



Twinning Rate in a Southeastern Brazilian Population

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Abstract. The twinning incidence from 1984 to 1993 was investigated in Campinas, State of São Paulo, Brazil, and the analyzed data were combined with previous series from the same population. This study has shown that the mean annual incidences and the standard deviations for DZ, MZ and DZ plus MZ twins for the period of 1984 to 1993 are estimated respectively as 4.7 ± 0.92 , 4.1 ± 1.11 , and 8.8 ± 0.87 per 1,000. In the same period the mean annual incidence of triplets was 0.15 ± 0.16 . It was also shown that the incidence of DZ twins is steadily decreasing since 1925, while the incidence of MZ pairs, after a period of decline is increasing since the sixties, due perhaps to the widespread use of oral contraceptives. Concerning the twinning rate as a whole, it has been shown that its declining trend has disappeared over the last few years.

Key words: Twinning rate, Dizygotic twinning rate, Monozygotic twinning rate, Multiple births, Secular trend, Oral contraceptives, Maternal age, Fecundity

INTRODUCTION

A previous study on the temporal variation of twinning rate (TR) in a Brazilian population, restricted to the period between 1965 and 1985 at five-year intervals, suggested that the decrease in TR observed in this period (24%) might have been a consequence of the efficiency of oral contraceptives [27]. This proposition was reached after taking into account that: 1) the decrease in TR incidence in the examined period was due to a striking decline (50%) in the dizygotic twinning rate (DZTR); 2) the DZTR is positively correlated with parity, independently of age [2, 10, 11, 29, 32]; 3) the analyzed period was coincident with both the increased popularity of the oral contraceptive (OC) method and the decline of parity in Brazil.

In a second investigation [4], carried out to verify earlier trends in twinning rate, records prior to 1965 were analyzed in the same population previously studied [27]. In

this survey it was observed that the decline of the TR is a phenomenon that started long before the introduction of OCs in Brazil. In fact, the decline in twinning from 1925 to 1965 was even stronger than that observed between 1965 and 1985, since in the former period the TR decreased from 20 to 11.6 per 1,000 (42%). As from 1925 to 1965 the mean maternal age did not vary significantly, while the fall of parity was not so high, the decline of twin births in this period was attributed mostly to the decrease in the proportion of Negroid parturients (60%). This hypothesis was based on the fact that the incidence of twin births in this period was highly correlated with the proportion of Negroid mothers, among whom the incidence of DZ pairs is higher than among Caucasoid women in populations in which OCs are not used [29].

The purpose of the present paper is to analyze the trend in DZTR, monozygotic twinning rate (MZTR), and TR in recent years (1984-1993), in the same population studied previously by the same Brazilian authors [4, 27], and to combine the recent data with the previous series.

SUBJECTS AND METHODS

The TR from 1984 to 1993 was investigated from the records of the largest maternity hospital of Campinas, State of São Paulo, Brazil (*Maternidade de Campinas*), that attends women who belong to all socioeconomic classes. During this period 86,804 deliveries were attended, among which 86,028 were singletons, 763 twins, and 13 triplets. These deliveries referred not only to live births but also to stillborn children. The population of Campinas, which counts about one million inhabitants, may be considered representative of southeastern Brazilian populations, as far as socioeconomic and racial composition is concerned.

The TR was defined as the number of twin pair deliveries per 1,000 child births (live births plus stillborn children), excluding fetuses with 500 g or less, classified as abortions. This fetal weight corresponds to a gestation age between 20 and 22 weeks, as well as to 25 cm fetal length [5].

The number of DZ pairs was estimated by Weinberg's rule [34], and the search for curves that best fit for the distribution of the data were performed by using the *Curve Fits*, Version 4.27 program.

RESULTS

Data on single and multiple deliveries covering the period from 1984 to 1993 are shown in Table 1. From the figures in this table, the mean annual DZTR, MZTR, and TR, and the standard deviations were estimated as 4.7 ± 0.92 , 4.1 ± 1.11 , and 8.8 ± 0.87 per 1,000, respectively. The triplet (6 MFF, 4 MMM, 2 FFF, and 1 MF?) mean annual incidence from 1984 to 1993 was estimated as 0.15 ± 0.16 per 1,000.

