

TWINS AND POPULATION STUDIES

National Institute of Neurological Diseases and Stroke, NIH, Bethesda, Md.

**A Survey of Twins in the Population
of a Prospective Collaborative Study****Ntinios C. Myriantopoulos**

This report is concerned with the twin births which occurred in the Collaborative Study of Cerebral Palsy, Mental Retardation and Other Neurological and Sensory Disorders of Infancy and Childhood. This is a collaborative endeavor of 14 institutions throughout the US and the National Institute of Neurological Diseases and Stroke, to observe and study factors which affect the parents before a child is born and to relate them to the outcome of pregnancy. To this end, we are following approximately 60 000 pregnant women from the first months of their pregnancy, through labor and delivery and up to the seventh year of the study child's life. The Study population is about 46% White, 46% Negro, 7% Puerto Rican, and the rest a variety of other ethnic groups. The prospective nature of the study makes possible the recording of observations with high accuracy and the avoidance of biases inherent in other types of investigations. These advantages should also be reflected in the collection and evaluation of twin data.

Tab. I gives a summary of the twins born to Study mothers. In all, 615 pairs of twins were born among 56 249 pregnancies with known outcome (1 : 91.5 births). Among Whites there were 259 twin births in 25 991 pregnancies (1 : 100.3 births); among Negroes, 331 in 26 080 (1 : 78.8 births); and among the Other group, consisting mostly of Puerto Ricans, 25 in 4178 (1 : 167.1 births). The twin birth incidence was higher among Negroes than among Whites, and agrees with previous findings (Strandskov, 1945; Enders and Stern, 1948; Shipley et al, 1967; US Dept. of HEW, 1967). The Other group, however, appears to have a very low incidence of twin births.

The zygosity of 508 pairs of twins was established by comparison of sex, blood types (using nine systems), finger and palm prints, and gross and microscopic examination of the placenta. As shown in Tab. I, 182 pairs were like-sexed MZ, 112 like-sexed DZ, and 204 unlike-sexed DZ. In 107 like-sexed pairs the zygosity could not be established (ZU) for various reasons, and in 10 pairs the sex of one or both twins could not be determined.

When estimated by the Weinberg method, the overall proportions of MZ and DZ pairs were 32.6% and 67.4% respectively, and agree with expectation. In Ne-

Tab. I. Twins in the Collaborative Study

Pairs	White		Negro		Other		Total	
	N.	%	N.	%	N.	%	N.	%
Like-sexed MZ	71	27.4	101	30.5	10	40.0	182	29.6
Like-sexed DZ	51	19.7	55	16.6	6	24.0	112	18.2
Unlike-sexed DZ	84	32.4	115	34.8	5	20.0	204	33.2
Like-sexed ZU	51	19.7	52	15.7	4	16.0	107	17.4
Sex unknown	2	0.8	8	2.4	—	—	10	1.6
Total	259	100.0	331	100.0	25	100.0	615	100.0
All cases with known outcome	25991		26080		4178		56249	
Birth incidence of twins	1/100.3		1/78.8		1/167.1		1/91.5	
‰	10.0		12.3		6.0		10.9	

groes the proportion of DZ pairs was much higher than in Whites (71.2% to 65.4%). Among twins in the Other group the estimate was for a higher proportion of MZ than DZ twins (60% to 40%), but this does not appear to be the result of sampling variation.

Age of mother is a very important parameter, known to influence the rate of twinning. Fig. 1 shows the percent twin births out of all births by age of mother, by race. The curve for all twins shows a sharp increase with age up to the 30-34 age group, then a decline, and again an increase after the 35-39 age group. The curves for Whites and Negroes show the same pattern but with a higher overall twin rate for Negroes in all age groups.

When examined by zygosity (Fig. 2) the MZ twinning rate appears to be rather stable until about 39 years and then to increase sharply. It is slightly higher in Negroes than in Whites, except in the last two age groups.

