ rate, in general, recent increases of MZ twinning have been noted in England and Wales [12], and in Australia most markedly in the 1970s [4]. Zahálková [22] reported an incidence of MZ twin births clustered in time and space, in southern Moravia. Changes in the twinning rate require further investigations, and if a study uses Weinberg's difference method, it should consider, as a possible cause, unbalanced loss of like-sexed or unlike-sexed pairs among DZ twins.

CONCLUSION

Both DZ and MZ twinning rates changed secularly and seasonally in old baptism records in London. Differences in seasonality by time and place suggested seasonally-changing environmental factors, probably more effective in summer and winter. Estimated MZ twinning rates also changed secularly, and were seasonally reduced in 1621-40. The causes of this MZ variation may be considered in terms of unbalanced loss of like-sexed pairs among DZ twins.

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