National Child Development Study
User Support Group

**Working Paper**
**No 12**

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*     SOCIAL CLASS CHANGES IN WEIGHT-FOR-HEIGHT            *
*       BETWEEN CHILDHOOD AND EARLY ADULTHOOD              *
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# SOCIAL CLASS CHANGES IN WEIGHT-FOR-HEIGHT BETWEEN CHILDHOOD AND EARLY ADULTHOOD

by

**C. Power and C. Moynihan**

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# SOCIAL CLASS CHANGES IN WEIGHT-FOR-HEIGHT BETWEEN CHILDHOOD AND EARLY ADULTHOOD

by

C. Power and C. Moynihan

## Introduction

The proportion of the population described as overweight and obese has been shown to increase markedly in early adulthood. One study in Britain reported a rise from 13% at age 20 to 24% at 26 among men and from 20% to 26% among women (Braddon et al, 1986). It is also known that the average weight-for-height of young adults varies between social classes (Knight, 1984), but it has not yet been demonstrated how increasing prevalence of overweight and obesity such as that in early adulthood in Britain develops within different social class groups.

The purpose of the present paper is to describe the timing and magnitude of these changes and hence contribute to our understanding of why the unequal social distributions of overweight and obesity occur. Given the associations between weight-for-height and health in later life (summarised in the Royal College of Physicians Report on Obesity, 1983) this has been identified as an urgent task of public health (Marmot et al, 1984). Furthermore, comparisons of the development of overweight and obesity between different social class groups may permit the identification of high risk groups and be relevant to prevention. Earlier efforts to identify teenagers at high risk during childhood have proved unsuccessful (Peckham et al, 1985) but different relationships may exist for an older age group with different social class backgrounds. Longitudinal analyses are needed to examine these relationships and data from the National Child Development Study, the 1958 cohort, has been used for this purpose.

## Subject and methods

The 1958 cohort - National Child Development Study (NCDS) - has its origins in the Perinatal Mortality Survey which was designed to examine the social and obstetric factors associated with stillbirth and death in early infancy. The subjects were all children born in the week 3-9 March 1958 and resident in England, Scotland and Wales. From a target population of 17,733 births information was obtained on 98%. This sample has been followed-up at ages 7, 11, 16 and 23. Immigrants to Britain born during the same week were incorporated at ages 7, 11 and 16 (Davie et al, 1972; Fogelman, 1983).

During childhood and adolescence medical examinations were carried out by the schools health service. Heights, and weights of the child in underclothes were measured; editing of these data have been described previously (Peckham et al, 1983). Self-reported data were obtained at age 23 and extreme values were checked in order to identify coding or reporting errors; a total of 13% of questionnaires. Values were checked by comparing individual growth curves alongside standard charts (Tanner et al, 1965); doctors' rating of stage of puberty at 16 and finally, the respondents' description of their bodysize at 23. (Cohort members had rated themselves as either 'underweight', 'the right weight', 'slightly overweight' or 'very overweight'). Implausible height increases were more readily determined amongst women since increases in height after age 16 are minimal (Tanner, 1965). Accordingly 0.2% of values were adjusted for women and 0.1% among men, who were more likely to have increased their height since 16 (Hulanicka and Kotlarz, 1983). Only 0.07% (9) values were discarded. No adjustments of weights were possible, although 13 subjects omitted by earlier coding were subsequently included.

Response rates in the NCDS have been described previously (Fogelman, 1983) but for the purposes of the present analysis the sample was compared at age 7 and age 23 specifically in relation to bodysize and social class. Sixty per cent of the target population at 23 had height and weight for both ages. The effect of this reduced sample size was that seven-year olds with a Body Mass Index (that is, weight in kilograms divided by height in metres$^2$) above the ninth decile were under-represented at age 23 (the percentage bias* was - 1.9%) as were those from manual social class backgrounds at age 7 (the percentage bias* was - 1.5%).

Whilst social class at age 7 was derived from father's occupation, the cross-sectional comparisons also reported in this paper were based on the current or latest occupations of the cohort members themselves at age 23.

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*Percentage bias was calculated as the ratio of observed over expected values minus 1, expressed as a percentage.

