Family factors affecting child development

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Neligan, G. A., and Prudham, D. (1976). *Archives of Disease in Childhood*, 51, 853. **Family factors affecting child development.** In a large, geographically defined population of children a number of family factors in addition to social class, determined by the father's occupation, were recorded by health visitors and school nurses with routine responsibility for these children. The quality of the children in normal schools was assessed in terms of nonverbal IQ and height at the ages of 5 and 10 years, and of behaviour as reported by the teacher at the age of 10 years. By analysis of variance the sum of the independent effects of the other family factors greatly outweighed that of occupational social class, except in the case of the IQ at 10 years. The most important of the other family factors was the quality of the mother's care of her child during the first 3 years of life.

The child's social class of origin, defined in terms of his father's occupational group, was described by Birch *et al.* (1970) as being 'perhaps the most effective single criterion available and the one most frequently used in socio-medical research' concerned with the development of children. It has produced interesting results in studies of large, geographically defined populations (Davie, Butler, and Goldstein, 1972; Neligan, Prudham, and Steiner, 1974). However, the nature of the father's work cannot directly affect his child's development in the majority of cases because he is physically removed from the child's environment when he is at work. Social class, which can be derived from his occupation by referring to the Registrar General's Classification of Occupations, must be acting as a label for the factors in the child's environment which really are capable of producing a direct effect. We have attempted to identify and evaluate some of these, partly in an attempt to find out what is truly happening, and partly in the hope of finding ways in which children's development can be favourably affected by modifying aspects of their environment which are likely to be more accessible to us than their father's occupation.

Material and methods

In the Newcastle Survey of Child Development we obtained useful information about the subsequent pro-

gress of 97.8% of the children born to mothers resident in our city during the years 1960-62, who survived the first month of life (Neligan *et al.*, 1974). Extra social information is available concerning the children born in 1961-62 for whom the city's health visitors completed a third year proforma (to supplement the information already available through their first and second year proformas). These data form the basis of the analyses whose results are reported in this paper. We have deliberately excluded the children who were born of a multiple or an illegitimate pregnancy because of the peculiar problems of environment and follow-up which they pose. The number of children covered by our different analyses are shown in Table II.

Some of the data from which we have derived our results need no explanation (e.g. sex of child, birthweight, number of older children in the family). The child's social class of origin was derived from the father's occupation by referring to the Registrar General's Classification of Occupations for the 1951 census (General Register Office, 1956), but we have combined social classes I and II, and IV and V, to avoid having unduly small numbers of children in some cells, and have subdivided social class III into A (nonmanual) and M (manual). The remaining items were defined as follows.

Family factors.

(a) The quality of the mother's 'care of child'. This was assessed by the health visitor when the child was 3 years old. The instructions stated, 'This is intended to include adequacy of food and clothing and of supervision by a responsible adult or older child: cleanliness: seeking appropriate help in case of illness: evidence of affectionate parental interest in the child', and was graded A (good on all counts), B (average), or C (poor). The reasons for regarding this factor as potentially important

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are, we believe, self-evident. The problem was how to define it, and in retrospect we wish our definition had been narrower.

(b) 'Prolonged absence' and 'incapacity' of a parent were also reported in the third year proforma. We have combined these two factors, which were reported separately, into one item for analysis, as they were so often closely related; for instance, a parent incapacitated due to psychiatric disorder was liable to prolonged absence in hospital. No strict definition of the duration of a significantly 'prolonged' absence was laid down; this was left to the health visitor's judgement, as was the severity of any 'incapacity'. She reported them if she judged that they were sufficient to interfere with the child's development. We included these factors as possible causes of emotional deprivation or lack of education within the home.

(c) 'Contact with specified social agencies'. The health visitor's instructions specified 'The Courts, the Probation Officer, the NSPCC, the National Assistance Board, the School Attendance Officer (for older children in the family)'. We recorded these as indicators of poor social relationships, poor socioeconomic status, or general disorganization of the families concerned.

(d) 'Number of immunizations' by the age of about 5 years. This was reported by the school nurse and we requested it as an indicator of the extent to which the mother had taken advantage of the freely available health facilities. The maximum (optimum) was 9, but for analysis we grouped the children as having had 0, 1-6, or 7+ immunizations.

Measurements of performance.

(1, 2) Standardized height at about 5 and about 10 years. Measurements were made by school doctors and/or nurses (or by our own staff in the private schools), and were standardized to ages of 5 years (mean

height 106.3 cm) and 10 years (mean height 135.3 cm), respectively.

(3) IQ at the age of 5 years was derived from the Goodenough Draw-a-man Test, administered by the children's own teachers as part of a group 'drawing test', and the results scored by our survey staff in accordance with the original instructions (Goodenough, 1926). The mean score for our population was 112.6.

