

MULTIPLE BIRTHS IN POLAND IN 1949-1971

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A statistical analysis has been carried out on the frequency of twin and triplet births in Poland in the years 1949-1971.

These frequencies appear to be higher than expected on the basis of Hellin's rule, there being 1 twin birth in 87 single births and 1 triplet birth in 118 twin births.

The share of MZ vs. DZ twins having been assessed through Weinberg's method, an analysis is carried out on maternal age, parity, and urban vs. rural environment. It is concluded that the frequency of polyovulation increases with parity, whereas it becomes reduced with age on account of menopause effect already at age 40.

In the period 1949 to 1971 inclusively, a total of 15,300,000 births were recorded in Poland: of these, 174,000 were twin, 1473 triplet, 14 quadruplet, and 1 quintuplet births. This means that there were 87 single births per one twin birth, 118 twin births per one triplet birth, and 105 triplet births per one quadruplet birth, in the mean. These frequencies are higher than the theoretical ones anticipated by Hellin (for a base of 85) respectively by: 2% for twins, 39% for triplets, and 24% for quadruplets.

The relatively high absolute figures of twin and triplet births entitle to a study of the changes in the frequencies of these births considering demographic aspects. The noted drop in frequency of both twin and triplet births, in the period of the above-mentioned 23 years, was the direct stimulus for this analysis.

1. ANALYSIS OF THE FREQUENCY OF TWIN BIRTHS

Duncan's law, formulating the relationship between the frequency of twin births and maternal age, was checked on 174,000 twin births.

The fractions of MZs and DZs births were assessed by means of Weinberg's method. This method overestimates the share of MZ vs. DZ births. The error of this estimation is caused by the variances of DZ fertilization¹, but this error must be neglected because of the difficulty to evaluate its magnitude.

Remarkable in the graph (Fig. 2) is the presence of a clear-cut maximum of the regression curve (3rd degree) of the frequency of MZ twins in the same age group (35-39) as that of DZ twins.

¹ The proof of this formulation was presented by the author of the present paper at the session of the Biostatistics Section of the Warsaw Branch of the Polish Society of Hygiene, on 21 November 1972.

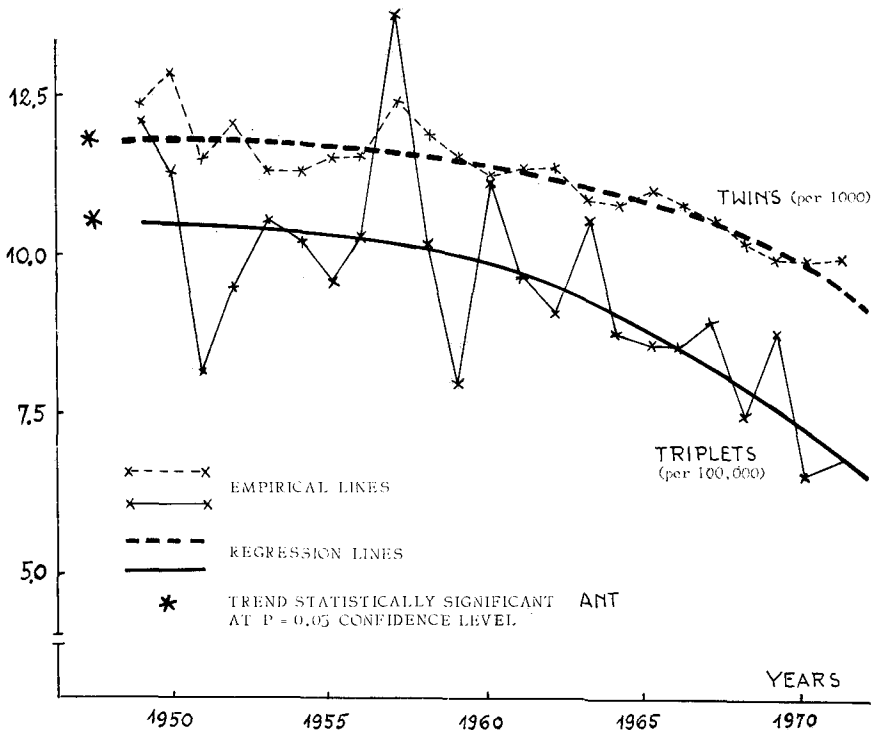


Fig. 1. Frequencies of twin and of triplet births. Regression curves, 2nd degree. Assessment of the trend on the significance level of 0.05.