## Assessment of body size

Reviewing the weight-for-height indices used in 13 studies, Cole (1985) has shown that the index $Wt/Ht^2$ was appropriate for pre-school children and adults. The weighting given to height in this formula is similar to those used in the previous analyses of seven year-olds in the 1958 and 1946 cohort studies (2.08 and 2.02 for boys and 2.20 and 2.25 for girls, respectively). Whereas, at age 11 weightings of 2.61 and 2.42 were used for boys and, 2.68 and 2.63 for girls (Simonite V, personal communication). Since the index at age 7 was comparable with that for adults, the present study compared weight-for-height at two ages only: 7 and 23. The measure used was the standard deviation score (SDS) similar to that used by Rona and Chinn (1982) which allows the differences in variance at age 7 and 23. The SDS was calculated for each subject as the difference between an individuals' measurement and the average of the population for each sex group separately, divided by the standard deviation of each group. Before calculating the SDS for an individual the measurements were transformed logarithmically to approximate a normal distribution. Thus the following formula was used:

$$\text{SDS} = (\log \text{BMI} - \bar{x} \log \text{BMI}) \div \text{standard deviation} \log \text{BMI}$$

The mean and standard deviations used in this formula are shown in Table 1.

Table 1: Means and standard deviations of log BMI used to calculate the SDS at age 7 and 23

| | Age 7 | Age 23 |
|---|---|---|
| Men | | |
| Mean log BMI | 2.7641 | 3.1324 |
| Standard deviation log BMI | 0.0987 | 0.1195 |
| Women | | |
| Mean log BMI | 2.7577 | 3.0867 |
| Standard deviation log BMI | 0.1150 | 0.1364 |

## Results

Ninety eight per cent of men (6133) and 98% of women (6141) who gave information at age 23 reported both their weight and height. Table 2 shows the distribution of BMI values divided into four weight categories used by the Royal College of Physicians (1983). The BMI values which determine the categories were different for men and women. Thus, a greater proportion of women (4%) compared with men (2%) were classified as obese, whereas a similar proportion were below the acceptable range of BMI.

Table 3 shows the prevalence percent of men and women in the four BMI categories according to their social class. There was a higher prevalence percent of overweight and obesity among men who were manual workers (24% and 23% of social classes IIIM, and IV and V, compared with 13% and 16% in social classes I and II, and IIINM).

Similarly, amongst women, 29% and 30% of social classes IIIM, and IV and V respectively were overweight and obese, compared with 19% and 20% of social classes I and II, and IIINM. The differences in the distribution of BMI between social classes were statistically significant (P < 0.001).

Table 4 shows the distribution of SDS at ages 7 and 23 for men and women. Changes in standard deviation scores (SDS) between the two ages were considerable. For example, 28% of boys and girls with a SDS of 0 to 0.5 (an average weight-for-height group) moved to a higher category between the ages of 7 and 23 and 48% moved to a lower one. The amount of change varied, however, between SDS groups 31% of girls with an SDS -1.0 to -0.5 at age 7, for example, remained in the same group by the time they were 23 while only 12% of those with a SDS 1.0 to 1.5 did so.

Changes in weight-for-height were also associated with social class background. for example, among 23 year-olds who, as children had scores > 1.5 a higher percentage of young men from manual backgrounds maintained their scores between 7 and 23 (Fig 1, 31% compared with 18% of the non-manuals, P < 0.01). Conversely, a lower percentage of these had scores at 23 which were within or below the middle range of the distribution. Likewise, women with an SDS > 1.5 at age 7 remained in the same SDS category at 23 more frequently if they had manual backgrounds (39% comapred with 22%).

The 23 year-old scores of the 0 to 0.5 SDS category at age 7 are illustrated in Figure 2. While the majority remained within the middle range, a greater percentage of children from manual backgrounds had higher scores at 23 years of age and a smaller percentage were lower. This trend was similar for both men and women.

Figure 3 shows the 23 year scores of those who had the lowest SDS at age 7 (i.e. <-1.5). Trends for men and women were inconsistent. A higher percentage of boys from non-manual backgrounds remained in the same SDS category at 23 (22% compared with 15% of those from manual backgrounds) whereas amongst women, the percentages were similar for the two social class groups (8% and 7%). A higher percentage of both men and women from manual backgrounds, however, had scores > 1.5 at age 23.

## Discussion

This study has shown percentage prevalences of overweight and obesity and social class differences among young adults which are consistent with the findings of others (Stark et al, 1981; Knight, 1984; Baird et al, 1974; Royal College of Physicians, 1983; Braddon et al, 1986). However, as one of three national longitudinal studies in Britain, it provides an opportunity to make comparisons, albeit limited, in secular trends. It has been shown previously that at age 7 there was a higher prevalence of overweight amongst those born in 1958 than those born in 1946 (Peckham et al, 1983), but Table 5 suggests that differences in early adulthood may not be large. The ages in the two cohorts were not strictly comparable, however, and confirmation of this observation must await future follow-ups of the longitudinal studies.