DZ twinning is higher in Negroes than in Whites, in line with previous observations. In both Whites and Negroes, it increases with age up to the 30-34 age group and then declines dramatically. The curves for ZU twins show the increase and decline characteristic of DZ twins up to the 30-34 age group, and then the sharp increase after 35 in Negroes only, which is characteristic of MZ twins.

Usable information about the placenta was available for 530 pairs. Of these, 9 pairs (1.7%) were monoamniotic, the rest diamniotic. The occurrence of a single amnion is, indeed, infrequent but not as rare as previously reported (Potter, 1963). Of the 159 MZ pairs for whom placental information was available, 48 (30.2%) were diamniotic-dichorionic, and their zygosity could not have been determined without the aid of blood types and other tests.

Fig. 3 shows the distribution of the twins by socioeconomic index, compared to that of the Study population. The index was developed to describe the population of the Collaborative Study (Myrianthopoulos and French, 1968) using the methodol-

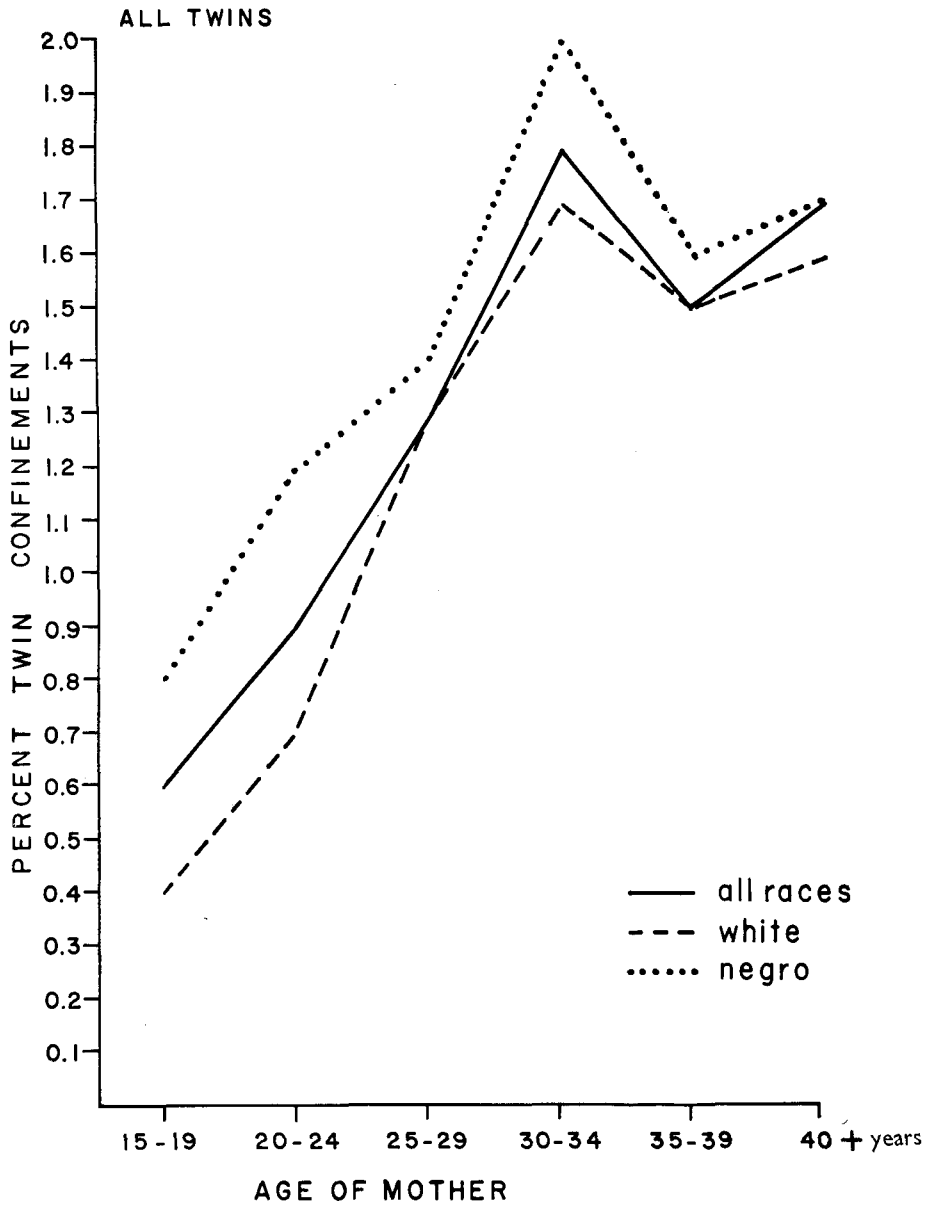


Fig. 1. Frequency of twin births, by race, in relation to maternal age.

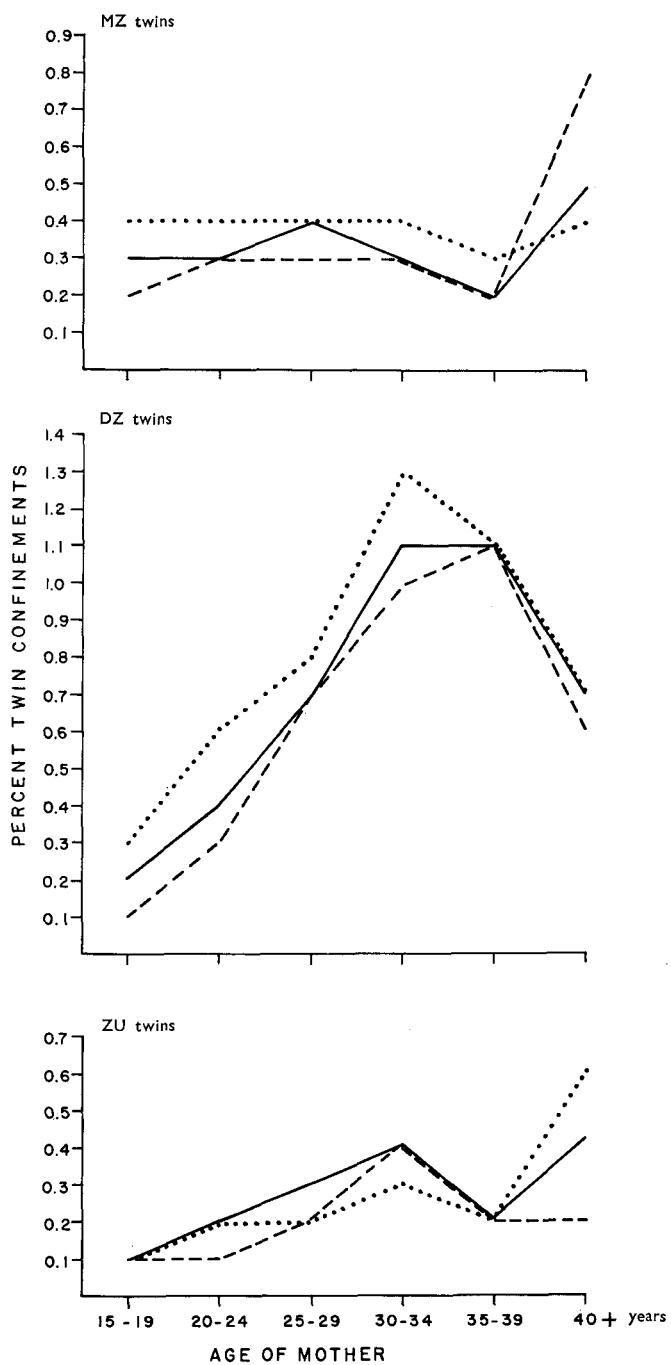


Fig. 2. Frequency of twin births in relation to maternal age, by race and zygosity.

