OBSERVATIONS ON ALL BIRTHS (23,970) IN BIRMINGHAM, 1947

V. BIRTH WEIGHT RELATED TO ECONOMIC CIRCUMSTANCES OF PARENTS

BY

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This communication presents evidence on the association of the birth weight of children born in Birmingham during 1947 with the economic circumstances of their parents. This matter was considered by Baird (1945), who recorded differences in the proportion of infants born prematurely (as identified by weight) in nursing home, hospital, and specialist practice, and more recently by Douglas (1950), who noted slight but unimportant weight differences between children of professional and manual workers. Such comparisons clearly require some consideration of the effect of birth rank (as provided by Douglas, who dealt separately with first and later births), since weight is correlated with birth rank and the proportion of individuals in each birth rank is not constant in different economic groups.

As indices of the economic circumstances of the parents we have used a classification of Birmingham wards into three groups of which details were provided by Record and McKeown (1949). Briefly, the city wards were classified using data from:

- (1) The Housing Survey Report (1946), which gave for each ward the number of houses:
 - (a) back to back
 - (b) with bathroom
 - (c) with bath
 - (d) municipally-owned.
- (2) The Birmingham City Statistical Office, which supplied the average rateable value for each ward.
- (3) The Town Planning Department, which gave the surface area of each ward, from which were calculated (by wards):
 - (a) housing densities
 - (b) population densities, using the ward population given in the Report of the Medical Officer of Health, 1947.

This classification is essentially based on the standard of housing, which provides an index of the economic circumstances of residents. As might be

TABLE I
PERCENTAGE DISTRIBUTIONS OF BIRTHS BY WEIGHT

Birth Weight		Ward Group					
Pounds	Half-pounds	I		II		III	
		Number	Per cent.	Number	Per cent.	Number	Per cent.
1	2	1	0.10	3	0.10	—	0.13
	3	7		7		5	
2	4	20	0.54	21	0.45	7	0.46
	5	25		23		11	
3	6	28	0.67	27	0.64	13	0.94
	7	28		36		24	
4	8	73	2.04	69	1.60	24	1.52
	9	97		87		36	
5	10	219	7.43	248	6.60	99	6.48
	11	399		396		157	
6	12	852	24.37	852	21.95	350	22.91
	13	1,174		1,291		555	
7	14	1,557	34.66	1,928	36.30	786	35.89
	15	1,324		1,616		632	
8	16	1,199	21.12	1,483	22.82	602	23.66
	17	557		745		333	
9	18	410	7.00	516	7.37	185	6.07
	19	171		204		55	
10	20	122	1.80	146	1.91	59	1.77
	21	28		41		11	
11	22	12	0.23	18	0.21	6	0.18
	23	7		3		1	
12	24	2	0.02	1	0.02	—	—
	25	—		1		—	
Over 12	Over 25	1	0.01	—	—	1	0.03
Number of Births		8,313	100	9,762	100	3,952	100
Mean (lb.)		7.38	—	7.46	—	7.43	—
Error of Mean		0.014	—	0.013	—	0.019	—
Standard Deviation		1.28	—	1.25	—	1.22	—

Of 22,454 births (see Table III, Part II), 323 are excluded as previously indicated, and 104 others because the ward group was not known.

expected, the ward groups so identified differ considerably in respect of live birth rates and infant mortality rates, as is indicated by data for 1946-47 which are as follows:

Ward Group	I	II	III	All Wards
Birth Rate	25.7	21.0	19.7	22.4
Infant Mortality Rate	49.2	36.5	33.1	40.4

1947 births were assigned by place of domicile to one of the three groups; Table I gives percentage distributions by weight and the mean weights of births in each group. Of the original 22,527 births of known weight (97 per cent. of all single births in Birmingham during 1947), the following have been excluded:

- (a) 73 in which the duration of gestation was less than 28 weeks
- (b) 323 as indicated in Table III, Part II
- (c) 104 for which ward group was not known.

Mean birth weight is slightly but significantly lower in Group I (in which housing standards are poorest) than in either of the other two groups; the difference in mean weights between Groups II and III is not significant. Weight distributions have also been compared by grouping births by weight in lb. (less than 4; 4—; 5½—; 7—; 8 and over). The χ^2 test gives values for p as follows:

I compared with II and III $p < 0.0001$
 II compared with III $p \approx 0.5$.

We may now inquire whether these results are influenced by the differences in birth-rank constitution of births in the three ward groups exhibited in Table II, in which it is shown that the proportion of births at low birth ranks is highest in wards with better housing. Table III (overleaf) gives mean weights by birth rank, and shows the well-known increase in weight from the first to the third birth. Hence it might be expected that the difference in mean weights already noted in Table I

TABLE II
 PERCENTAGE DISTRIBUTION OF BIRTHS BY BIRTH RANK

Birth Rank	Ward Group							
	I		II		III		Total	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
1	2,746	35.59	3,560	40.89	1,615	45.18	7,921	39.61
2	2,217	28.74	2,517	28.91	1,012	28.31	5,746	28.73
3	1,213	15.72	1,209	13.88	509	14.24	2,931	14.66
4 and over	1,539	19.95	1,421	16.32	439	12.23	3,399	17.00
Total ..	7,715	100	8,707	100	3,575	100	19,997	100

Ward group was unknown in 104 of 20,101 births of known birth rank (see Table V, Part II).