The main purpose of this analysis was to examine the relationship between early weight-for-height and social background and later weight-for-height. It has been shown that weight-for-height during early adulthood was not necessarily determined by that in childhood. Notably, 44% of men and 43% of women who were the heaviest at 23 (ie. SDS > 1.5) had had scores less than 0.5 at age 7, and more than a third of the heaviest boys and girls (SDS > 1.5) at age 7 had scores of 0.5 or less at 23. Identification of the most overweight young adults on the basis of weight-for-height alone at age 7 would not be high. These findings are consistent with earlier work on both the 1946 and 1958 cohorts (Stark et al, 1981; Peckham et al, 1983, 1985). Subsequent overweight was, nevertheless, greatest among the heaviest children. The ratio of those with a SDS > 1.5 at both age 7 and 23 to, for example, those whose score was 0 to 0.5 at 7 and subsequently 1.5 at 23 was 4.9:1 for boys and 4.3:1 for girls. The magnitude of the risk of overweight in early adulthood for those who were heavier in childhood would appear, therefore, to be similar in both the 1958 and 1946 cohorts.

Whilst the relationships of weight-for-height at the two ages were similar for different social class backgrounds, lower social class during childhood was associated with a greater likelihood of becoming overweight. This was not entirely unexpected since overweight and obesity in adulthood has been linked with social class of origin in North America (Goldblatt et al, 1965). Studies in Britain and America are not always consistent. Garn et al (1981) has shown that boys and girls from low socio-economic groups were slightly leaner than those from higher groups, but that after puberty this was reversed. No such change occurred in the British population described here, in which widening social class differences occur from childhood. Moreover, lower social class was associated with greater likelihood of remaining overweight; a distinction not shown in earlier studies (Stunkard et al, 1972). To some extent this was unexpected since the poor prognosis for overweight children was previously thought to be generally applicable (Stark et al, 1981).

The trend of increasing prevalence of overweight amongst lower social classes is consistent with a weak association during childhood (Peckham et al, 1983; Rona and Chinn, 1982) and a stronger association, as shown here, in early adulthood. Indeed, by the age of 23 there was a threefold difference among men and a twofold difference among women of higher and lower social classes, in the percentage of obese, as defined in the Royal College of Physicians Report (1983). Such marked differences have not been previously described in a large nationally representative group of young adults in Britain. The OPCS sample showed only small social class differences in the average BMI for 20 to 24 year-olds (Knight, 1984) and other studies have been restricted to women of all ages (Silverstone et al, 1969) or different geographical locations (Goldblatt et al, 1965). It should also be recognised that problems of comparability between studies and different ages are considerable. unavoidable. The Standard Deviation Score adopted here was an attempt to overcome problems associated with the comparison of childhood and adulthood indices.

In conclusion, these results have suggested that prediction of weight-for-height from childhood to early adulthood was poor and that preventative strategies aimed at children may be ineffective. The likelihood of overweight later on was greater, however, for the most overweight at age 7 and the risk associated with overweight during childhood can be seen, therefore, to extend beyond the teenage years (Peckham et al, 1983). This was particularly so for children from lower social class backgrounds and suggests that social class associations in early adulthood may reflect a longer term effect of social background. These findings have important implications since they suggest that social factors influence the development and maintenance of overweight and obesity. There is an urgent need to understand what these social class differences represent. Perhaps children in higher social classes are subjected to greater pressures from a variety of sources to lose and not to gain weight. Certainly there are social class discrepancies between actual and perceived weight among young adults (to be reported elsewhere) which may generate different degrees of pressure within different social class groups. Whilst recent research has reaffirmed the genetic role in the development of obesity (Stunkard et al, 1986) this must be reconciled with the role of social influences. Explanations, such as the role of education and social mobility, must await further exploration of these data.

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We are grateful to F. Braddon and M. Wadsworth for data from the 1946 survey and T. Cole and O. Stark for their helpful comments.

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Table 2: Prevalence (%) in four BMI categories at age 23

| BMI Category | Men (n=6133) Range | % | Women (n=6141) Range | % |
|---|---|---|---|---|
| Below acceptable weight | < 20 | 10 | < 18.7 | 10 |
| Acceptable weight | 20-24.9 | 70 | 18.7-23.7 | 68 |
| Overweight | 25-30 | 18 | 23.8-28.6 | 18 |
| Obese | > 30 | 2 | > 28.6 | 4 |

