The Influence of Certain Social Factors on the Physical Growth and Development of a Group of Dublin City Children

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INTRODUCTION

This paper presents the results of an inquiry into the influence of a number of social factors on certain growth and development parameters, based on an investigation of 412 Dublin city children aged between four and seven years, carried out in 1971. The social factors considered in this paper are size of family, standard of home conditions and occupation of father while the criteria used to measure child growth and development are height and weight. Other factors of more medical interest, such as birth weight, length of stay in hospital etc., were also studied and other measurements, also of a more medical character (such as skinfold thickness), were also taken in the course of this inquiry; the results of these analyses will be presented elsewhere.

METHODOLOGY

Selection of Study Group

The potential study group consisted of 1,433 Dublin city children with whom initial contact had been made some four years previously when they

were included as either "cases" or "controls" in a Gastroenteritis Survey (1) carried out under the auspices of the Medical Research Council of Ireland. This source provided a reasonably up-to-date list of homes with children of an appropriate age, and a further advantage was that the files already contained relevant information. An initial investigation of the 1,433 addresses was carried out with the co-operation of the (then) Dublin Health Authority and from this it transpired that some 233 families could not be traced, mainly due to change of address. Of the remaining 1,200 on file, 900 were visited between January and December 1971; it was not possible to visit the full complement of addresses available due to constraints of time and resources. From the 900 visits carried out a total of 412 usable records was compiled; however it must be emphasised that in the case of nearly all of the remaining 500 or so visits there were simple and valid reasons for not obtaining records, such as a child being "out" when the field worker called or no parent being present to give permission for the examination. In only one case did a parent refuse to co-operate.

It is necessary to emphasise that due to the nature of the Gastroenteritis Survey referred to previously the children included in this study were largely from families in the lower income ranges. The findings given in this paper therefore cannot be regarded as being representative of all Dublin city children in the age groups concerned. It was also recognised at the outset that the inclusion of some children who were "cases" in the original Gastroenteritis Survey could influence the results. A special analysis of this aspect was carried out by comparing data for children who were recorded as having "infective Gastroenteritis" in the previous inquiry (who numbered 58) with the data for the remaining 354 children included in the present inquiry; the results did not indicate any significant difference between the two sub-groups in the overall sample of subjects. The authors are also conscious of the fact that the group of children included in the survey obviously did not constitute a random sample in the strict theoretical sense. However, apart from the acknowledged weighting in favour of the lower socio-economic groups, there is no reason to suspect that the group selected is unrepresentative in any other way. Statistical tests have been used to further illustrate the trends shown by the data presented and indeed, as will be seen subsequently, these do help to highlight the various differences involved. However, in view of the qualifications referred to above, the authors consider that the results of these tests should be treated with some reserve.

Collection of Data

The examination of each child was carried out on a domiciliary basis by the same observer. The height and weight of each child were recorded using techniques recommended by Tanner (2). During each visit a relevant socio-medical profile was also recorded for each child by questioning the parent or parents present.

In addition to the three social factors considered in this paper information on many other aspects of a socio-medical nature was also collected, such as family income, age at which full-time education of parents ceased,

total duration of hospitalisation etc. However, the content of the present paper has been limited to the three factors mentioned as in the case of some of the others (e.g. duration of stay in hospital) no significant influence on physical development was evident and further, in the authors' view, the presentation of too many different analyses can be misleading as many of the social factors involved are strongly correlated, for instance family income and father's occupation.

Presentation of Data

All the raw physical measurements for each child were subsequently plotted on standard percentile charts developed by Tanner, Whitehouse and Takaishi (1966) (3) and the data in all the tables in this paper are presented in percentile form. Basically these charts provide for boys and girls separately, and for different ages an estimation of the "population" distribution according to the physical measurement concerned, i.e. height or weight. By reference to the charts each child can be given a rating, in percentile form, which indicates its position in relation to other children of the same age and sex. By way of illustration a copy of the weight percentile chart for girls is shown in the Appendix.

The source data and construction of these standards dates to the early 1960s when large scale surveys of children were carried out by a number of professional bodies in London, including among others, the University of London and London County Council. As one can see from the Appendix, the standards specifically distinguish the 3rd, 10th, 25th, 50th, 75th, 90th and 97th percentile points of the relevant distribution for each age; intermediate percentile points can be interpolated, but not to a great degree of accuracy.