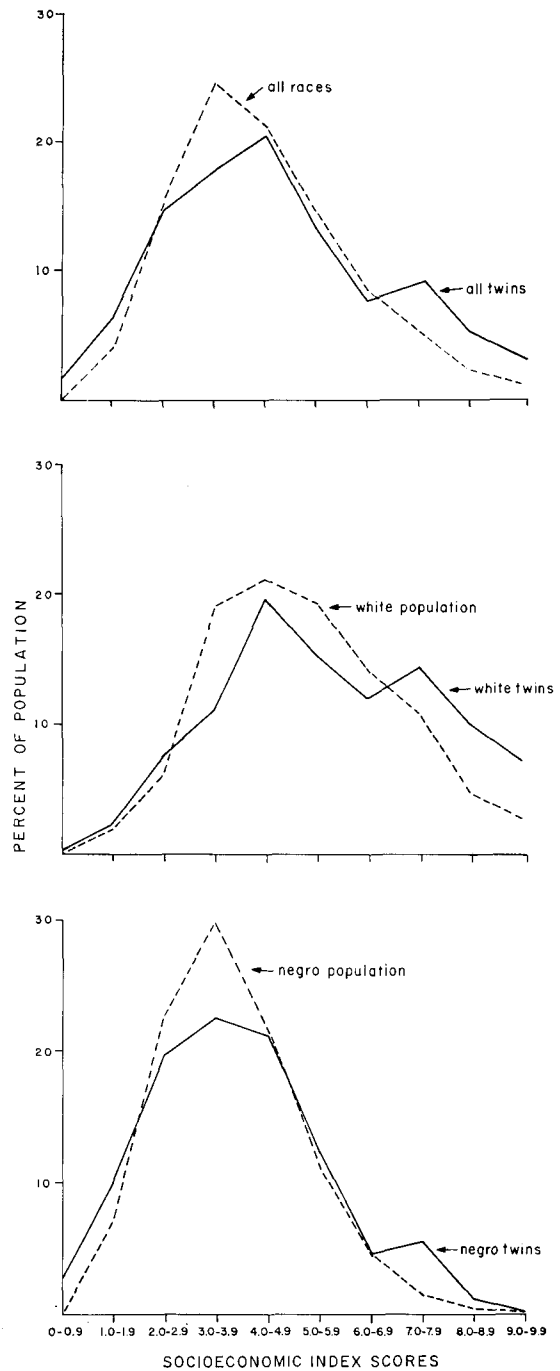


Fig. 3. Distribution of socioeconomic index scores of mothers of twins, by race, compared to that of the Study population.

ogy of the US Bureau of the Census (1963). The scores for the socioeconomic index are given on a scale from zero (low) to 10 (high). The fit is very good except at the extreme right where there is an increase of twins in the 6.0-9.9 socioeconomic range. This seems to imply that mothers in the higher socioeconomic categories have more twins. The curve for Whites shows a pronounced and significant increase in the same socioeconomic categories, and bimodality is evident. The fit of the curve for Negro twins is excellent but shows the same significant increase in the 6.0-9.9 socioeconomic categories. When plotted by zygoty (Fig. 4) the same picture is again obtained. In the higher socioeconomic categories there is a significant increase in MZ, DZ and ZU twins.

The observation of Erickson and Fellman (1967) that in Scandinavian populations the rate of twinning was significantly higher in illegitimate maternities than in legitimate ones, is not clearly borne out in our material. Our data show that the proportion of illegitimate twin births out of all births is slightly higher than the legitimate ones for all maternal age groups, but the differences are not significant.