Table 3: Prevalence (%) in four BMI Categories according to social class at age 23

| BMI Category+ | Social class++ I and II | IIIN | IIIM | IV and V | Chi-squared value (DF = 9) |
|---|---|---|---|---|---|
| Men | (n=1264) | (n=988) | (n=2364) | (n=1192) | |
| Below acceptable weight | 12 | 12 | 8 | 9 | |
| Acceptable weight | 75 | 72 | 68 | 68 | 90.71 *** |
| Overweight | 12 | 15 | 21 | 20 | |
| Obese | 1 | 1 | 3 | 3 | |
| Women | (n=1265) | (n=2913) | (n=544) | (n=1240) | |
| Below acceptable weight | 10 | 10 | 8 | 9 | |
| Acceptable weight | 71 | 70 | 63 | 61 | 86.21 *** |
| Overweight | 16 | 17 | 23 | 23 | |
| Obese | 3 | 3 | 6 | 7 | |

\+ See table 2 for BMI values defining the four categories
++ Social class was not available for 325 men and 179 women.
*** Significant, $P < 0.001$

Table 4: Percentage distribution of standard deviation scores at ages 7 and 23

| SDS23 | SDS7 <-1.5 | -1.5 to -1.0 | -1.0 to -0.5 | -0.5 to 0.0 | 0.0 to +0.5 | +0.5 to +1.0 | +1.0 to +1.5 | >+1.5 |
|---|---|---|---|---|---|---|---|---|
| **Men** | | | | | | | | |
| | (192) | (493) | (678) | (1111) | (1205) | (637) | (321) | (294) |
| | % | % | % | % | % | % | % | % |
| < - 1.5 | 17 | 14 | 8 | 5 | 2 | 1 | 1 | 1 |
| -1.5 to -1.0 | 14 | 17 | 16 | 10 | 7 | 4 | 3 | 3 |
| -1.0 to -0.5 | 23 | 22 | 21 | 21 | 15 | 13 | 10 | 6 |
| -0.5 to 0.0 | 18 | 19 | 22 | 24 | 24 | 21 | 15 | 13 |
| +0.0 to 0.5 | 14 | 15 | 18 | 21 | 23 | 20 | 23 | 15 |
| +0.5 to +1.0 | 9 | 8 | 9 | 10 | 16 | 19 | 19 | 20 |
| +1.0 to +1.5 | 3 | 3 | 3 | 5 | 7 | 11 | 13 | 15 |
| >+1.5 | 3 | 2 | 4 | 4 | 6 | 10 | 16 | 27 |
| **Women** | | | | | | | | |
| | (195) | (492) | (726) | (1209) | (1112) | (568) | (314) | (319) |
| < - 1.5 | 9 | 8 | 6 | 2 | 1 | - | 1 | 1 |
| -1.5 to -1.0 | 21 | 19 | 15 | 9 | 5 | 2 | 3 | 1 |
| -1.0 to -0.5 | 24 | 30 | 31 | 23 | 17 | 15 | 8 | 6 |
| -0.5 to 0.0 | 21 | 21 | 23 | 28 | 25 | 23 | 20 | 13 |
| +0.0 to 0.5 | 12 | 10 | 15 | 21 | 24 | 23 | 25 | 20 |
| +0.5 to +1.0 | 9 | 5 | 6 | 8 | 12 | 17 | 18 | 13 |
| +1.0 to +1.5 | 4 | 4 | 2 | 5 | 8 | 10 | 12 | 13 |
| >+1.5 | 2 | 2 | 2 | 5 | 8 | 10 | 13 | 34 |

The figures in parentheses are actual numbers

Table 5: Percentage population defined as underweight and overweight in two national surveys

| BMI Category+ | NSHD* (age 20 in 1966) (n=4196) | NCDS (age 23 in 1981) (n=6130) | NSHD* (age 26 in 1974) (n=4228) | OPCS (age 20-24) (n=527) |
|---|---|---|---|---|
| Men | | | | |
| Below acceptable weight | 14 | 10 | 9 | 78 |
| Acceptable weight | 73 | 70 | 67 | |
| Overweight | 12 | 18 | 22 | 19 |
| Obese | 1 | 2 | 2 | 3 |
| Women | (n=4072) | (n=6148) | (n=4161) | |
| Below acceptable weight | 10 | 10 | 8 | Data not |
| Acceptable weight | 70 | 68 | 66 | available |
| Overweight | 17 | 18 | 21 | |
| Obese | 3 | 4 | 5 | |

+See table 2 for BMI values defining the four categories

NSHD = National Survey of Health and Development (1946 Cohort Study)