If it is admitted that the above-mentioned overestimation of MZ vs. DZ twins by Weinberg's method amounts to 5%, then the frequencies of MZ twins would prove to be constant in all analysed aspects. It is remarkable that, at the beginning and end of the maternal reproductive-age interval, the frequencies of MZ and DZ twin births are identical.

If the analysed period of time is divided into two parts, approximately equal from the point of view of the number of births recorded, a drop in the frequency of DZ twin births will be noted, and an increase in the frequency of MZ twin births is recorded in the entire time interval of the reproductive age of the women, accepting the marginal limits of this time interval (Fig. 3).

Analysing the noted changes under the aspect of time, a reduction, of the frequency of DZ twin births, increasing with time, and a systematic although slight growth of the frequency of MZ twin births, are recorded (Fig. 4). While the first reduction can be easily explained, the increase in frequency of MZ twin births is surprising. It is noted in all maternal age groups (Fig. 5).

The decrease in frequency of DZ twin births was probably caused by a change in demographic parameters characterizing the population of mothers. In the past 23 years, the share of young mothers with a lower frequency of DZ twin births (according to Duncan's

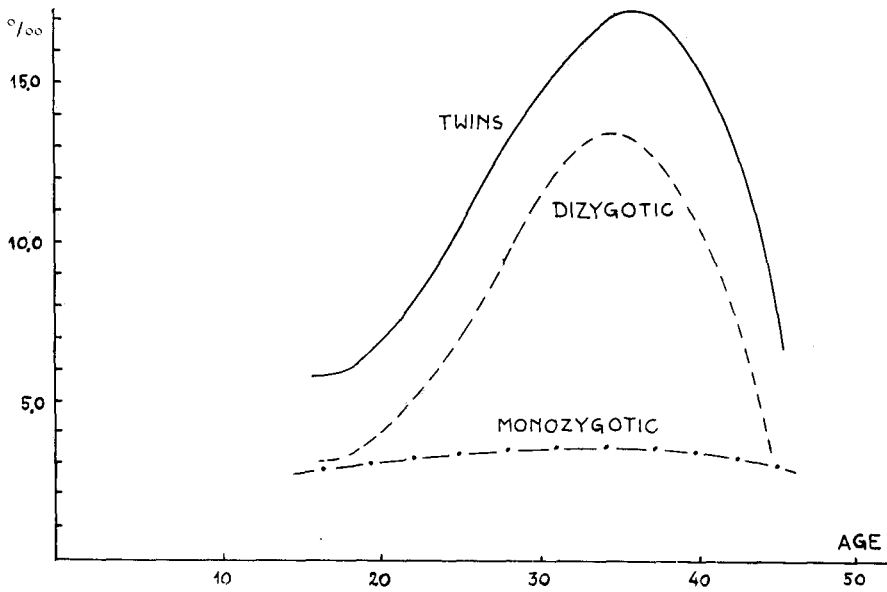


Fig. 2. Frequency of twin births according to maternal age and zygosity

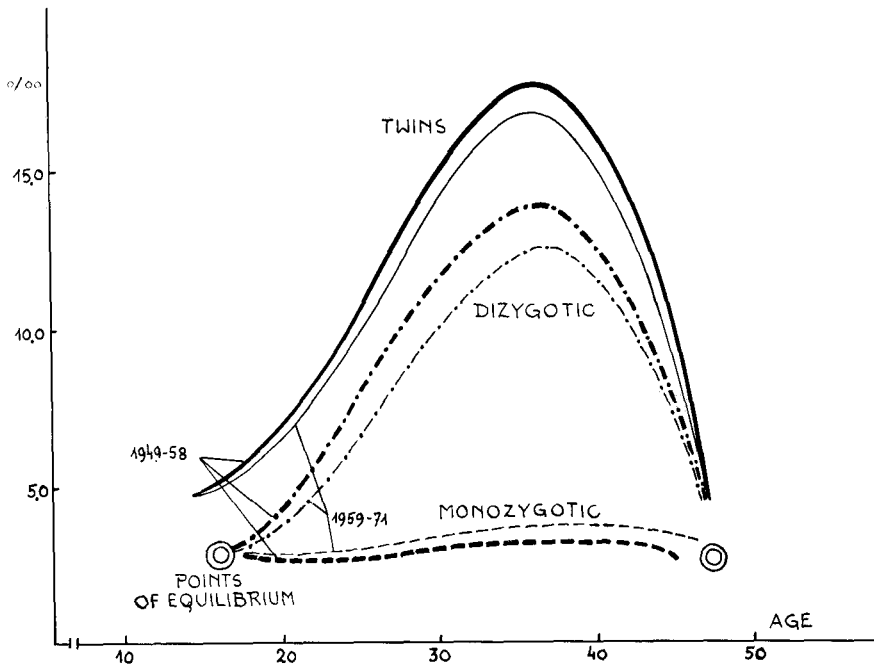


Fig. 3. Frequency of twin births according to maternal age and zygosity in the two periods, 1949-1958 and 1959-1971