Fetal and neonatal deaths among the twins (Tab. II) amounted to 17.3% and

Tab. II. Fetal and neonatal mortality of twins by sex

Sex	Pair	N. of births	N. of deaths	% of deaths
♂	Like-sexed	404	93	23.0
	Unlike-sexed	204	23	11.3
Total		608	116	19.1 P < 0.001
♀	Like-sexed	398	56	14.1
	Unlike-sexed	204	24	11.7
Total		602	80	13.3 P > 0.3
♂+♀	Like-sexed	802	149	18.6
	Unlike-sexed	408	47	11.5
	Sex unknown	20	17	85.0
Total		1230	213	17.3 P < 0.003

were significantly higher among like-sexed than among unlike-sexed pairs. While female deaths were slightly higher in like-sexed than in unlike-sexed pairs, the difference is not significant: male deaths were responsible for the higher frequency of deaths in like-sexed pairs, and the difference here is highly significant. The death

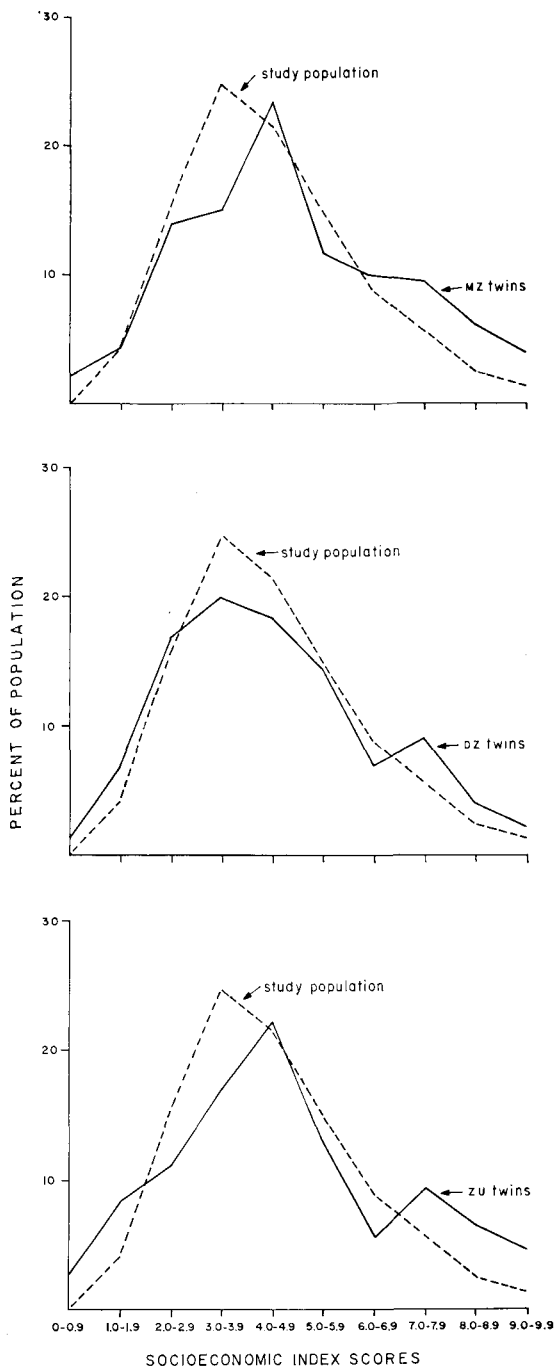


Fig. 4. Distribution of socioeconomic index scores of mothers of twins, by zygosity, compared to that of the Study population.

rate of Negro twins was 17.5% and that of White twins approximately the same (17.8%). The death rate of twins in the Other group was much lower, only 10.0%, but the numbers here are small. The fetal and neonatal death rates in the total Collaborative Study population are 5.6% for Whites, 5.0% for Negroes and 5.7% for Other, with an overall rate of 5.4%.

Mortality was significantly higher in MZ (20.2%) than DZ pairs (14.3%). The mortality of one or both twins of a pair by zygosity could not be calculated directly because of the large number of ZU twins. The mortality of one or both twins of a pair was, therefore, examined by sex distribution. The proportion of like-sexed pairs with two deaths (14.2%) was significantly higher than that of pairs with one death (8.7%). The difference was contributed entirely by the male pairs whose proportion with two deaths was 18.8%, while that with one death was 8.4%. In the female like-sexed pairs there was no appreciable difference between pairs with one and two deaths, the proportions being 9.0% and 9.5% respectively.