The main advantage in transforming data into percentile form is that it enables one to standardise the figures with regard to sex and age, i.e. it is possible to amalgamate information for different sex and age groups and still investigate the data with respect to other factors. If we attempted to analyse our information using the original raw measurements for height and weight we would have had to keep subdividing the data according to sex and age (in view of the obvious effect which these factors have on physical development when considered in absolute terms) and the resulting frequencies in our tables would have been so small as to render meaningful statistical analyses virtually impossible.

The authors are aware that the use of these percentile standards can be criticised on the grounds that they are not based on Irish data and that they are now somewhat out of date. While it is true that an absolute rating for an individual child based on these standards would be open to criticism on the above grounds, it must be borne in mind that all the analyses which we shall present will consist of internal comparisons between different sub-groups of the overall group of children studied; as the same methods are used in evaluating each sub-group the comparisons carried out are meaningful.

THE RESULTS

Overall Trends

The group of children included in the survey turned out to be somewhat deficient in terms of Tanner's standards, which is not really surprising in view of their confined social background. In the case of both height and weight measurements only 40 per cent of the children were on or above the fiftieth percentile and about 35 per cent of children were below

TABLE 1

Number and percentage distribution of the 412 children according to detailed percentile categories, for height and weight measurements

	Height		*Weight*	
Percentile Category	*No.*	*%*	*No.*	*%*
less than 3rd	17	4·1	15	3·6
3rd to 10th	49	11·9	50	12·1
10th to 25th	74	18·0	64	15·5
25th to 50th	116	28·2	116	28·2
50th to 75th	85	20·6	103	25·0
75th to 90th	46	11·2	42	10·2
90th to 97th	18	4·4	14	3·4
97th or over	7	1·7	8	1·9
	412	100·0	412	100·0

the twenty-fifth percentile. For both measurements the proportion of children under the tenth percentile was roughly 15 per cent; while this may not appear to be a very big deviation in the absolute sense, it does imply that about 50 per cent more children have been classified to this "very deficient" category over and above what should be there in terms of the standards used. The full range of results, for all percentile categories, is shown in Table 1.

The Influence of Family Size

Analyses involving family size (measured in terms of the number of children*) are contained in Table 2. The overall conclusion here is that family size has a substantial affect on child growth and development measured in terms of the parameters used, the evidence suggesting that children in smaller families fare considerably better than children in large families. This relationship is particularly marked in the case of the height measurements; concentrating on the figures for the highest and lowest percentile categories shown (i.e. the upper and lower quadrants) over the range of family size groups distinguished, it is seen that for families with one or two children the proportion of subjects falling in the lowest quadrant is over 18 per cent and this figure increases steadily without deflection as

*The number of children alive at the time of the investigation.

TABLE 2

Height and weight measurements, expressed in percentile form, classified by size of family

	No. of children in family												
	1 or 2		*3 or 4*		*5 or 6*		*7 or 8*		*9 or more*		*Total*		*Value of* χ^2
Percentile Category	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	$(df=8)^+$
Height													
less than 25th	7	18·4	25	23·6	42	35·0	25	36·2	41	51·9	140	34·0	
25th to 50th	11	28·9	31	29·2	30	25·0	21	30·4	23	29·1	116	28·2	****
50th to 75th	9	23·7	26	24·5	26	21·7	14	20·3	10	12·7	85	20·6	26·4
75th or over	11	29·0	24	22·6	22	18·3	9	13·0	5	6·3	71	17·3	
Total	38	100·0	106	100·0	120	100·0	69	100·0	79	100·0	412	100·0	
Weight													
Less than 25th	10	26·3	22	20·7	43	35·8	20	28·9	34	43·1	129	31·2	
25th to 50th	8	21·1	37	34·9	27	22·5	22	31·9	22	27·8	116	28·2	***
50th to 75th	9	23·7	30	28·3	28	23·3	21	30·4	15	19·0	103	25·0	22·7
75th or over	11	28·9	17	16·0	22	18·3	6	8·7	8	10·1	64	15·5	
Total	38	100·0	106	100·0	120	100·0	69	100·0	79	100·0	412	100·0	

*—Significant at the 5·0% level.
**—Significant at the 2·5% level
***—Significant at the 1·0% level.
****—Significant at the 0·1% level.
+Note that in the calculation of χ^2 the two middle quadrants (the 25th to 50th and the 50th to 75th) have been amalgamated.

one considers in succession the various family size categories until it reaches a very high level of 52 per cent for families with nine or more children. In contrast, the proportion of children in the uppermost quadrant (i.e seventy-fifth percentile or over) falls from 29 per cent to just over 6 per cent over the same range of family sizes.