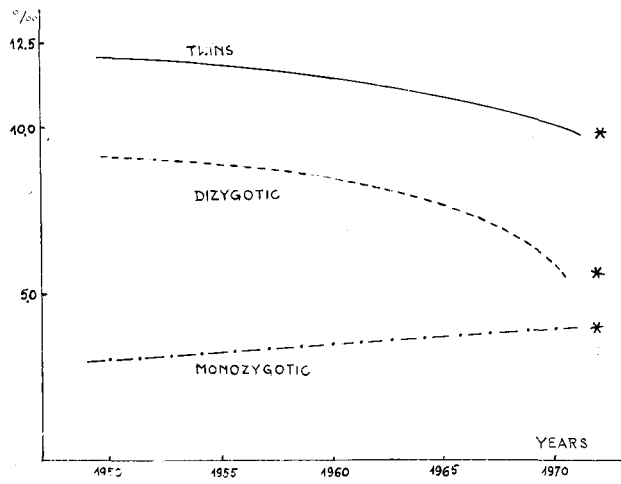


Fig. 4. Frequency of twin births according to zygosity

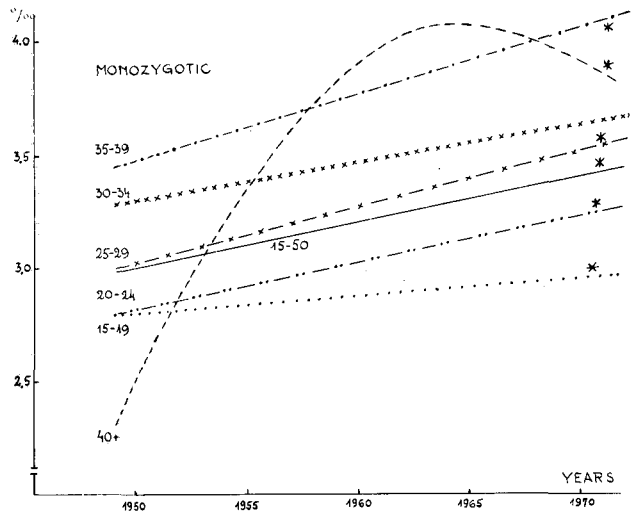


Fig. 5. Frequency of MZ twin births in relation to maternal age

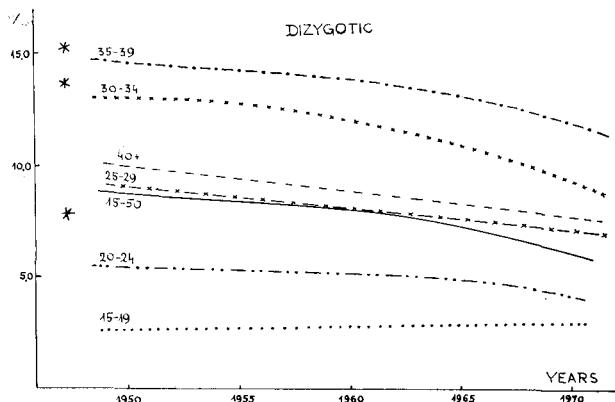


Fig. 6. Frequency of DZ twin births in relation to maternal age

law) has systematically increased. This does not, however, explain the drop in the above-mentioned frequency in the various age groups of mothers (Fig. 6), particularly in mothers over 30 years of age. The other factor exerting a stronger influence on the above-mentioned frequency², is the number of deliveries previously incurred by the individual mothers. For Poland, the author has only data taking into account the parity of the twin birth exclusively for 1958 for over 9000 twin births.

Summing up the demographic factors exerting an influence on the frequency of DZ twin births, the author draws the conclusion that the number of previously incurred deliveries and the age of the woman are the factors exerting the greatest effect on the probability of a polyzygotic pregnancy. The first factor exerts a positive influence, and the second a negative one. The effect of the first factor appears to be stronger, but it seems to decrease with age (Fig. 7). The effect of the second factor is weaker and seems to increase with age (Fig. 8). The actions become equalized between the age of 35 and 39 years, and then the frequency attains a maximum value. In women above the age of 40 years the inhibiting factor predominates, because of the inception of the climacterium process decreasing the probability of polyovulation. In other terms, in two women of similar age, the probability of multiovular pregnancy is greater in the one who had more deliveries; but of two women who had the same number of deliveries, the probability is higher in the younger one.

