

FACTORS INFLUENCING THE DECLINE OF TWINNING INCIDENCE IN A SOUTHEASTERN BRAZILIAN POPULATION

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ABSTRACT

The twinning incidence from 1925 onwards was investigated in Campinas, State of São Paulo, Brazil. This study has shown that the decline of the twinning rate is a phenomenon that started in this city much before the introduction of oral anovulatorys in the sixties. The decline in twinning from 1925 to 1965 (42%) seems to be due mostly to a striking decrease (60%) in the proportion of Negroid parturients, together with the decline of parity (9%) of Caucasoid women. Maternal age did not influence twinning incidence from 1925 to 1965. The decline of the incidence of twin births after 1965 in Campinas was influenced by the decrease of parity, of maternal age and of the prevalence of Negroid women in the population.

INTRODUCTION

Studies in several countries have shown that the incidence of twinning has declined in the present century (Jeanneret and MacMahon, 1964; Czeizel and Acsádi, 1971; James, 1972-1986; Elwood, 1973; Eriksson and Fellman, 1973; Kruegger and Propping, 1976; Brackenridge, 1977; Nielsen *et al.*, 1978; Imaizumi and Inouye, 1979; Hémon *et al.*, 1981; Katsouyianopoulos, 1981; Parisi and Caperna, 1981, 1982; Moraes *et al.*, 1989; Allen and Parisi, 1990). This decrease is almost always restricted to dizygotic (DZ) twins, the incidence of monozygotic (MZ) pairs being accepted to be fairly constant in most countries, at about three to four per thousand (Parisi and Caperna, 1981). A few authors have recently observed a slight increase of MZ pairs (James, 1980; Doherty and Lancaster, 1986; Chen *et al.*, 1987; Allen and Parisi, 1990).

Incidence of twinning is positively correlated with maternal age as well as parity independent of maternal age, and most authors agree that these increments are due to an increase in DZ twinning rate only (Bulmer, 1959; Nylander, 1981; Chen *et al.*, 1987; Bertranpetit and Marin, 1988; Picard *et al.*, 1989; Allen and Parisi, 1990).

The proneness of DZ twinning in large families is explained as due to the tendency to polioovulation of twin-prone women, and not merely by numerical odds (Bulmer, 1959; Jeanneret and MacMahon, 1962; Renkonen, 1966; Eriksson and Fellman, 1967; Allen and Schachter, 1971). Twin-prone women would also have a fertility advantage of being more easily fecundable, their average time till conception being 2.2 months shorter than that of mothers of singletons (Allen and Schachter, 1971). These women would be responsible for the rises of twinning incidence in periods of high coital rates, as those just following wars (Jeanneret and MacMahon, 1962; Elwood, 1973; Brackenridge, 1977; Parisi and Caperna, 1982).

In multiracial populations, such as in Brazil, the maternal ethnic composition should also be taken into account, since DZ twinning rate is highest among Negroids, followed by Caucasoids, and lowest among Mongoloids (Imaizumi and Inouye, 1979; Azubuike, 1982; Khoury and Erikson, 1983; Akanlawon and Ejiwunmi, 1986; James, 1986). The higher incidence of DZ pairs among Negroids is attributed to the greater production of hypophyseal gonadotropins by Black as compared to White women (Milham, 1964; Nylander, 1973, 1981).

The only available study on temporal variation of twinning incidence in a Brazilian population (Moraes *et al.*, 1989) was restricted to the period between 1965 and 1985, during which it was observed that the twinning rate of a southeastern Brazilian population decreased 24%, due to a striking fall (50%) in the DZ incidence. They interpreted this drastic fall as due to the efficiency of contraceptive methods introduced in the sixties, since the great decrease in parity of southeastern Brazilian women from 1965 to 1985 was coincident with the popularization of oral contraception. Otherwise stated, the decline of DZ twinning was attributed to the removal of the fertility advantage of the more fecund DZ twin-prone women by limiting the family size to a desired (low) number.

To verify earlier trends we studied records prior to 1965 for the same population studied by Moraes *et al.* (1989).

SUBJECTS AND METHOD

The twinning incidence from 1925 onwards was investigated from the records of the largest maternity hospital of the city of Campinas (State of São Paulo, Brazil). The women who are attended at this maternity hospital belong to all socioeconomic classes of Campinas, and may be considered as representative of southeastern Brazil.