The figures relating to the weight measurements show a similar pattern even though the progression involved is not as steady as in the case of the height data. While the proportion of children in the lowest quadrant rises from 26 per cent to 43 per cent over the range of family sizes when considered in order of increasing numbers, it does fluctuate somewhat in between. The percentage of children in the highest quadrant for families with one or two children is nearly 30 per cent and this decreases fairly steadily to just over 10 per cent for families with nine children or more.

Statistical tests of significance have been carried out in order to further analyse the data presented. These are χ^2 tests of association and the values of the χ^2 statistic obtained (one for each measurement criterion) are given in the final column of Table 2. In each of these separate calculations the data for the two middle quadrants (i.e. 25th to 50th and 50th to 75th percentiles) have been amalgamated in order to make the tests more sensitive in detecting significant changes for the highest and lowest quadrants which are clearly of more interest. The point we are making here is that differences between the figures for the two middle quadrants are not as important in that they represent "just below normal" and "just above normal" situations.

Not unexpectedly, in view of the clear cut trends referred to above, the test for the height measurements yielded a very high value of χ^2, in fact significant at the 0·1 per cent significance level. The χ^2 value calculated for the weight measurements was also very significant, at the 1·0 per cent level. These tests thus lend further support to the conclusion that, for the socio-economic group concerned, there is a strong (but negative) association between family size and standards of physical growth and development attained.

Now that the reader has perhaps a clearer picture as to the types of physical measurement involved in this study, before proceeding with any further analyses it is appropriate to make some general observations concerning these measurement criteria. In relation to height it must be kept in mind that there exists a strong hereditary influence in that the height of the child and parent height are very strongly correlated in the positive sense. This does not however, invalidate our conclusions as long as there is not a relationship between mean parent height and the particular influence under consideration. For example, in the situation previously analysed, involving family size, hereditary considerations would be most unlikely to affect the comparisons as there is no evidence to suggest that parent height and family size are related in any way. In other words while acknowledging the presence of the hereditary factor, we are assuming that it is present to an equal extent in all of the sub-categories considered.

Indeed there are available percentile standards which take mean parent

height into account (Tanner, Goldstein and Whitehouse, 1970) (4) and these were used where possible, as an additional exercise, during this inquiry. While one cannot dispute, from a theoretical point of view, that these standards are more precise, there is the serious obstacle that, in inquiries of the kind in question here, it is very difficult to obtain heights for both parents unless one is prepared to undertake repeated visits to households on a very substantial scale. Not only does this substantially escalate the cost of the survey, it can also greatly lengthen the period of information collection unless much greater numbers of field workers are employed. The field worker in our inquiry, while making repeated visits to a limited extent, managed to record the height of both parents for 80 of the 412 children included. It is of interest to note that for the great majority of these eighty children an improved rating was recorded with the more exact standards taking mean parent height into account.

It is likely that the hereditary influence is also present for the weight measurements to some extent but it is generally acknowledged as not being as strong as in the case of height and it is unlikely to have a significant effect. One important point, however, to keep in mind in relation to the weight data is that those children who fall in the highest quadrant cannot necessarily be regarded as "superior" in any sense. Many of them were classified to this category because they were considerably overweight and the children who fell in the extreme upper percentile categories (such as that between the 90th and 97th percentile and over the 97th percentile) can be deemed, from a health point of view, to be the cause of as much concern as their counterparts at the other extreme of the percentile range. In this context an interesting feature of the results for the weight measurements is that while the proportion of children classified to the highest quadrant decreases fairly steadily when one considers the family size groups in increasing size order the percentage shows an unexpected upturn for the largest families with nine or more children. This feature will in fact occur again in a later table involving occupation of father where for what one might call the apparently "weakest" or "most deprived" category the figures indicated an unexpected reversal of the general trend. While the authors acknowledge that, in view of the very small frequencies involved for these cells, the sampling errors must be substantial, this reversal of trend may be due to these large families having an imbalanced diet, for example in the form of excessive consumption of carbohydrates such as bread and the cheaper forms of meat products.

The Influence of Home Conditions

During the course of each home visit the field worker availed of the opportunity to assess the general standards of home conditions with particular reference to facilities for food storage, water supply, waste disposal and toilet arrangements. Households were classified to one of four categories—good, fair, poor and very poor; these judgements were, of course, purely subjective but they were all carried out by the same observer working to a set procedure and the authors are of the opinion that meaningful comparisons between the four categories can be made. The results are given in Table 3.