During the past 15 years a systematic decrease of the average parity of birth was noted. It amounted to 17% in the urban areas and to 10% in the rural areas, and the average was ~30% higher in the rural areas than in the urban areas. Together with the previously discussed change in the age structure of the mothers, this explains the decrease of DZ twin births and the difference between urban and rural areas (Fig. 9).

2. ANALYSIS OF THE FREQUENCY OF TRIPLET BIRTHS

The entire reasoning on the demographic factors conditioning the frequencies of twin births may be probably reported to triplet and to other multiple births. The evaluation of the fraction of the three possible types of triplet deliveries is complicated by the 120 times lower numbers, and the gaps in records which are certainly greater than for twin births. In addition, these gaps are nearly certainly disproportionately distributed on various types of births, being lower for multiovular births (because of the higher vitality of the neonates).

Assuming a probable model of fertilization, the frequency of triplet births should be equal to the square of the frequency of twin births. This is in principle concordant with observation, assuming greater gaps in the recording of triplets than of twins. Clearly visible is the higher sensitivity of the frequency of triplet births to the mother's age, for a similarity of the shapes of regression curves (Fig. 10).

There is a clear-cut drop in frequency of triplet births in the periods compared with the shape of the regression line being maintained (Fig. 11).

As previously noted, the difference in the frequency of twin births between cities and villages has been mainly caused by the difference in parity between rural and urban women.

² This can be proved by comparing the coefficients of partial correlations or of double regression.

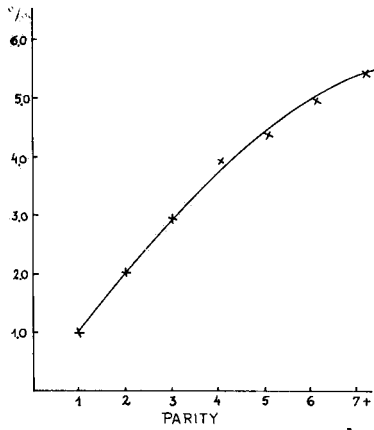


Fig. 7. Frequency of twin births in relation to parity. (1958 data, according to Z. Smolinski).

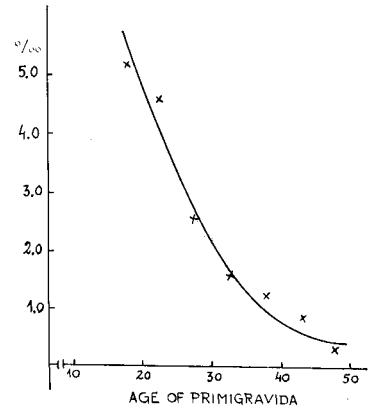


Fig. 8. Frequency of twin births in relation to the age of primipara mothers. (1958 data, according to Z. Smolinski).