(4) Nonverbal IQ at the age of 10 years was derived from the Test 5/BD of the National Foundation for Educational Research (1965), administered as a group test in the normal schools and scored by our staff. The mean score for our population was 94.5. Children who were in special schools for the educationally or severely subnormal were not assessed in this way and are not included in our results at the age of 10 years.

(5) Behaviour assessed by the teacher at the age of 10 years. The proforma B(2) was completed by the child's own teacher and scored by our staff in accordance with the instructions of Rutter (1967), a score of 9 or more being regarded as 'abnormal'.

The use of appropriate *methods of statistical analysis* is of crucial importance in a study of this kind, where our purpose was to identify and evaluate the extent to which the effects upon child development which have often been attributed to differences in their social class of origin may actually be caused by environmental factors that act more directly and can be modified more easily by members of the health services. Factors (a)-(d) above, and the number of children in individual families, are examples of such environmental factors. Their relationships with 'social class' in our population are shown in Table I, where the more favourable gradings(s) of each factor are placed above the less favourable. In the case of two factors this decision was based on published evidence. Neligan *et al.* (1974) illustrated the progressive disadvantage in height and IQ associated

TABLE I
Percentage of favourable/unfavourable gradings of five social factors, related to social class

Factors	Social class			
	I + II	IIIA	IIIM	IV + V
No. of older children				
0	33.5	32.5	30.0	25.8
1-3	57.3	57.3	56.4	54.0
4+	9.2	10.2	13.6	20.0
Mother's care of child at age of 3 years				
A	75.8	60.8	45.4	29.3
B	23.3	38.6	51.0	64.1
C	0.9	0.6	3.6	6.7
Prolonged absence or incapacity of either parent				
No	94.6	95.2	90.3	86.9
Yes	5.4	4.8	9.7	13.1
Contact with specified social agencies				
No	97.9	96.1	93.4	79.1
Yes	2.1	3.9	6.6	20.9
No. of immunizations by age of 5 years				
7+	87.8	83.4	73.1	56.0
1-6	7.4	10.9	16.7	24.6
0	4.8	5.9	10.2	19.4

IIIA, nonmanual; IIIM, manual.

with 'care of child' grades B and C, and with increasing numbers of previous children. It is a striking and consistent feature of the table that the proportion of favourable gradings of each factor progressively falls and the proportion of unfavourable gradings rises as we move from social classes I and II to IV and V. Clearly social class could act as a very effective label for each of these five factors, which can be regarded as labels for different aspects of the children's immediate environment.

Furthermore, it follows from this simple observation that there are likely to be systematic associations between the five factors themselves, with a tendency to 'clustering' of the favourable grades in some children and of unfavourable grades in others. This was confirmed by Neligan *et al.* (1974), whose Tables 8.5 and 8.6 show a progressive decrease in the proportion of children with an intermediate or optimal number of immunizations and a progressive increase in the proportion with larger numbers of older sibs in the 'care of child' grades B and C, within social class groups. In other words, the mothers whose general standard of care of their children was graded as least satisfactory by

their health visitors tended to make less use of the freely available services and to have larger numbers of children.

When the relation between a number of factors are as complicated as this, the only way in which we can hope to identify, let alone evaluate and compare, the independent effects of the individual factors is by using a method of multivariate analysis which allows for the effects of all other factors which appear relevant in each case. The method used and discussed by Davie *et al.* (1972) and by Neligan *et al.* (1974) appears most suitable for this purpose. In addition to social class and the five family factors discussed, we have included two biological factors in our analyses because we previously showed that they produced significant independent effects in our population: these are the child's sex and birthweight (Neligan *et al.*, 1974).

Results

In Table II we have summarized the results of our analyses of variance in terms of the independent effects of each of the eight factors upon the children's height and IQ at the ages of 5 and 10

TABLE II

Results of analysis of variance to identify the independent effects of 2 biological and 6 family factors after allowing for the effects of the other 7 variables in each case