*Figures corrected for initial population sampling effect

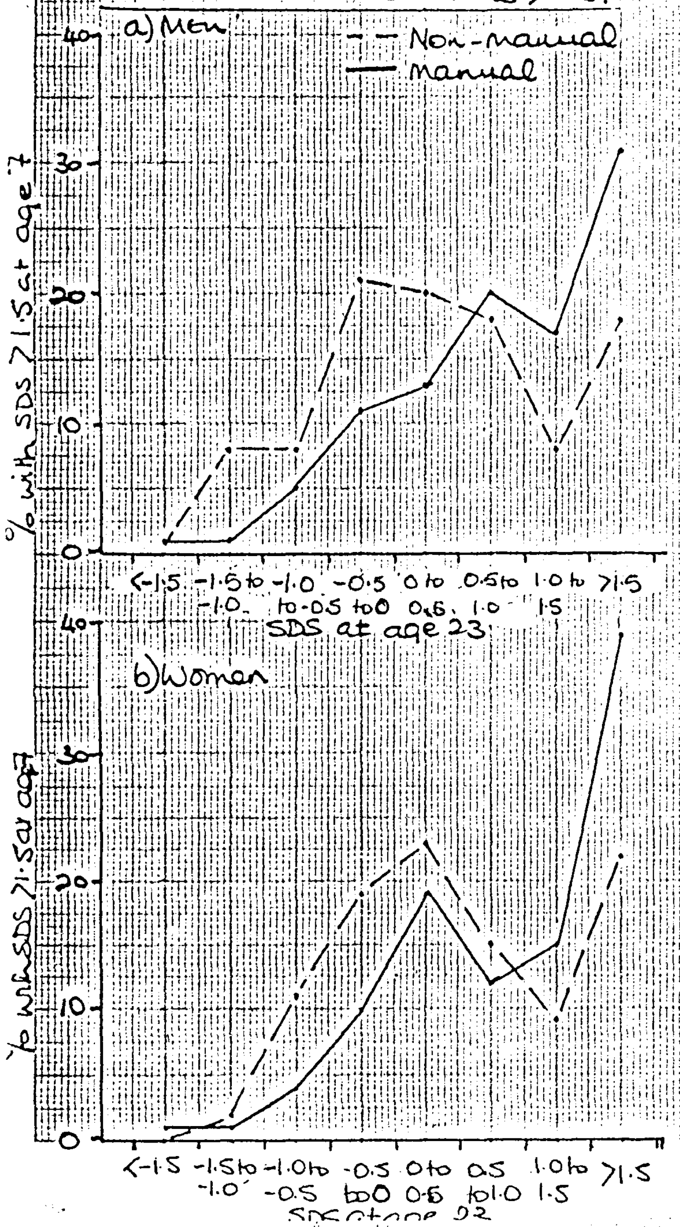



Figure 1: SDS at age 23 for children whose score was >1.5.