TABLE 3

Height and weight measurements in percentile form, classified by home conditions

Percentile Category	*Home Conditions*										*Value of* χ^2 $(df=6)^+$
	Good		*Fair*		*Poor*		*Very Poor*		*Total*		
	No.	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%	
Height											
Less than 25th	16	16·6	43	29·0	46	42·2	35	59·3	140	34·0	
25th to 50th	27	28·1	44	29·7	29	26·6	16	27·1	116	28·2	
50th to 75th	25	26·1	34	23·0	21	19·3	5	8·5	85	20·6	41·3****
75th or over	28	29·1	27	18·3	13	12·0	3	5·1	71	17·3	
Total	96	100·0	148	100·0	109	100·0	59	100·0	412	100·0	
Weight											
Less than 25th	21	21·9	39	26·4	45	41·3	24	40·7	129	31·2	
25th to 50th	29	30·2	39	26·4	27	24·8	21	35·6	116	28·2	
50th to 75th	26	27·1	42	28·4	25	22·9	10	16·9	103	25·0	17·2***
75th or over	20	20·8	28	18·9	12	11·0	4	6·8	64	15·5	
Total	96	100·0	148	100·0	109	100·0	59	100·0	412	100·0	

*—Significant at the 5·0% level.
**—Significant at the 2·5% level.
***—Significant at the 1·0% level.
****—Significant at the 0·1% level.
+Note that in the calculation of χ^2, the two middle quadrants (25th to 50th and 50th to 75th) have been amalgamated.

In the case of the height measurements there is a very strong correlation between home conditions and the distribution of the sample children among the percentile categories. For the "good" home conditions category the proportion of children in the lowest quadrant is only 17 per cent, for the "fair" it is nearly 30 per cent, it rises to 46 per cent for "poor" households and it reaches an astonishingly high 60 per cent for households classified as "very poor". The figures for the highest quadrant show a correspondingly sharp and consistent reverse trend, falling from nearly 30 per cent for "good" homes to 5 per cent for those classed as "very poor".

The weight figures indicate a similar trend though the relative difference between the home conditions categories are not as great. The percentage of children in the lowest quadrant from "good" homes is 22 per cent and it rises to 41 per cent for "very poor" homes, but there is apparently little difference between those classed as "poor" and "very poor" in this instance. At the other end of the scale the proportion of children who are classed as being above the 75th percentile decreased from 21 per cent to 7 per cent over the range of home conditions categories concerned.

The statistical tests yielded an extremely high value of χ^2 for the height figures (well in excess of the 0·1 per cent significance level) while the value for the weight measurements was significant at the 1·0 per cent level.

We have already referred to the problem of inter-relationships between different social factors and, in fact, such an effect is present to some extent between the two influences considered so far in this paper. It is possible to investigate the extent of some of these relationships from the survey data itself. For example Table 4 following shows a cross-classification of the 412 households in our survey according to family size and standard of home conditions and reference to the percentages shown indicates evidence of substantial correlation between those two factors in that substandard home conditions tend to feature more prominently for larger families.

This is not to say however, since family size is plainly the causative element here, that our second analysis involving home conditions is redundant. It should be remembered that the data classified according to the different home conditions categories exhibited a rather more pronounced trend than did those involving family size (especially the height measurements) and from this it can be inferred that the criterion of home conditions does have an influence on child growth and development in its own right.

We have adverted to this particular problem of inter-relationships as it must be remembered at all times that growth and development is an extremely complex phenomenon subject to a great many interacting influences (of both a social and medical nature) and one has to tread cautiously in drawing conclusions concerning the affect of any one factor taken in isolation.

The Influence of Social Background

Information on the occupational status of each child's father was sought during every household visit. While these descriptions were

TABLE 4

The 412 survey households classified by size of family and home conditions

Home Conditions	No. of Children in Family										Total	
	1 or 2		3 or 4		5 or 6		7 or 8		9 or more			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Good	15	39·5	40	37·7	29	24·1	8	11·6	4	5·1	96	23·3
Fair	15	29·5	45	42·5	44	36·7	22	31·9	22	27·8	148	35·9
Poor	7	18·4	12	11·3	36	30·0	24	34·8	30	38·0	109	26·5
Very Poor	1	2·6	9	8·4	11	9·2	15	21·7	23	29·1	59	14·3
Total	38	100·0	106	100·0	120	100·0	69	100·0	79	100·0	412	100·0

initially recorded in some detail they were subsequently grouped into the nine socio-economic occupational classes as used in Volume IV of the Report of the 1966 Census of Population. As the frequencies in some of the higher socio-economic categories were very small, these were grouped and five cells only were ultimately used in our analyses. As in some cases, the names of these five groups do not adequately describe the coverage involved, we thought it better to list the five categories with an indication of the kind of occupation included in each one. These are:

(1) Professional occupations such as doctors teachers, engineers, etc., employers and salaried employees in general.
(2) Intermediate non-manual workers—covering such occupations as clerical workers, typists, shop assistants, etc.
(3) Other non-manual workers—which include such occupations as bus drivers, postmen, waiters, storekeepers, etc.
(4) Skilled manual workers such as carpenters, electricians, dyers, etc.
(5) Semi-skilled and unskilled manual workers such as packers and bottlers, brick layers, labourers, etc.