Factors	Goodenough IQ at 5 years	Nonverbal IQ	Height (cm)		Behaviour % abnormal
		At 10 years	At 5 years	at 10 years	
(a) Sex					
Female	2.8	0.6	-0.4	-0.3	-4.0
Male	-2.8*	-0.6	0.4*	0.3†	5.1*
(b) Birthweight					
4.0+	2.8	2.4	2.8	3.6	0.3
2.5-	0.4*	-0.1*	-0.1*	0.1*	-0.9†
2.5	-3.2	-2.3	-2.7	-3.7	0.6
(c) No. of older children					
0	-0.1	0.3	1.0	0.9	-0.3
1-3	0.8	0.6	0.1*	0.3*	0.2
4+	-0.7	-0.9	-1.1	-1.2	0.1
(d) Care of child					
A	2.8	3.1	0.5	0.5	-5.0
B	0.7*	0.2*	-0.2*	-0.2†	-1.1*
C	-3.5	-3.3	-0.3	-0.3	8.2
(e) Parental absence/incapacity					
No	1.4	0.9	0.1	0.2	-1.9
Yes	-1.4	-0.9	-0.1	-0.2	2.1*
(f) Contact with specified agencies					
No	1.4	1.3	0.3	1.8	-2.5
Yes	-1.4†	-1.3†	-0.3‡	-1.8*	2.9*
(g) No. of immunizations					
7+	1.4	3.1	0.7	0.7	-4.3
1-6	-0.6†	-0.3*	-0.1*	-0.1*	1.0*
0	-0.8	-2.8	-0.6	-0.6	4.4
(h) Social class					
I+II	3.8	7.1	0.8	0.7	-4.8
IIIA	1.2	0.8	0.6	0.8	-1.2
IIIM	-1.1*	-2.5*	-0.4*	-0.6*	1.2‡
IV+V	-3.9	-5.4	-1.0	-0.9	6.7
Overall mean	112.6	94.5	106.3	135.3	15.4
Standard deviation	17.7	14.8	5.2	6.4	
Overall constant	108.4	91.4	105.6	133.7	
No. of children	4524	3788	4651	3443	4146

* $P < 0.001$ (very highly significant); † $P < 0.01$ (highly significant); ‡ $P < 0.05$ (significant).

years, and upon their teachers' assessment of their behaviour at the age of 10 years. In this sense the word 'effect' is intended to imply a statistical rather than a direct causal relation.

It can be seen that six of the eight factors have a significant independent effect upon all five measurements of performance. There are two exceptions. (1) The number of older children in the family. This has a highly significant effect upon the two measurements of height only, suggesting that increasing competition with older sibs adversely affected our children's physical nutrition to a greater extent than their intellectual and behavioural development. (2) The prolonged absence or incapacity of a parent during the child's first 3 years has a highly significant effect upon the behaviour measurement only (though the direction of the effects upon both height and IQ is also adverse). Whether through lack of precept and example, or through emotional disturbance, this factor appears to have affected behavioural development significantly more than intellectual or physical development.

The remaining six factors (2 'biological' and 4 'family') have a significant effect upon each of the five measurements of performance. The spread of the effects is very wide, therefore, and its direction for each of the five dependent variables is almost uniformly the same in the case of each factor: the most obvious exception being that female sex has what is commonly regarded as an adverse effect upon height, in contrast with its favourable effect upon the other four variables.

If we look at the absolute effects of the individual factors (in terms of IQ points, cm of height, or percentage with 'abnormal' behaviour) they may seem too small to be of practical significance: but, because they are independent of each other (as a result of the method of analysis used), they can be added together to produce surprisingly large net effects. Confining ourselves to the sum of the effects of the six family factors (c-h in Table II), since these are our main interest, we find that a child with the most favourable grading in all six would be expected to have an IQ at the age of 5 years 23.3 points ($1.3 \times$ standard deviation) higher than a child with the least favourable grading in all six. At the age of 10 years the comparable figures for IQ are 30.7 points and $2.1 \times$ SD. The equivalent effects upon height are 6.8 cm ($1.3 \times$ SD) at 5 and 9.8 cm ($1.5 \times$ SD) at 10 years. The results for behaviour cannot properly be treated in this way, since they are expressed in terms of the proportion who were 'abnormal' rather than in terms of the absolute scores, since the distribution of these was

considered to be too skewed (20% of boys and 30% of girls scored 0, and the mean for the population was 4.1 out of a maximum possible of 52).

Discussion

Our main objective in carrying out this series of analyses is to learn more about the absolute and relative importance of various factors in determining the quality of our schoolage children. We have focused on what we have called 'family' factors, of a relatively simple kind, so that adequate assessments can be made by the routinely responsible members of the health service. Within this field we have been particularly interested to see how other factors compare in importance with 'social class', which has been the commonly accepted way of defining the child's environment in studies of development. For this purpose the most obvious first step is to compare the results summarized above with those of the series of analyses reported by Neligan *et al.* (1974), which were based upon the same population and data, using the same methods of analysis, but evaluating a different set of factors.

In these earlier analyses we compared the effects of six factors (independent variables) upon the children's IQ and height at the ages of 5 and 10 years (dependent variables). The two 'clinical' factors (mode of delivery and delay in onset of regular respirations) produced no significant effects and were not included in our present analyses. The two 'biological' factors (child's sex and birthweight) previously produced highly significant effects upon all four dependent variables, and the results in our present analyses are similar. Only two 'social' factors were included in the previous analyses; both social class and number of previous pregnancies produced highly significant effects upon all four dependent variables. In our present analyses the same holds true for social class; but the number of older children in the family no longer has a significant effect upon the IQ score, though it still has a highly significant effect upon the child's height at both 5 and 10 years. This suggests that the effects upon IQ in the previous analyses were actually being produced by mechanisms more closely associated with some of the new factors which have been separately identified in our present analyses (i.e. the mother's care of her child, the family's contact with the specified social agencies, and the number of immunizations the child has had, all of which have produced very significant effects). The fact that the former effect upon height has persisted suggests that in this case the number of older children in the family must have acted through some other mechanism, less closely

associated with these new factors; increasing competition for food would appear to be a possibility.