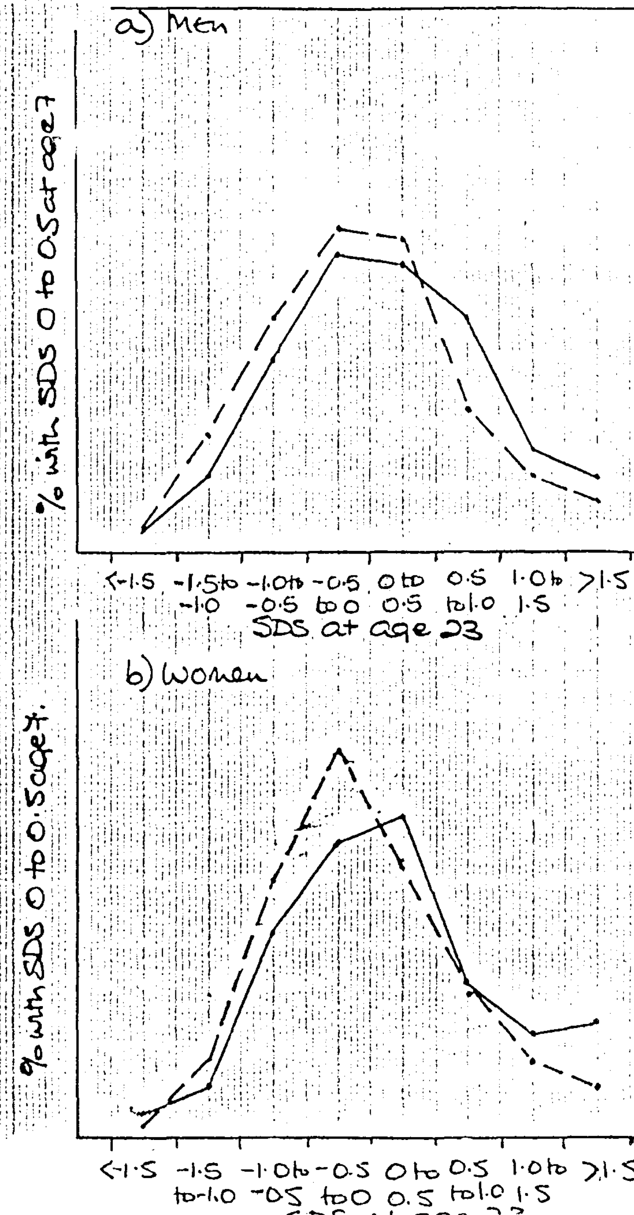



Figure 2: SDS at age 23 for children with scores 0 to 0.5

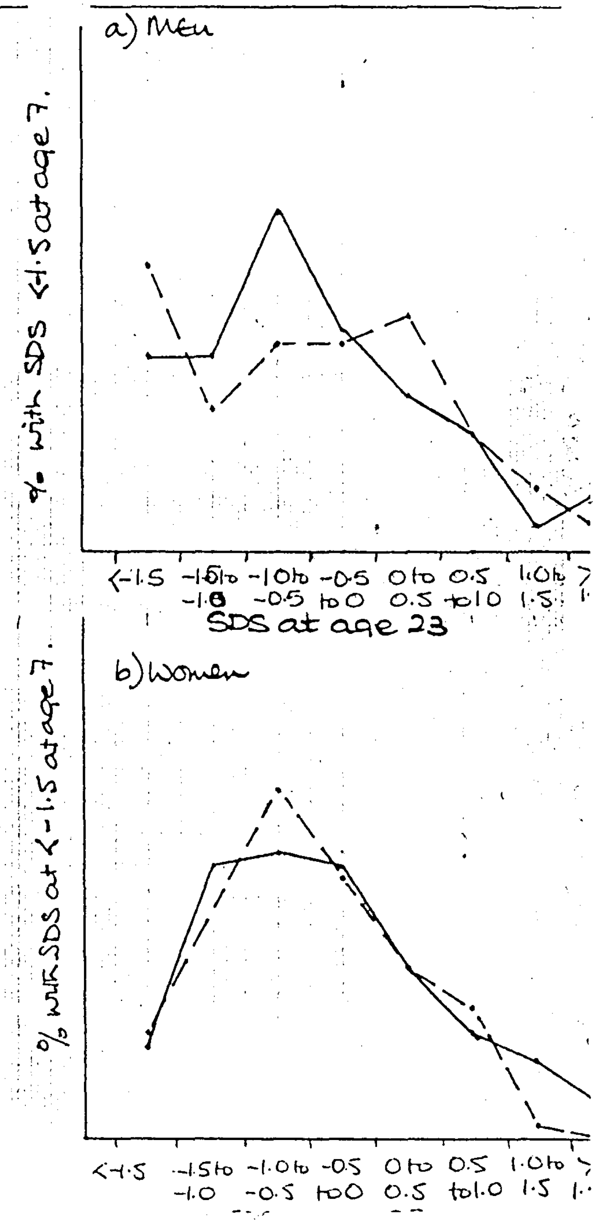



Figure 3: SDS at 23 for children whose score was <-1.5

Figure 1: SDS at age 23 for children whose score was >1.5.