The results (which are given in Table 5) show that in the case of the information for height there is a fairly strong association between father's occupation and the level of physical development, in that children belonging to families in the less well off social categories exhibit a level of development considerably worse than in the higher social groups. The proportion of children classified to the lowest quadrant (less than the twenty-fifth percentile) was roughly one quarter for the two highest socio-economic groups but it rose to 34 per cent for the next lowest category (other non-manual workers) and increased sharply again to about 42 per cent for the two final groups covering skilled and unskilled manual workers. At the other end of the percentile scale the proportion of children in the uppermost quadrant remained very steady at about 20 per cent for the first three social groupings but then dropped significantly to about half of that level in the cells relating to skilled and unskilled workers.

The data for the weight measurements show a very similar pattern. With regard to the position of children falling in the lowest quadrant, the figures again indicate little difference between the two highest social categories, the proportion being about 25 per cent, and while this percentage increases to nearly 34 per cent for the next group (other non-manual workers) it remains at that level for subsequent categories further down the scale. In contrast the data for the uppermost quadrant does indicate a more steady type of progression—the proportion of children therein is 25 per cent for the category covering professional people, employers etc., and this falls steadily as one progresses down through the social groups until it reaches roughly 11 per cent for the two lowest groups concerned.

In regard to the statistical tests of significance, while the values of the χ^2 statistic obtained were fairly high none of them were actually significant in the sense that they exceeded the 5 per cent limit even though the value

TABLE 5

Height and weight measurements, expressed in percentile form, classified by occupation of father

Percentile Category	Occupation of Father: Professional, Employers, Salaried Employees (1)		Intermediate Non-Manual Workers (2)		Other Non-Manual Workers (3)		Skilled Manual Workers (4)		Semi-Skilled and Unskilled Manual Workers (5)		All Children		Value of χ^2 ($df=8$) +
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Height													
Less than 25th	11	22·9	25	26·3	43	34·4	22	43·1	39	41·9	140	34·0	
25th to 50th	13	27·1	29	30·5	28	22·4	13	25·5	33	35·5	116	28·2	
50th to 75th	14	29·2	23	24·2	28	22·4	11	21·6	9	9·7	85	20·6	12·3
75th or over	10	20·8	18	18·9	26	20·8	5	9·8	12	12·9	71	17·3	
Total	48	1 00·0	95	100·0	125	100·0	51	100·0	93	100·0	412	100·0	
Weight													
Less than 25th	11	23·0	24	25·2	42	33·6	18	35·3	34	36·6	129	31·2	
25th to 50th	13	27·1	26	27·4	33	26·4	17	33·3	27	29·0	116	28·2	
50th to 75th	12	25·0	28	29·5	31	24·8	11	21·6	21	22·6	103	25·0	8·8
75th or over	12	25·0	17	17·9	19	15·2	5	9·8	11	11·8	64	15·5	
Total	48	100·0	95	100·0	125	100·0	51	100·0	93	100·0	412	100·0	

*—Significant at the 5·0% level.
**—significant at the 2·5% level.
***—Significant at the 1·0% level.
****—Significant at the 0·1% level.
+Note that in the calculation of χ^2 the two middle quadrants (the 25th to 50th and the 50th to 75th) have been amalgamated.

for the height measurements was only slightly below it. These results bear out a general feature of this particular analysis in that while there is fairly substantial evidence of an association between social background and standards of physical growth and development this relationship is not as strong or nearly as well defined as in the case of the factors previously studied, namely, size of family and standard of home conditions.

One other interesting subsidiary feature to observe here is how closely the figures for the two highest socio-economic groups (when amalgamated) coincide with the percentile standards being used. This is illustrated by Table 6, which shows that the observed set of proportions for the various "quadrant" categories for the height and weight data are not all that different from the "expected" situation (which is $\frac{1}{4}$; $\frac{1}{4}$; $\frac{1}{4}$; $\frac{1}{4}$) except for the highest quadrant where there is a slight deficiency.