TABLE III
MEAN BIRTH WEIGHT RELATED TO BIRTH RANK

Birth Rank	Ward Group			
	I	II	III	Total
1	7.08 ±0.024	7.23 ±0.020	7.20 ±0.031	7.17 ±0.014
2	7.41 ±0.027	7.50 ±0.025	7.52 ±0.038	7.46 ±0.017
3	7.65 ±0.036	7.64 ±0.037	7.71 ±0.053	7.65 ±0.026
4 and over	7.58 ±0.037	7.77 ±0.037	7.61 ±0.070	7.65 ±0.026
All Birth Ranks	7.38 ±0.014	7.46 ±0.013	7.43 ±0.019	7.43 ±0.008

would be increased when births in the same rank are examined. The effect is mainly on first births, for which the means are:

7.08 in Group I
7.23 in Group II
7.20 in Group III

The differences between Groups I and II are also substantial at birth ranks "4 and over", but as numbers are smaller the standard errors are considerably greater.

Another question of interest in this context is the relation between duration of gestation and economic circumstances of parents. It is commonly stated that the incidence of "premature" birth is higher among poorer mothers, but the index of maturity in such calculations has invariably been birth weight. Any substantial difference in the distributions by duration of gestation would, of course, influence weight at birth. Table IV gives the distribution of births by duration of gestation for each of the three ward groups. There are no significant differences in the means, which are:

280.76 in Group I
280.73 in Group II
280.58 in Group III

The data suggest that there are no conspicuous differences in the percentage distributions, and when the births are grouped by duration of gestation in weeks (35 and under; 36—; 39—; 42 and over) the χ^2 test gives $p \approx 0.5$. Finally the association between mean weight, duration of gestation, and ward group is considered in Table V. There is here no consistent relationship between weights of births in each group.

TABLE IV
PERCENTAGE DISTRIBUTION OF BIRTHS BY DURATION OF GESTATION

Duration of Gestation (weeks)	Ward Group					
	I		II		III	
	Number	Per cent.	Number	Per cent.	Number	Per cent.
28	5	0.08	8	0.11	3	0.10
29	3	0.05	10	0.14	3	0.10
30	7	0.11	11	0.15	5	0.16
31	23	0.36	14	0.19	13	0.42
32	14	0.22	21	0.29	8	0.26
33	34	0.54	30	0.41	12	0.39
34	44	0.69	43	0.59	24	0.78
35	99	1.56	125	1.72	41	1.34
36	191	3.01	178	2.45	66	2.16
37	290	4.57	332	4.57	137	4.47
38	554	8.73	651	8.96	273	8.91
39	1,266	19.95	1,487	20.46	625	20.41
40	1,792	28.24	2,034	27.99	937	30.60
41	1,142	18.00	1,335	18.37	534	17.44
42	524	8.26	660	9.08	230	7.51
43	212	3.34	188	2.59	94	3.07
44	98	1.54	91	1.25	39	1.27
45	47	0.74	47	0.65	18	0.59
46	1	0.02	4	0.06	—	—
Number of Births ..	6,346	100	7,269	100	3,062	100
Mean (days)	280.76	—	280.73	—	280.58	—
Error of Mean	0.18	—	0.17	—	0.25	—
Standard Deviation ..	14.36	—	14.14	—	14.05	—

Ward group was unknown in 72 of the 16,749 births referred to in Table III, Part II.

TABLE V
BIRTH WEIGHT RELATED TO DURATION OF GESTATION

Duration of Gestation (weeks)	Ward Group					
	I		II		III	
	Number of Births	Mean Weight (lb.)	Number of Births	Mean Weight (lb.)	Number of Births	Mean Weight (lb.)
28—	8	2.00	18	2.33	6	2.33
30—	30	3.07	25	2.96	18	2.83
32—	48	3.79	51	3.65	20	3.65
34—	143	5.34	168	5.37	65	5.49
36—	481	6.25	510	6.18	203	6.18
38—	1,820	6.74	2,138	6.88	898	6.86
40—	2,934	7.22	3,369	7.23	1,471	7.19
42—	736	7.31	848	7.39	324	7.25
44—	146	7.34	142	7.39	57	7.38
Total	6,346	—	7,269	—	3,062	—

SUMMARY

The standard of housing has been used as a basis of classification of Birmingham city wards into three groups, to which single births for the year 1947 have been allocated by place of domicile. It is shown that birth weight is slightly but significantly lower in the poorest group than in the other two groups. This difference is not accounted for by differences in the birth rank of births in each group, and is greater when first births are compared. There are no differences in duration of gestation, as measured by the mean and percentage distribution.

REFERENCES

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