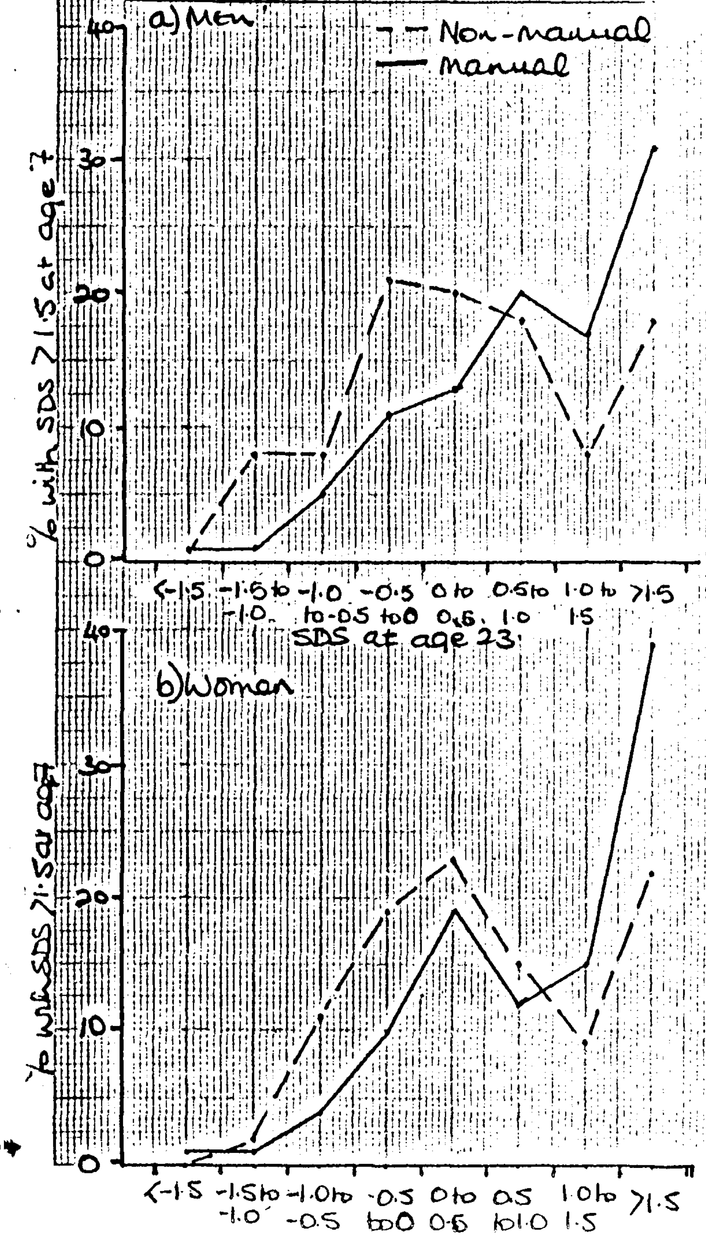



Figure 2: SDS at age 23 for children with scores 0 to 0.5

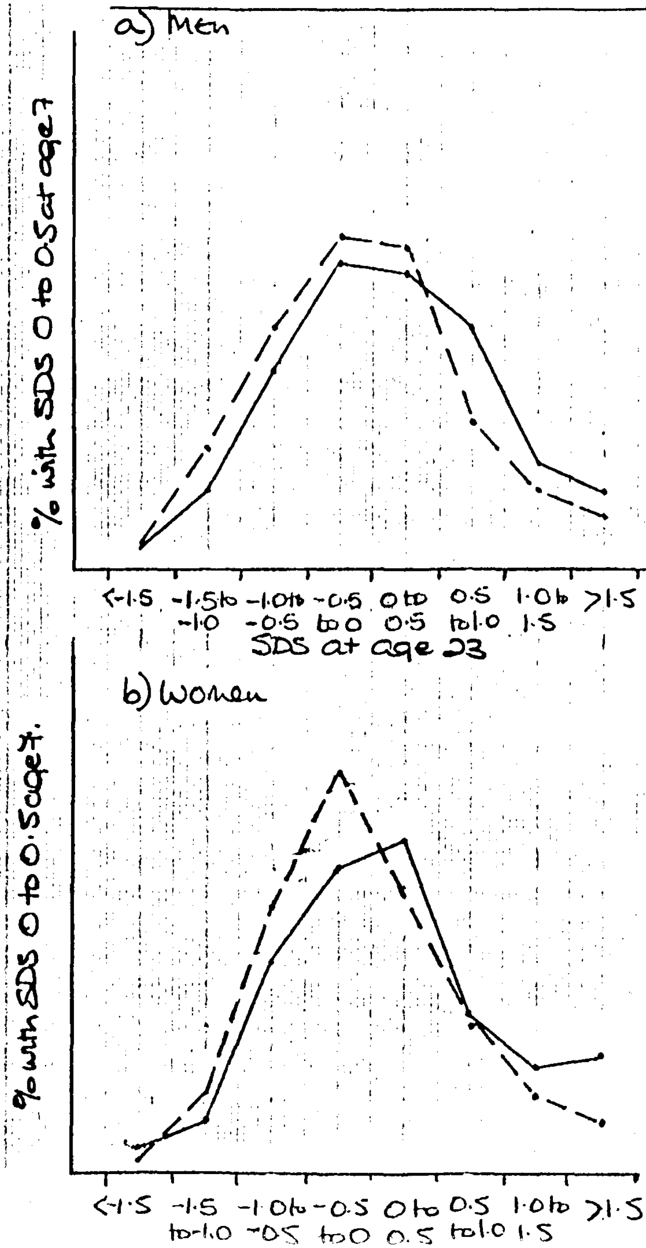
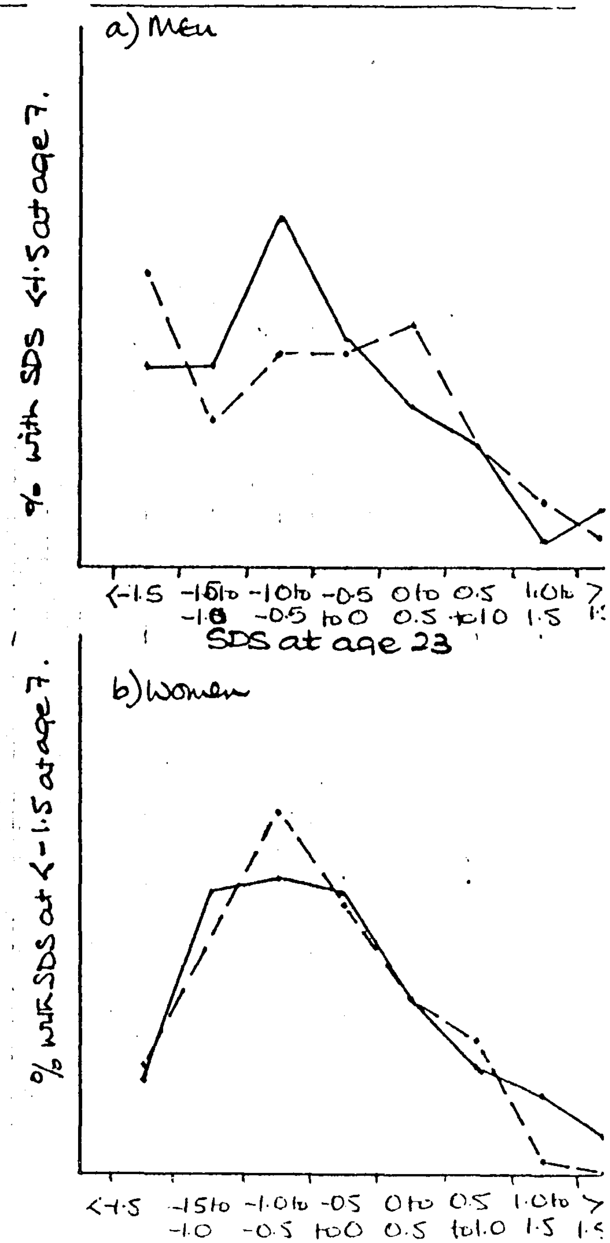