TABLE 6

Height and weight measurements, expressed in percentile form, for socio-economic groups 1 and 2

	Height		*Weight*	
Percentile Category	*No.*	*%*	*No.*	*%*
less than 25th	36	25·2	35	24·5
25th to 50th	42	29·4	39	27·3
50th to 75th	37	25·9	40	28·0
75th or over	28	19·6	29	20·3
Total	143	100·0	143	100·0

This indeed highlights again one of the major drawbacks in the inquiry namely, the confined social background of the children studied. One can see from Table 5 that the study group included only a relatively small number of children in the highest social category and indeed it can be said that nearly all these children were fairly well down the social scale within that category, i.e. the group did not include any children from what one would classify as "well-off" families. It would have been so much more interesting if the survey had been able to cover a larger number of children from the more well-off sections of our community so as to be able to carry out a more detailed and better balanced investigation of the influence of social background. For example, it would have been interesting to see if the performance of children from the relatively "well off" socio-economic groups would have been superior in relation to the standards used. However, even within the limited confines of the inquiry the overall picture in relation to the effect of the social background is quite clear. It would also, of course, have been interesting to have covered children from rural areas in order to examine the results from the standpoint of rural/urban comparisons.

Concluding Remarks

One repetitive feature of the results of this inquiry, which must have impressed the reader, is how children in the socially "weakest" or "most deprived" categories always appear to make the worst showing, e.g. children from the larger families, or from the lower socio-economic groups. Indeed this feature also manifests itself in other analyses not presented here, e.g., involving income groups. This makes sober reading indeed for the social scientists as it is yet one more illustration of how the pressures of living in present-day society bear hardest on those least able to withstand them.

The authors hope that the results of this inquiry will highlight the need for a set of genuine Irish standards in relation to child height and weight. While wishing in no way to criticise the standards used in this study, based on UK data (indeed had they not been available it is doubtful if any meaningful results could have been obtained) it is well accepted that there are considerable differences between races in relation to bodily stature, particularly regarding height; results based on Irish data would be more precise and would allow scope for analyses in absolute terms. It is also hoped that these results will stimulate other researchers to examine this area in more depth than we have. The size of the study group and the restricted social background of the children involved placed limitations on what could be extracted from the inquiry in the way of results. It is clear that many more interesting tabulations would be possible with a larger and more widely based sample; we have already mentioned some of these—the extension of the survey to cover all social groups and all areas of the country in order to investigate regional differences; it would also be desirable to extend the range of ages covered.

It must be emphasised of course that the findings in this paper are not new in that similar trends, in relation to the social factors considered, have been documented in other countries. However, to the best of our knowledge this is the first such inquiry carried out in this country and it is hoped, now that the evidence has been brought nearer home, that the results will have some influence on organisations and persons concerned with the problems of child welfare.

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(4) Tanner, J. M., Goldstein, H., and Whitehouse, R. H., 1970—*Standards for Children's Height at ages 2–9 years allowing for Height of Parents.* Archives of Disease in Childhood, 45; 755.

(5) Census of Population of Ireland 1966, Vol. IV—Occupations.

Dr. R. C. Geary: My remarks will be confined to statistical aspects. The percentile transformation used by the authors is ingenious as a device for correcting sample subjects for age, so avoiding the difficult small sample numbers at each age. Theirs is probably a device which could be used widely in the social sciences. Nor do I think that the authors have much to worry about from the non-randomness of their sample.*

The non-significance by χ^2 shown in Table 5 lends added significance to the devastating showing of Table 2, namely as suggesting that the latter is true of large families in every social grade.

I am in full agreement with the authors that these statistics should be set up officially on an adequate sampling scale, perhaps not annually but at five year intervals, so that we could observe the improvement in height and weight of Irish children at selected ages and classified by various social criteria. One is reminded that years ago considerable attention was devoted to these statistics, as collected on the occasion of young men entering on military service in certain countries. Dr. Lillie's observations, to the effect (as I understood them) that height and weight of children are associated with physical and mental health, lend added importance to these statistics.

There have been several references by previous speakers to the extent to which children in large families are at a disadvantage. One might add to this book of evidence the clear showing in the report of the 1965-66 Household Budget Inquiry the lower consumption per head in families with large number of children. Perhaps the Director of CSO will bear tonight's proceedings in mind in his compilation of the current HBI.