The regression curves that best fit to the distribution of the annual incidences are shown in Figure 1, in which it is seen that a quadratic regression curve fitted best to the distribution of DZTR (y) during the period from 1984 to 1993, according to the equation $y = 4.6572 + 0.2443 (\text{year}) - 0.0335 (\text{year})^2$. This curve undoubtedly indicates that the

Table 1 - Total number of deliveries (singletons, twins classified according to sex, and triplets) and incidence of multiple births per 1,000 in the *Maternidade de Campinas* from 1984 to 1993

Year	Singletons	MM	FF	MF	DZTR	MZTR	TR	Triplets
1984	8,786	15	39	22	4.96	3.61	8.57	2 (0.23)
1985	9,197	31	26	21	4.53	3.88	8.41	1 (0.11)
1986	9,284	32	30	24	5.12	4.06	9.18	2 (0.21)
1987	7,653	23	22	19	4.92	3.37	8.29	4 (0.52)
1988	8,871	25	27	31	6.92	2.35	9.27	- (-)
1989	8,748	30	21	19	4.31	3.63	7.94	- (-)
1990	8,176	25	27	15	3.64	4.49	8.13	- (-)
1991	7,951	35	30	19	4.73	5.72	10.45	1 (0.12)
1992	8,419	36	32	16	3.76	6.12	9.88	1 (0.12)
1993	8,943	25	27	19	4.21	3.66	7.87	2 (0.22)
Total	86,028	277	281	205	4.72	4.07	8.79	13 (0.15)

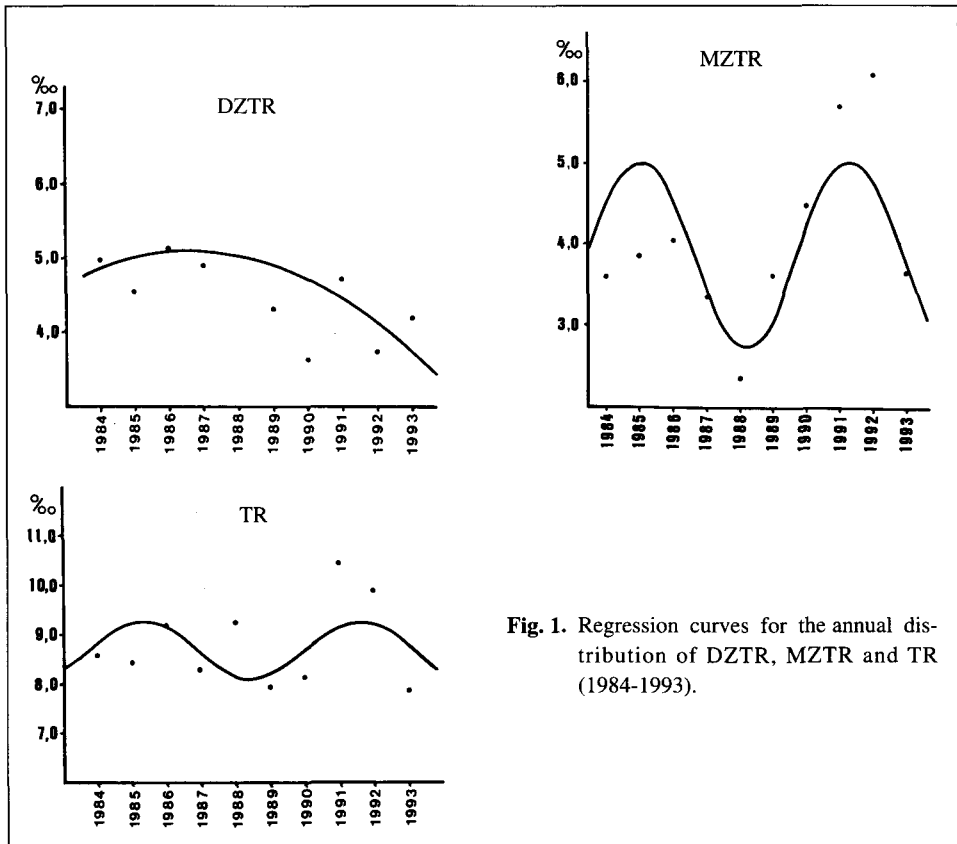


Fig. 1. Regression curves for the annual distribution of DZTR, MZTR and TR (1984-1993).

annual rate of these twins decreased in the period analyzed. Different pictures are obtained by the regression curves that best fitted for the annual MZTR, and TR (y), which are the sinusoidal regressions $y = 3.8669 + 1.1658 \sin(\text{year} - 0.4782)$ for MZ pairs, and $y = 8.6842 + 0.5748 \sin(\text{year} - 0.7446)$ for DZ plus MZ pairs.

DISCUSSION

A sinusoidal regression curve may indicate not only a cyclic variation but also a tendency to stability around a mean value. This seems to be valid for the TR, since the standard deviation calculated for the annual rates from 1984 to 1993, which is the average amplitude (0.87 per 1,000), is only almost 10% of the mean, thus indicating that the TR in the last years reached stability around a mean value of 8.8 per 1,000.