Figure 3: SDS at 23 for children whose score was <-1.5



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# NATIONAL CHILD DEVELOPMENT STUDY

The National Child Development Study (NCDS) is a continuing longitudinal study which is seeking to follow the lives of all those living in Great Britain who were born between 3 and 9 March, 1958.

It has its origins in the Perinatal Mortality Surveys (PMS). This was sponsored by the National Birthday Trust Fund and designed to examine the social and obstetric factors associated with the early death or abnormality among the 17,000 children born in England, Scotland and Wales in that one week.

To date there have been four attempts to trace all members of the birth cohort in order to monitor their physical, educational and social development. There were carried out by the National Children's Bureau in 1965 (when they were aged 7), in 1969 (when they were aged 11), in 1974 (when they were aged 16) and in 1981 (when they were aged 23). In addition, in 1978, details of public examination entry and performance were obtained from the schools, sixth-form colleges and FE colleges.

For the birth survey information was obtained from the mother and from medical records by the midwife. For the purposes of the first three NCDS surveys, information was obtained from parents (who were interviewed by health visitors), head teachers and class teachers (who completed questionnaires), the schools' health service (who carried out medical examinations) and the subjects themselves (who completed tests of ability and, latterly, questionnaires). In addition the birth cohort was augmented by including immigrants born in the relevant week in the target sample for NCDS1-3.

The 1981 survey differs in that information was obtained from the subject (who was interviewed by a professional survey research interviewer) and from 1971 and 1981 Census (from which variables describing area of residence were taken). Similarly, during the collection of exam data in 1978 information was obtained (by post) only from the schools attended at the time of the third follow-up in 1974 (and from sixth-form and FE colleges, when these were identified by schools). On these last two occasions no attempt was made to include new immigrants in the survey.

All NCDS data from the surveys identified above are held by the ESRC Data Archive at the University of Essex and are available for secondary analysis by researchers in universities and elsewhere. The Archive also holds a number of NCDS-related files (for example, of data collected in the course of a special study of handicapped school-leavers, at age 18; and the data from the 5% feasibility study, conducted at age 20, which preceded the 1981 follow-up), which are similarly available for secondary analysis.

Further details about the national Child Development Study can be obtained from the NCDS User Support Group.

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