



## Biometric analysis of the multiple maternities in Finland, 1881-1990, and in Sweden since 1751.

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Abstract: Hellin's law states that if the twinning rate is  $w$ , then the triplet rate is  $w^2$ , the quadruplet rate is  $w^3$ , and so forth. The opinion of today is that Hellin's law holds only approximately. In this study the inaccuracy of Hellin's law is studied and the discrepancies are explained mathematically. In our earlier studies we built linear models for the twinning rate. Because most of the mothers are younger than 40 years of age and because in this age interval the twinning rate depends linearly on age, linear regression methods have been applied. Hellin's law suggests using the square-root transformation of the triplet rate  $r$ . Statistical arguments speak in favor of using the arcsin square root of  $r$  transformation. We discuss both transformations. Despite the fact that Hellin's law is only approximate, the arcsin transformation proves valuable. The transformed triplet rate can be modeled in a way similar to the twinning rate. We consider secular data from Finland for 1881-1990 and from Sweden since 1751. Using Hellin's law, we compare the triplet rates and the twinning rates and study the time trends of the observed twinning and triplet rates. The data are standardized. Our theoretical results are applied to multiple maternity data for Finland. Using maternal age as the regressor, we build a linear model for the twinning rate and for the arcsin-transformed triplet rate. This analysis shows a decreasing linear time trend in the triplet series for the period 1881-1950 but not in the twinning series. The triplet rate has an increasing trend after 1960, which seems to be mainly caused by artificial induction of ovulation.

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