The twinning incidence was defined as the number of twin pair deliveries per 1,000 births, excluding fetuses with less than 22 weeks, which were classified as abortions. The numbers of DZ pairs were estimated by Weinberg's differential method (Weinberg, 1901).

Other concomitant data were maternal age, parity (number of live or stillborn children, abortions excluded), number of abortions, and skin color of the parturients, who were classified as Caucasoids (Whites) and Negroids (Negroes and Mulattoes). Mongoloid women were excluded from this study because of their small number. These data were collected from hospital records from 1925 to 1939 continuously, and at five-year intervals since 1940.

RESULTS AND DISCUSSION

The data covering the period between 1925 and 1990 (Table I) show clearly that the fall of the twinning rate is a phenomenon that started in Campinas before the sixties. As a matter of fact, from 1925 to 1965 the incidence of twin births decreased 42%, falling from 20 to 11.6 per 1,000. Since this decline started much before the introduction of oral anovulatorys, their widespread use after the sixties cannot be considered as the single factor accounting for the decrease of the incidence of twin births in southeastern Brazil.

Table I - Total births and twinning incidence per 1,000 in the Maternidade de Campinas from 1925 to 1990.

Years	Births	Incidence
1925-1929	1,450	20.00
1930-1934	2,820	17.38
1935-1939	4,453	17.97
1940-1944	5,635	17.92
1945-1949	7,719	13.34
1950-1954	11,649	11.33
1955-1959	15,775	11.60
1960-1964	18,251	11.62
1965-1969	20,328	10.08
1970-1974	28,902	9.86
1975-1979	52,450	6.75
1980-1984	53,326	8.83
1985-1989	44,247	9.02
1990	8,352	7.90

Maternal age did not influence twinning rate from 1925 to 1965. As shown in Table II, the mean age of the mothers had a general decrease only after 1965. The mean age has not varied significantly over time among Caucasoid mothers, while among Negroids it has even increased significantly.

Table II - Mean age (\bar{x}) and standard deviation (s) of Caucasoid and Negroid mothers attended at the Maternidade de Campinas from 1935 to 1965, and in 1990.

Period	Caucasoids			Negroids		
	No.	\bar{x}	s	No.	\bar{x}	s
1925-1949	5,644	26.7	6.17	1,196	24.9	6.09
1950-1965	10,912	26.6	5.91	1,408	26.2	6.24
1990	6,684	25.5	5.67	1,476	25.1	6.14

Table III shows that parity suffered a general decline only after 1965. From 1925 to 1965 it declined only among Caucasoids (9%), while Negroids had an increased birth rate.

Table III - Mean parity (\bar{x}) and standard deviation (s) of Caucasoid and Negroid mothers attended at the Maternidade de Campinas from 1925 to 1965, and in 1990.

Period	Caucasoids			Negroids		
	No.	\bar{x}	s	No.	\bar{x}	s
1925-1949	5,646	3.04	2.86	1,196	2.90	2.76
1950-1965	10,202	2.76	2.13	1,408	3.31	2.51
1990	6,684	1.97	1.19	1,476	1.40	1.71

Investigation of the ethnic composition of the parturients showed that the proportion of Negroid women has fallen drastically (60%) from 1925 to 1964, decreasing from 24% to 9.6% (Table IV). This reduction goes on up to the present, as a consequence of the continuous economic changes that have favored immigration (from abroad and also from other places in Brazil) of Caucasoids to Campinas. As seen in Table IV, the proportion of Negroid women was 7.8% in 1980-1984, *i.e.* 19% less than that observed in 1960-1964.

Table IV - Proportion of Negroid mothers among the parturients attended at the Maternidade de Campinas from 1925 to 1984.

Years	Parturients	% Negroids
1925-1929	1,450	24.0
1930-1934	2,820	20.7
1935-1939	4,453	14.7
1940-1944	5,635	18.0
1945-1949	7,719	17.7
1950-1954	11,649	15.5
1955-1959	15,775	10.2
1960-1964	18,251	9.6
1965-1969	20,328	8.3
1970-1974	28,902	10.0
1975-1979	52,450	8.4
1980-1984	53,326	7.8

Taking into account that:

1. the distribution of the incidence of twin births seen in Table I is highly correlated with the proportion of Negroid mothers shown in Table IV ($r = 0.88$);
2. the incidence of twin pairs among Negroids is higher than among Caucasoids, due to a higher DZ twinning rate (Table V); we suppose that the striking decrease in the proportion of Negroid parturients, together with the decline of parity of Caucasoid women have contributed to the decline of twinning from 1925 to 1965.

