BIRTH WEIGHTS OF SOUTH AFRICAN BABIES

IV. ASSOCIATION WITH MATERNAL AGE

BY

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This paper is a report on the association between birth weight and age of mother. Previous communications have dealt with the effects on birth weight of race, sex, birth rank, and season of birth (Salber and Bradshaw, 1951a, b; 1952).

MATERIAL AND METHODS

The data were collected from various hospitals and nursing homes in Durban, Pietermaritzburg, and Cape Town (as previously described), the numbers considered here being 3,164 European, 1,059 Coloured, 2,188 Bantu, and 1,391 Indian babies. As before, abortions and multiple births were excluded, but in determining the birth rank of the child, abortions were included.

In view of the close relationship between age of mother and birth rank of child, an attempt was made to assess the association of birth weight specifically with each of these variables:

- (i) by determining the mean birth weight for each maternal age group within each birth rank,
- (ii) by recourse to analysis of variance.

The maternal age was taken in 5-year groups from 15 to 35 +. Birth ranks were classified 1, 2, 3, and 4 +. All calculations are for sexes combined, as no significant differences were found between boys and girls.

RESULTS

(1) *Examination of Sub-Group Means.*—The mean birth weight, with standard deviation, for each birth rank in each maternal age group, is shown in Table I (opposite) for the four ethnic groups. There is a steady rise in birth weight with increasing rank, when all maternal ages are grouped; and this trend is also discernible within each maternal age. When all ranks

are combined, association of birth weight with age of mother is not consistent: in the Europeans virtually no difference is found from age to age; in the Coloured and Bantu groups, birth weight appears to increase until the maternal age 30-34 years, with a slight drop in the highest age-group; in the Indian group, there is a steady rise in birth weight with increasing age. When each birth rank is considered separately the following facts may be noted as age increases:

- (a) among first-born Europeans, weight decreases;
- (b) among first-born Coloured, Bantu, and Indians, weight increases;
- (c) among births after the first, weight shows no consistent trend in any of the four groups.

(2) *Analysis of Variance.*—The data were first tested for homogeneity by the procedure described by Kendall (1947), by setting out the mean weights separately for each racial group, as a one-way classification with twenty classes (*i.e.* four birth ranks and five maternal age groups). The variance of the means of the classes and the "residual variance" (*i.e.* that obtained from the pooled data within the twenty classes) were obtained, giving two separate estimates of population variance in birth weight. The significance of the ratio of these was tested by Snedecor's *F*-test. For each ethnic group the difference was significant at the 1 per cent. level, indicating that the data are not homogeneous, *i.e.* variations in birth rank and maternal age together account for a significant proportion of variation in birth weight.

The data were then arranged as a two-way classification:

- (i) An estimate of population variance was

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TABLE I
MEAN BIRTH WEIGHT ACCORDING TO MATERNAL AGE AND BIRTH RANK

Racial Group	Maternal Age	Birth Rank														
		1			2			3			4+			All Ranks		
		No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.	No. of Births	Mean Weight (lb)	S.D.
European	15-19	103	7.52	1.01	8			1						112	7.51	1.02
	20-24	686	7.41	1.10	216	7.61	1.21	34	7.24	1.07	5			941	7.46	1.13
	25-29	479	7.32	1.18	403	7.70	1.09	140	7.80	1.26	29	7.84	1.23	1,051	7.54	1.18
	30-34	197	7.15	1.10	258	7.70	1.09	152	7.80	1.01	64	7.88	1.53	671	7.58	1.16
	35+	85	7.09	1.14	128	7.38	1.24	103	7.74	1.18	73	7.81	1.14	389	7.49	1.21
	All Ages	1,550	7.34	1.13	1,013	7.64	1.14	430	7.74	1.15	171	7.86	1.31	3,164	7.52	1.16
Coloured	15-19	168	6.53	1.06	39	6.52	0.85	7						214	6.50	1.04
	20-24	169	6.63	1.04	136	6.90	1.19	56	7.34	1.00	30	6.93	1.60	391	6.84	1.16
	25-29	43	6.88	1.33	54	6.83	1.03	44	6.99	1.05	89	7.20	1.24	230	7.01	1.19
	30-34	11			21	7.44	0.88	15			74	7.51	1.51	121	7.43	1.32
	35+	3			5			6			89	7.29	1.54	103	7.27	1.50
	All Ages	394	6.63	1.09	255	6.90	1.12	128	7.08	1.08	282	7.29	1.46	1,059	6.93	1.23
Bantu	15-19	220	6.64	1.06	46	6.65	1.30	3						269	6.65	1.10
	20-24	382	6.74	0.95	321	6.96	1.07	130	7.14	1.07	62	7.08	1.56	895	6.90	1.07
	25-29	91	6.99	0.86	156	7.12	1.13	181	7.24	1.11	219	7.40	1.24	647	7.23	1.14
	30-34	5			35	7.02	1.23	38	7.12	0.94	172	7.29	1.22	250	7.23	1.18
	35+	3			4			8			112	7.19	1.09	127	7.18	1.05
	All Ages	701	6.75	0.98	562	6.99	1.13	360	7.19	1.07	565	7.29	1.25	2,188	7.02	1.11
Indian	15-19	197	6.19	1.04	53	6.33	1.26	13			5			268	6.22	1.07
	20-24	168	6.20	0.95	153	6.44	1.07	109	6.58	0.99	100	6.78	1.15	530	6.45	1.05
	25-29	32	6.39	0.95	41	6.60	1.04	41	6.57	1.03	202	6.73	1.42	316	6.66	1.29
	30-34	6			12			11			135	6.72	1.47	164	6.65	1.41
	35+	1			2			1			109	6.91	1.33	113	6.88	1.33
	All Ages	404	6.20	0.99	261	6.43	1.11	175	6.55	0.96	551	6.77	1.36	1,391	6.51	1.19