Most investigators agree that the second-born twin has a somewhat higher mortality risk than the first, but the data usually include fetal deaths and it does not make sense to assign birth order to fetal deaths. It seems more logical to consider only the neonatal deaths. In our material, among 111 neonatal deaths with known sex, 56 occurred in the first- and 55 in the second-born twin; and among 28 pairs with only one neonatal death, 15 occurred in the first- and 13 in the second-born twin. Obviously, there is no difference in neonatal deaths between first- and second-born twins.

The causes of fetal and neonatal twin deaths, as far as they could be determined, are given in Tab. III. Highest on the list of fetal deaths is abortion. The most com-

Tab. III. Fetal and neonatal twin deaths

Cause of death	Fetal deaths		Neonatal deaths		Total	
	N.	%	N.	%	N.	%
Abortion	44	41.5	—	—	44	20.7
Resp. distress syndrome	—	—	37	34.6	37	17.4
Anoxia, asphyxia	8	7.5	8	7.5	16	7.5
Malformation	4	3.8	10	9.3	14	6.6
Trauma, hemorrhage	6	5.7	7	6.5	13	6.1
Other	15	14.1	40	37.4	55	25.8
Unknown	29	27.4	5	4.7	34	15.9
Total	106	100.0	107	100.0	213	100.0

mon cause of neonatal deaths was respiratory distress syndrome, a disease of prematurity; it accounted for 34.6% of neonatal deaths (17.4% of all deaths). Abortion as a cause of death was low in MZ (3.7%), compared with DZ twins (12.5%). Anoxia was higher in MZ (11.2%) than in DZ twins (6.3%). Malformation was also significantly higher in MZ (9.2%) than in DZ twins (2.1%). Respiratory distress syn-

drome and trauma were about the same in the two groups, although both were lower in ZU twins.

Sex differences were not significant for abortion and respiratory distress syndrome. Males, however, seem to have had higher mortality from anoxia, while females suffered more from malformation and trauma. Trauma as a more frequent cause of death in females is rather difficult to explain, especially when male infants are generally heavier and more prone to trauma during birth. The numbers, however, are small and the difference may well be due to sampling variation. The material on malformations in these twins will be presented in detail elsewhere.

References

- ENDERS, T., STERN, C. (1948). The frequencies of twins, relative to age of mothers, in American populations. *Genetics*, **33**: 263.
- ERICKSON A. W., FELLMAN J. (1967). Twinning in relation to the marital status of the mother. *Acta Genet. (Basel)*, **17**: 385.
- MYRIANTHOPOULOS N. C., FRENCH K. S. (1968). An application of the U.S. Bureau of the Census socioeconomic index to a large, diversified patient population. *Soc. Sci. Med.*, **2**: 283.
- POTTER E. L. (1963). Twin zygosity and placental form in relation to the outcome of pregnancy. *Amer. J. Obstet. Gynec.*, **87**: 566.
- SHIPLEY P. W., WRAY J. A., HECHTER H. H., ARELLANO M. G., BORHANI N. O. (1967). Frequency of twinning in California. *Amer. J. Epidem.*, **85**: 147.
- STRANDSKOV H. H. (1945). Plural birth frequencies in the total, the "white" and the "colored" U.S. populations. *Amer. J. Phys. Anthropol.*, **3**: 49.
- US BUREAU OF THE CENSUS (1963). Methodology and scores of socioeconomic status. Working paper N. 15, Washington, D.C.
- US DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE (1967). Multiple Births, United States - 1964. Public Health Service Publication N. 1000 - Series 21 - N. 14, Washington, D.C.
- N. C. MYRIANTHOPOULOS, Ph.D., Section on Epidemiology and Genetics, Perinatal Research Branch, NINDS, NIH, Bethesda, Md. 20014, USA.