The same interpretation cannot be extended to the MZTR, since the standard deviation (1.1 per 1,000) estimated for the annual rate is 27% of the mean (4.1 per 1,000), being therefore a rather large average amplitude (Fig. 1). On the other hand, the distribution of raw data on MZTR has shown a sharp rise from 1988 to 1992, as seen in Table 1 and Figure 1. This view stimulated us to investigate the distribution of twinning incidence in a larger context. So, by combining the present data with those collected previously [4, 27] from the records of the same maternity hospital, it was possible to obtain a quinquennial distribution of the estimates of TR, DZTR, and MZTR in the city of Campinas from 1925 onwards (Table 2).

Table 2 - Quinquennial incidence of twins from 1925 onwards

Quinquennium	Total births	DZTR	MZTR	TR
1925-1929	1,450	15.2	4.8	20.0
1930-1934	2,820	12.8	4.6	17.4
1935-1939	4,453	14.8	3.2	18.0
1940-1944	5,635	16.3	1.6	17.9
1945-1949	7,719	10.9	2.5	13.4
1950-1954	11,649	7.9	3.4	11.3
1955-1959	15,775	9.0	2.6	11.6
1960-1964	18,251	8.3	3.3	11.6
1965-1969	20,328	7.2	2.9	10.1
1970-1974	28,902	6.6	3.3	9.9
1975-1979	52,450	4.1	2.6	6.7
1980-1984	53,326	5.0	3.8	8.8
1985-1989	44,141	5.2	3.5	8.7
1990-1994	33,799	4.1	5.0	9.1