TABLE II

Racial Group	Variable	F	Degrees of Freedom		Level of significance of contribution to total variance due to variable (per cent.)
			Greater Mean Square	Lesser Mean Square	
European	Maternal Age	1.19	4	3,145	Less than 5
	Birth Rank	10.67	3	3,145	1
Coloured	Maternal Age	3.93	4	1,040	1
	Birth Rank	3.22	3	1,040	5
Bantu	Maternal Age	2.89	4	2,169	5
	Birth Rank	2.33	3	2,169	Less than 5
Indian	Maternal Age	1.31	4	1,371	Less than 5
	Birth Rank	3.45	3	1,371	5

obtained, unbiased by birth rank, assuming homogeneity of birth-weight data with respect to maternal age. The significance of the ratio between this and the independent residual variance obtained previously was tested as before. When this is significant, maternal age *per se* is presumed to introduce a significant degree of heterogeneity into the data.

(ii) This procedure was repeated with the appropriate substitutions to determine the significance of heterogeneity in birth-weight data due to birth rank *per se*. Results of this analysis are given in Table II.

By the method of least squares, parameters were estimated (Table III, overleaf) representing the expected deviation due specifically to maternal age or to birth rank of any particular birth weight from the population mean. These parameters serve as indices summarizing, on a comparative basis, the

TABLE III

(a) PARAMETERS ESTIMATING ASSOCIATION OF BIRTH RANK WITH BIRTH WEIGHT

Birth Rank	Racial Group			
	European	Coloured	Bantu	Indian
1	-0.36	-0.23	-0.22	-0.25
2	-0.02	-0.05	-0.06	-0.05
3	+0.11	+0.11	+0.09	+0.05
4+	+0.27	+0.17	+0.19	+0.24

(b) PARAMETERS ESTIMATING ASSOCIATION OF MATERNAL AGE WITH BIRTH WEIGHT

Maternal Age	Racial Group			
	European	Coloured	Bantu	Indian
15-19	+0.16	-0.31	-0.19	-0.10
20-24	+0.04	-0.08	-0.03	-0.02
25-29	+0.02	-0.03	+0.16	+0.02
30-34	-0.04	+0.31	+0.08	-0.05
35+	-0.18	+0.10	-0.01	+0.14

direction and degree of influence on birth weight of each of the two variables.

Table IIIa shows that birth weight rises steadily with increasing birth rank, independently of maternal age. An interesting feature of Table IIIb is that the European and Non-European patterns are diametrically opposed up to the 25-29 age group. In the European group, birth weight tends to be highest for the young mothers, and to drop steadily with increasing age. In the Non-European groups, birth weight is in general lowest for the young mothers and rises in all three groups to the 25-29 year group. After this the trend is inconsistent; but it appears that among Non-Europeans, mothers of 35+ tend to have heavier babies than young mothers, whereas among Europeans, babies born to mothers of 35+ are much lighter than those of young mothers.

DISCUSSION

There is little published information about the association of age of mother with birth weight.

Duncan (1864) and Griffith and Gittings (1907) stated that the heaviest babies were born to mothers age 25-29. These authors did not assess the separated associations of birth weight with age of mother and birth rank.

Donald (1939) stated that:

age of mother had no apparent effect on the weight of first-born children, but may have had a slight

influence on second-born children, mothers about 30 years old having the heaviest.

Uttley (1940), investigating the weights of Chinese babies, stated:

the older the mother, the heavier is the baby.

But in his results ranks were combined, and no consistent relationship was apparent on examination of his data for each rank separately.

McKeown and Gibson (1951) concluded that:

- Weight increases with parity.
- There is no consistent association between weight and maternal age when birth rank is fixed.

Solth and Abt (1951), working on a German and Swiss population over the last 50 years, found that:

mean birth weight increases with age of mother up to 35 years, and then decreases slightly. The increase is in both primiparae and multiparae. Of the three factors, age of mother, parity, and sex of child, parity has the greatest effect on birth weight.

Karn and Penrose (1951) found that birth weight increases with parity, but decreases slightly with mother's age.

The differences between European and other groups in the association of birth weight with maternal age, to which we have drawn attention, may be in part due to the likelihood that influences of maternal age and birth rank are not strictly additive, but depend on their inter-relationship. In this connexion it is of some interest to record that the product-moment coefficient of correlation between age of mother and birth rank was found to be relatively low in Europeans (+0.46 as against +0.72, +0.72 and +0.77 for Coloured, Bantu, and Indian groups respectively).

SUMMARY

(1) Birth weights of infants were studied with special reference to association specifically with age of mother. The material comprised 3,164 European, 1,059 Coloured, 2,188 Bantu, and 1,391 Indian babies.

(2) When age of mother is fixed, there is a steady increase in birth weight with increasing rank in all racial groups.

(3) When rank is fixed, as age increases the following facts are apparent:

- among first-born Europeans, weight decreases;
- among first-born Coloured, Bantu, and Indians, weight increases;
- among births after the first weight shows no consistent trend in any of the four groups.

(4) The correlation between age of mother and birth rank is much higher for the three non-European groups than for the Europeans.

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