To fulfil our main purpose, however, we have compared the effects of social class in our earlier analyses (measured in IQ points or cm of height) with the results of our present analyses after the introduction of four new 'family' factors into the calculations. As we have seen in the case of the number of older children, any difference should reflect the extent to which effects previously attributed to social class were really attributable to mechanisms more closely associated with the new factors. To our surprise, we have found no such difference. Reference to Figs. 9.1 and 9.2 of our previous publication (Neligan, *et al.*, 1974) shows that the advantage of children in social classes I and II over those in IV and V was about 10 IQ points at 5 years and 16 at 10 years, 2 cm of height at 5 years and 3 at 10 years. The corresponding results of our present analyses are 10 IQ points at 5 years and 15.8 at 10 years, 2.8 cm at 5 years and 3 at 10 years. In other words, the effects of social class upon these dependent variables in our previous analyses must have been due to factors other than the new 'family' factors which have been introduced into our present analyses. The possible nature of these other factors can be obtained from the results of a much more detailed investigation of a representative sample of 209 children from this same population, studied at the ages of 5, 6, and 7 years (Neligan *et al.*, 1976). A number of additional 'family factors' were identified by means of expert and standardized assessment of the mothers by a psychiatrist and a psychologist. These were included in a series of multiple regression analyses, and as a result the effects of social class as derived from the father's occupation were almost eliminated. The additional factors identified by these means which produced significant effects were the mother's extraversion score, her expectations of her child's abilities at the age of 5 years, and her neighbourliness.

However, if we return to our whole survey population and the factors identified for us by the routinely responsible health visitors, we can compare the sum of the effects of the other 5 'family factors' (c-g in Table II) with those of social class. The sums come to 15 IQ points at 5 years and 18 at 10 years, 6.8 cm of height at 5 years and 9.8 cm at 10 years. These totals are about 2 or 3 times as great as the effect of social class (see above) except in the case of IQ at the age of 10 years. It was suggested previously (Neligan *et al.*, 1974) that the markedly favourable effect of being in social class I or II upon this variable may be due to an associated

factor which was not allowed for in either survey, namely private schooling.

Several previous investigators have reported the effects of the quality of the mother's care of her child, assessed in various ways. Wortis and Freedman (1965) found that the mother's 'growth fostering' score was positively correlated with the motor and social development of young Negro children. Drillien (1964) found that her children's growth and illnesses were correlated with the mother's 'efficiency', and their behaviour with her 'handling' of them. Douglas (1964) found that the level of 'maternal care' in his national sample of British children 'had a greater influence than social class on their chances of being put into the upper streams' at school. Miller *et al.* (1974) found that their mothers' 'standard of child care' had an effect upon their children's intelligence test scores which was about equal to that of their father's occupation.

The adverse effect of increasing numbers of previous pregnancies upon a group intelligence test at the age of 7 years was reported by Ilesley (1967), and this persisted when the analysis was confined to children in social class III. Davie *et al.* (1972) found that increasing total numbers of children in the family had an adverse effect upon the reading and arithmetic attainment, and social adjustment, of their index children. They discussed the possible reasons at some length without coming to any definite conclusions. We can only add that in our population, with the same form of analysis but including a number of extra 'family' factors, the effect of the number of older children upon IQ is no longer significant.

The only other factor which we have included, concerning which there is similar information in the literature, that we know of is parental absence or incapacity during the first 3 years of the child's life. Douglas (1975) has reported that in his population a similar factor had an adverse effect upon performance, detectable during adolescence but not earlier in childhood. The reason for this difference is not clear.

Our findings, which are in general agreement with the few relevant previous reports, confirm that a group of family factors recorded by health visitors and school nurses produces a considerably greater effect upon the measured quality of our child population in normal schools at the ages of 5 and 10 years than does the social class derived from the father's occupation. The health visitor's assessment of the quality of the mother's care of her child during the first 3 years of life is the most important of this group of factors, both because of the magnitude of its effects and because it seems to

be the factor most likely to be accessible to modification. Where the quality of the mother's care is noted to be poor, extra support by a health visitor or social worker coming into the home, and by nursery facilities outside the home selectively applied, may be expected to produce an improvement in the child's later development. This possibility at least appears to be worth testing.

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