It is difficult to explain why among Caucasoid women the mean parity during 1950-1965 was lower than during 1925-1949, since the birth control conditions in 1950-1965 were as inefficient as before. The rapid socioeconomic changes due to industrialization in Campinas may, perhaps, as in Italy, have provoked stress, which is known to influence fertility by determining a decline of the sperm count, sperm transport, and rate of ovulation, as well as by increasing prenatal loss (Parisi and Caperna, 1982).

The influence of maternal age and of the prevalence of Negroid women on the decline of the twinning rate after 1965 cannot be discarded without additional proof, since both these variables have shown a significant decrease from 1965 onwards. Otherwise stated, the decline in the incidence of twin births after 1965 cannot be attributed only to the decrease of parity, as suggested previously by Moraes *et al.* (1989).

Presently the frequency of Negroid women may have lost its importance as a factor influencing the twinning rate, since Caucasoid and Negroid women converge to the same mean maternal age (Table II) and mean parity (Table III).

Table V - Incidence of twin births and of DZ pairs per 1,000 among the children born to Caucasoid and Negroid mothers attended at the Maternidade de Campinas, 1925-1965.

Years	Caucasoids			Negroids		
	Births	Twins	DZ	Births	Twins	DZ
1925-1929	1,102	18.15	12.70	348	25.86	22.99
1930-1934	2,235	13.87	9.84	585	30.77	23.93
1935-1939	3,798	17.38	13.69	655	21.37	21.37
1940-1944	4,621	15.36	14.28	1,014	29.59	25.64
1945-1949	6,349	12.76	11.97	1,370	16.06	5.84
1950-1954	9,838	10.27	7.73	1,811	17.12	11.04
1955-1959	14,171	11.43	8.61	1,604	13.09	12.47
1960-1965	19,455	11.51	7.20	2,739	13.51	10.22

Nevertheless, maternal age and parity may not be the sole causes or, at least, the main factors responsible for the decline of twinning rate among Negroids, since these variables have increased among Negroid women from 1950 to 1965, while the incidence of twin births in this ethnic group during this period has not. On the contrary, a decline of this incidence was seen, due to a fall in the DZ twinning rate (Table V). Thus, the correlation coefficient between the twinning rate and the five-year intervals from 1925 to 1964 for Negroids was negative and identical to that calculated for Caucasoids ($r = -0.83$). During the same period the correlation coefficient between the DZ incidence and the five-year intervals was estimated as $r = -0.68$ for Caucasoids and $r = -0.76$ for Negroids. As expected, the incidence of MZ pairs was not significantly correlated with these intervals, neither among Caucasoids nor among Negroids.

Abortion rate among Negroid women did not have an effect since, according to our unpublished data, this rate has varied little from 1925 to 1965 (10.5% from 1925 to 1949, and 10,2% from 1950 to 1965). We could not explain the decline in the incidence in twinning among Negroids.

In some countries the main source of information for secular variation studies in twinning rate are their official publications of vital statistics, which include complete and reliable demographic data. This is not the case for Brazil nor for many other countries, in which researchers are compelled to analyse hospital records. Obviously, such data are biased if twin births are attended preferentially in maternity hospitals. From the late fifties on this bias surely does not exist in Campinas, since deliveries at home became extremely rare in this city. As for the data prior to 1960, it seems improbable that information on

twinning rate obtained in the Maternidade de Campinas are biased, since from 1925 onwards about 70% of all parturients belonging to all social classes of Campinas were attended in this maternity hospital.

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RESUMO

A incidência de gêmeos a partir de 1925 foi investigada em Campinas, Estado de São Paulo, Brasil. Este estudo mostrou que o declínio da incidência de gêmeos é um fenômeno que começou nessa cidade muito antes do início do emprego de anovulatórios orais, na década de sessenta. A queda dos nascimentos gemelares no período entre 1925 e 1965 (42%) parece ser devida, principalmente, a uma acentuada diminuição (60%) da proporção de parturientes negróides e a um declínio da paridade (9%) das mulheres caucasóides. A idade materna não influenciou a incidência de gêmeos no período entre 1925 e 1965. A queda da taxa de nascimentos gemelares depois de 1965 em Campinas foi influenciada pela diminuição da paridade, da idade materna e da prevalência de mulheres negróides na população.

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