T. Linehan: The importance of the implications of the results shown in the paper has been adequately explained by the previous speakers. In view of this importance it is necessary to examine the basic data and

**Added after meeting:* in view of the regularity of the findings in each class in e.g. Table 2. The results for each family size group may be unbiased. In view of T. P. Linehan's contribution to the debate, one can easily see how larger families came to be heavily over-represented in the sample, thus prejudicing the "Total" estimates. However, as Linehan has shown, these totals may be corrected using Census data as weights.

analysis carefully. The question arises immediately how representative is the sample used? Of the total of 900 addresses visited only 412 usable records were compiled—a response rate of only 46 per cent. Have the authors been able in any quantitative way to assess whether non-respondent children differed from respondent children in relevant characteristics?—did the healthier (taller?) children tend to be "out" more often?

Table 1 shows clearly that the group of children studied were on average smaller and lighter, age for age, than those to which the charts used relate. It is possible to show that the spread or dispersion however is much the same in the two sets. Thus in the case of height measurements the distribution given by the charts needs to be moved about 0·28 standard deviations to the left to give the observed distribution. The method of presentation adopted is indeed ingenious and warrants application in other fields. I might observe, however, that it would help readers if some order of magnitude were given for the measurements.

It is tempting to use the overall results for a purpose not intended by the authors—the comparison of the height and weight profile for all Dublin children with those of the population to which the charts relate. The sample is not a representative one for this purpose. Thus in Table 2 the number of families of different sizes (number of children) are given. In percentage form they compare as follows with a distribution derived from the fertility volume of the 1961 Census of Population.

No. of children in family	*Table 2 of paper*	*1961 Census Volume VIII (Fertility) Duration of Marriage 25-30 years Dublin and Dun Laoghaire*
	Percent	*Percent*
1 or 2	9	24
3 or 4	26	31
5 or 6	29	22
7 or 8	17	12
9 or more	19	11
	100	100

(Ideally the comparison should be made with the distribution, by size, of families which in 1971 had at least one child in the 4–7 age group. As this is not available I have used the latest available figures for completed families). There is a substantial deficit of smaller families and a corresponding surplus of larger families in the group under study—this does not, of course, affect the basic theme of the paper which concerns the marked differences *between* families of different sizes. If the 1961 distribution is applied to the percentile distribution for height shown in Table 2 for each size the overall pattern is brought nearer to the standard underlying the charts, as follows:

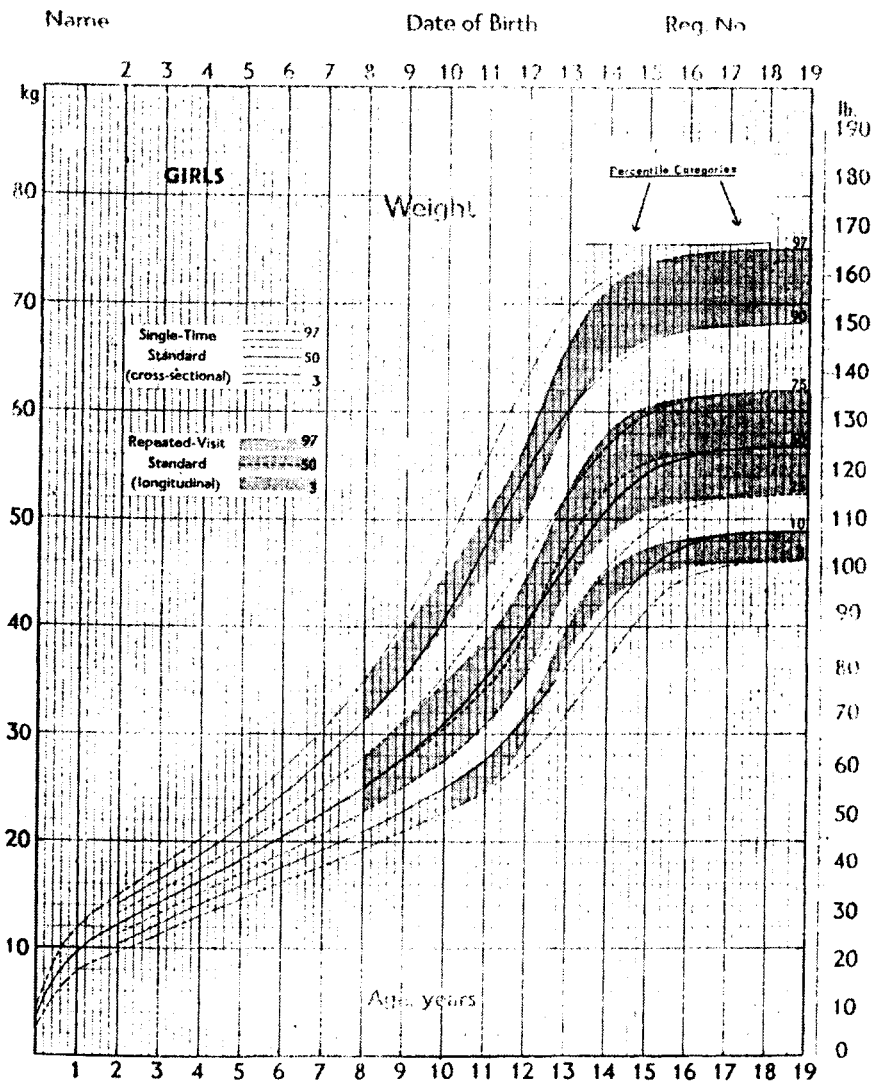
	Table 2	*Reweighted*	*Standard*
less than 25 percentile	34·0	29·5	25
25th to 50th percentile	28·2	28·3	25
50th to 75th percentile	20·6	21·9	25
75th percentile or over	17·3	20·2	25