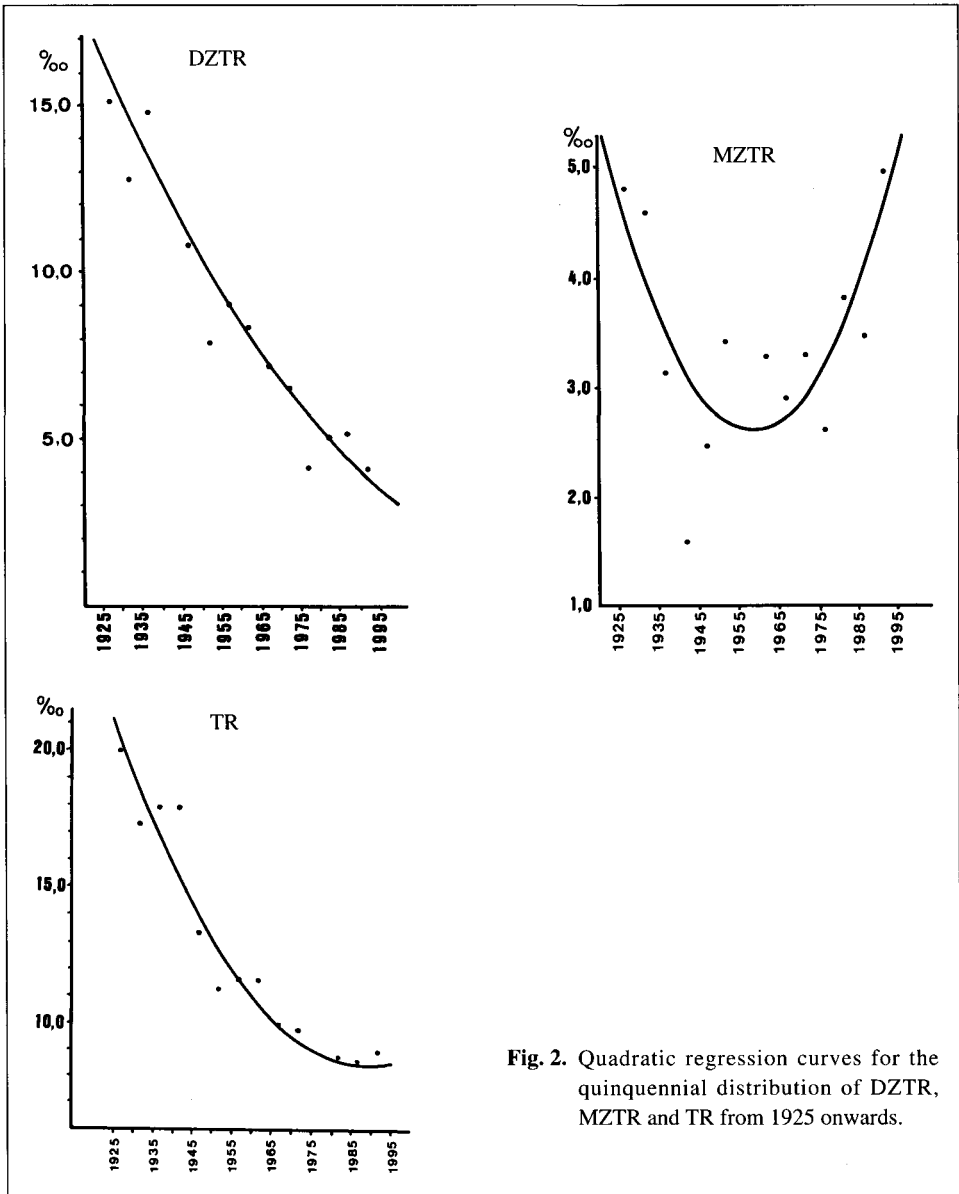


Fig. 2. Quadratic regression curves for the quinquennial distribution of DZTR, MZTR and TR from 1925 onwards.

The curves that best fit the distribution of various types of twinning incidence from 1925 onwards (Fig. 2) were quadratic regressions of the forms $y = 23.9390 - 0.3279 (\text{year}) \pm 0.0012 (\text{year})^2$ for DZ pairs, and $y = 9.1778 - 0.2241 (\text{year}) + 0.0019 (\text{year})^2$ for MZ twins. Obviously, the quadratic regression for DZ plus MZ pairs is $y = 33.1168 - 0.5520 (\text{year}) + 0.0031 (\text{year})^2$.

From Figure 2 it may be concluded that the incidence of DZ pairs has decreased not only from 1984 to 1993, as shown in Figure 1, but that it is falling systematically since 1925. This decline has been so regular that even a linear regression could be used to represent the DZTR from 1925 onwards. The preference for a quadratic regression was merely due to the fact that its standard deviation (1.60) was smaller than that observed for the linear regression (1.67), since in both cases the determination coefficients were identical (0.86).

The decline in DZTR in the last years in the studied population seems to be influenced basically by the significant decrease of both maternal age and parity, which are known to be positively correlated with DZ twinning incidence [1-3, 6,10, 11, 15, 29, 32]. Accordingly (Table 3), the average maternal age is presently almost two years less than that observed thirty years ago ($t_{\infty} = 10.159$; $P \ll 0.001$). The same table shows that the distribution of deliveries varied significantly from the 1950-1965 to the 1984-1993 period ($\chi^2_6 = 282.5$; $P \ll 0.001$; data not shown).

Figure 2 also shows that, after a period of decline, MZTR is rising frankly since the sixties, thus confirming the authors' suspicion drawn out from Figure 1. This increase has also been observed in other populations [2, 9, 11, 13, 21], and has been more conspicuous in countries in which the use of OCs was widespread [9]. Such epidemiological association was explained as a possible consequence of residual effects of long term use of OCs, such as the depression in tubal motility, and the changes in the endometrial mucosa and the oviductal epithelium [9]. Moreover, delayed ovulation occurs frequently in the first cycle after withdrawal of oral contraceptives [33]. All these effects are believed to increase MZ twinning, since delayed implantation of the embryo is associated to polyembryony in armadillos, while delayed ovulation induces MZ twinning in rabbits [7].

The distribution of DZ plus MZ twinning incidence presented in Figure 2 is in accordance with studies performed in several countries, which have shown that the TR has declined in the present century [2, 8, 12, 14, 16-26, 28, 30, 31]. However, if we consider the most recent years, the same figure may be interpreted as showing either that TR has reached steady trend or that a slight rise in TR is beginning. The former interpretation is more conservative and it is in accordance with the sinusoidal regression curve for DZ plus MZ twinning rate for 1984-1993 presented in Figure 1. At any rate, the observed descending tendency in TR for early decades does not exist anymore.

Table 3 - Mean age and mean number of deliveries of mothers sampled in different periods

Period	N.	Age		Deliveries	
		Mean	S.D.	Mean	S.D.
1925-1949	6,840	26.4	6.19	3.02	2.84
1950-1965	11,610	26.6	5.95	2.83	2.17
1984-1993	1,565	24.9	5.83	1.94	1.33

CONCLUSION

Our study allows the following conclusions concerning the twinning incidence in southeastern Brazil:

1. the DZTR, estimated to 4.7 ± 0.92 per 1,000 for the 1984-1993 period, is decreasing since 1925;
2. the MZTR, after a period of decline, is increasing since the sixties, due perhaps to the widespread use of OCs. Its average for the 1984-1993 period has been estimated to 4.1 ± 1.11 per 1,000;
3. the overall twinning incidence as a whole has declined strikingly in the present century, but this trend has disappeared over the last few years, and is now estimated to 8.8 ± 0.87 per 1,000;
4. the mean annual incidence of triplets in the period from 1984 to 1993 is estimated to 0.15 ± 0.16 per 1,000.

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