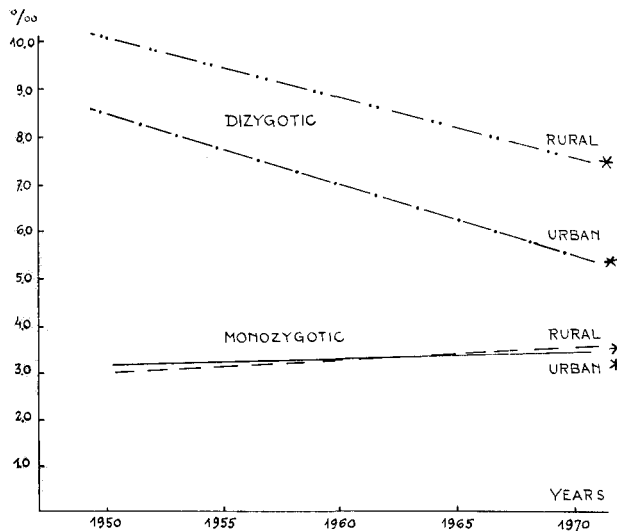


Fig. 9. Frequency of twin births in towns and villages, according to zygosity

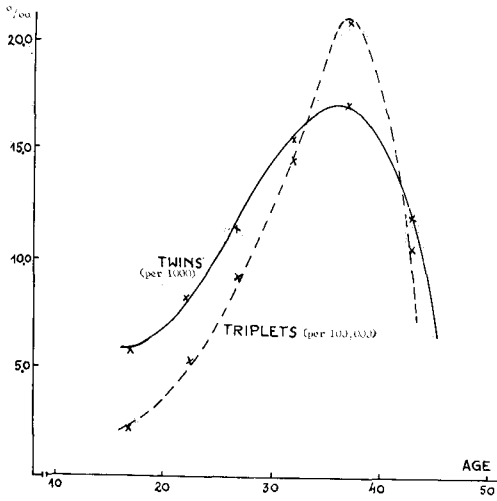


Fig. 10. Frequency of twin and of triplet births in relation to maternal age

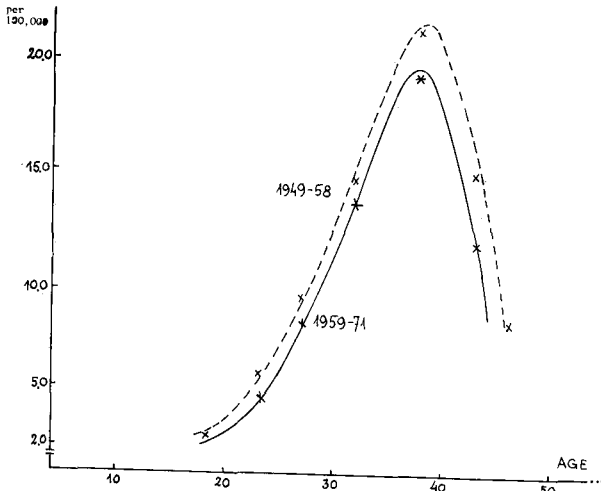


Fig. 11. Frequency of triplet births in relation to maternal age, in the two periods, 1949-1958 and 1959-1971

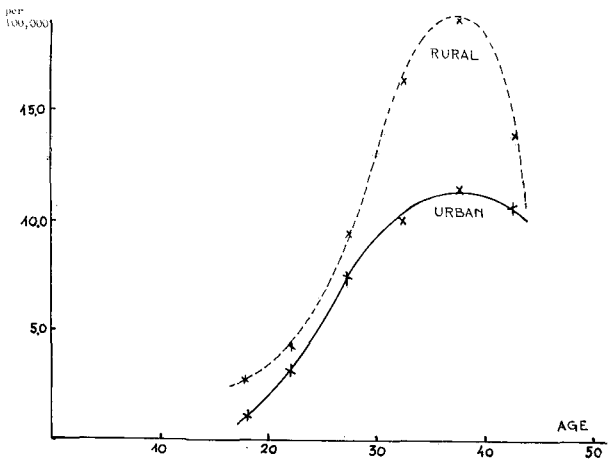


Fig. 12. Frequency of triplet births in cities and villages, in relation to maternal age

This is also true for triplet births. The differences in frequency distinctly increase up to the age of 40, and the differences in parity also beyond this age, but at that time the process of menopause already exerts its influence and induces a breakdown of frequency (Fig. 12).

3. VITALITY OF NEONATES AND THE SECONDARY PROPORTION OF SEXES

In the period under discussion the frequencies of stillbirths in twin, triplet, and quadruplet deliveries were correspondingly three, six, and nine times higher than in single births. In fact, these proportions are probably higher because of the considerable decrease in birth-weight in correspondence with the rise in class of the multiple birth. In every class of multiple delivery it was regularly noted that the frequency of stillbirths and of infants unfit for life grows with the numbers of male births and decreases with the probability of multiovularity of this delivery. In consequence, a multiple birth has a greater chance to remain unrecorded in its class, the more boys are born in this delivery, the higher the class of this delivery, and the more uniovular neonates it contains. Therefore, a decrease of the secondary proportion of sexes, that is, the ratio of male to female births, should be observed with the increase of the class of multiple birth.

This is confirmed in the case of triplet deliveries. Whereas in single deliveries 106 boys in the mean are noted for 100 girls, in triplet births this proportion is 95 to 100. Surprising is the fact that a ratio of over 108 to 100 is noted in twin births. This difference is statistically significant and grows with the age of the mother. It seems that the only way to interpret this phenomenon is to assume that the probability of a pregnancy with MZ males is higher than it results from the probabilistic model of fertilization.

The analysis of regression and correlation was carried out on a Polish-made digital computer of ODRA 1304 type at a significance level of 0.05.