In proposing a vote of thanks to the Authors, *Dr. Lillie* stated that he felt privileged to be present, and he wished to congratualte the authors on carrying out the first such enquiry of this nature in this Country. The authors stated that they hoped that the results of this enquiry would highlight the need for a set of genuine Irish standards in relation to child height and weight. This, he felt, would be only a very basic benefit of the investigation. In fact, many other benefits should accrue when we consider the significance of the various factors involved.

In this paper it has been shown that size of family, standard of home conditions and occupation of the father may all affect the growth and development of the child, as determined by his height and weight. One would wonder, therefore, if the parameters of height and weight have really any practical significance. Let us take the analogy of pregnancy, which however is not strictly comparable, but similar. If the baby in untero is deprived to a small degree its birth weight and length will be decreased. If it is deprived to a greater degree it may suffer mental and physical retardation. If the process is carried a step further, the baby will die in utero. These facts have long been accepted by obstetricians. Thus, it is reasonable to postulate that in extra-uterine existence that which causes a deficit in the height or weight of a child, may, if carried to a more extreme degree, cause retardation or even death. Retardation, whether physical or mental, will be a cause of handicap. It follows, therefore, that that which causes the deficit in height or weight may also be a cause of handicap. Thus, I feel that the criteria of development as laid down in this work are significant.

On consideration of the social factors, the size of family was highly significant. This again is a factor which has been strongly suspected by obstetricians. In an investigation of two hundred cases of Grand Multiparity (patients having had seven or more viable pregnancies) carried out by the Speaker recently, the following facts emerged:

> That such mothers belonged largely to the lower socio-economic groups. They tend to be poorly educated, and quite naturally of an older age group. The grand multipara has a rather indifferent attitude to life; she is easy-going, and one might say, couldn't care less about many aspects of living. She tends to eat poorly, concentrating largely on carbohydrates which, in turn, lead to obesity. The poor quality diet also causes deficiencies of iron and folic acid, which in turn lead to anaemia, deficiency of calcium, which lead to dental caries. In fact, in this group 50 per cent of patients had dental caries, and half of the remainder were edentulous. The grand multipara does not



Note. The "single time" standards (designated by the lines rather than the shaded areas) were, of course, used in the present study.

bother about family planning; she tends to come late to antenatal clinics, and once having attended is much more likely to default than her less parous sister. She is also very apt to ignore medical advice. It is quite understandable, therefore, that the grand multipara has a high perinatal mortality rate, and also an increased maternal mortality rate. Nevertheless, it is difficult to determine cause from effect, but there can be little doubt that some limitation of family size would be of benefit to this group of patients. I have no doubt, therefore, that among the social factors the size of a family has great significance.

With regards to the standard of home conditions and occupation of father, these parameters are closely related, but not identical. The standard of home conditions is largely dependent on family finance, and the level of education of the parents. The father's occupation determines the family income largely, and in turn is dependent on his education and ability. Where both of these social factors are low it means poverty, both mental and physical. Socio-medical investigations from other centres have shown that poverty produces mothers who may be too young, or too old, and who tend to have too many children. It is the main predisposing factor in the causation of premature delivery, and thus is a major cause of perinatal mortality. Among the infants who survive, the intelligence quotient is lower than those born into a higher socio-economic group. There is also an increased liability to cerebral palsy, epilepsy, mental deficiency, behaviour disorders, sensory disorders and autism. It is thus easy to see how poverty begets poverty.

Thus, Dr. Kent and Mr. Sexton have produced a piece of work which should have widespread sociological effects. It is a most valuable paper which should initiate research in many other fields, and it gives me great pleasure in proposing a vote of thanks to the authors.