

RELATIONSHIP BETWEEN FAMILY SIZES OF TWO SUCCESSIVE GENERATIONS¹

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THE object of the present article is to show, on the basis of sample material described below, that the size of the family from which the parents come holds an important place among the biological and social factors influencing the number of children born to them. This problem, which may be described as the study of the relationship between the fertility of successive generations, has received comparatively little attention from students of differential fertility. Raymond Pearl (1) records that "a number of *ad hoc* attempts have been made to measure biometrically the degree of inheritance of human fertility, by the technique of correlating size of completed families in parental and filial generations." Among these attempts the study of Karl Pearson and his associates (2) published in 1899 can still be regarded as a classic on the subject and references to it will be made in the subsequent discussion.

More recently Marcel Bresard (3) found the existence of positive association between family sizes of two generations within several socio-economic groups, and came to the following conclusions: "Les reinseignements sur la dimension des familles sur deux générations ont fourni des indications très intéressantes sur un phénomène important: le caractère traditionnel de la fécondité différentielle dans les lignées." "Les personnes appartenant à des familles nombreuses descendent plus fréquemment de parents appartenant eux-mêmes à des familles nombreuses et inversement, les influences tant paternelles que maternelles se manifestant avec une intensité très voisine, phénomène manifeste dans *tous* les groupes professionnels."

¹ The research embodied in this paper was carried under the auspices of the Population Investigation Committee, London, England and represents part of the research project of that Committee.

While Pearson ascribed the relationship to hereditary causes, Bresard seeks the explanation in the tradition of family pattern, implying *the desire* on the part of the second generation to build up a family similar in size to that from which at least one of the parents came. This difference in outlook undoubtedly reflects the progress, during the last half century, in the extent and effectiveness of family planning, associated with the use of contraceptives and other forms of birth control. The latter factor played a comparatively minor part with regard to the generations which were the subject of Pearson's study; on the other hand, Bresard seems to have ignored the hereditary factor by assuming tacitly that families are as large as the parents want them to be.

The separation of the biological and the sociological influence is by no means an easy matter. Subject to certain reservations, the inheritance of fecundity could be studied by relating the number of live births occurring in marriages of completed fertility to the number of brethren on the husband's and/or wife's side, provided that no means of birth control were practiced among the generations involved and that the condition of the completeness of marriage applied also to the first generation. The selection of a sample of, say, mothers and daughters, which would satisfy these conditions is theoretically possible, but the procedure might introduce a distorting bias on account of the correlation between fertility and survivalship. In addition, the information on the practice of birth control as well as on the number of live births provided by mothers whose average age would be about 70, would hardly be reliable.

The hypothesis that there is a certain family tradition with respect to family size presupposes both the desire and the ability on the part of the parents to produce a definite number of children. Logically, the testing of this hypothesis should therefore be confined to those marriages of completed fertility which had successfully planned the size of their families.

It will be seen that the nature of the material on which the present study is based, does not entirely fulfill the requirements

set out above. Its advantage in comparison with the few other studies executed hitherto lies in the opportunity it offers to carry out a separate analysis of marriages in which some kind of birth control was practiced and of those in which it was not. Some use will also be made of the information on the number of children planned at marriage.

THE MATERIAL

At the request of the Royal Commission on Population, an Inquiry into Family Limitation was undertaken in 1946 by the Royal College of Obstetricians and Gynaecologists. The main object of this investigation, the report on which was published as the first volume of the Papers of the Royal Commission on Population (4), was to ascertain the extent and effectiveness of birth control methods in the married population of Great Britain. For this purpose a sample consisting of married female patients was interviewed by members of the medical profession in a number of hospitals. Owing to the intimate nature of the questions asked, it was thought expedient to secure the doctor-patient relationship even at the expense of sacrificing the principle of random selection².

The present analysis has been made possible thanks to the inclusion in the schedule of the question on number of brethren, including deceased, on the husband's and wife's side, thus providing, subject to certain qualifications³, a picture of the fertility of the first generation. It is important to bear in mind that we have no information on the duration of marriage nor the prevalence of birth control among our subjects' parents, and here our data fall short of the desiderata outlined in the introductory paragraphs. It is also worth pointing out that since the questions were answered by the wives, the records of the number of their brethren can be expected to be more reliable than those of the number of their husbands' brethren.

² This principle was ensured only with regard to the selection of patients *within* a given hospital.

³ Apart from the inter-correlation between fertility and the chance of survival which was mentioned before, the incidence of complete sterility is entirely disregarded.

In order to make the group more homogeneous, only marriages of at least fifteen years duration in which both spouses were only once married were included in the analysis. The sub-sample selected to meet these requirements consists of 1,482 families.⁴

PARENT-OFFSPRING RELATIONSHIP WITH REGARD TO FAMILY SIZE

When testing the hypothesis that family size runs through generations one comes at once to the difficulty of separating the effect of the size of the family of the husband from that of the wife. These two are not always similar and very rarely identical. It seems that Pearson dodged this issue when he related the number of children born to fathers to the number of children born to sons and, similarly, the fertility of mothers to that of the daughters, since clearly each son had also a mother and each daughter a father, whose family size was not irrelevant. It is conceivable that fecundity is inheritable through one sex only, but no evidence exists to support this theory. Similarly, it is impossible to state *a priori* which of the partners to a marriage which plans successfully its number of children has more say in the matter of deciding what that number is to be.

In Table 1, average family sizes (i.e. average number of live births) of marriages of at least fifteen years' duration are shown according to the size of the family from which each of the spouses comes.

A small family is defined here and in the following tables as one in which there were one or two children (including the subject), medium-sized as one consisting of three to five children, large as one of six to ten children and very large as one in which there were more than ten children. The table shows a number of interesting features. To begin with it will be noticed that

⁴ The original sample was divided into two large groups according to whether the women interviewed found themselves in hospital in connection with pregnancy or not. Dr. Lewis-Faning confined his analysis to the latter ("Non-Maternity") groups and his practice was followed here.

the averages in the marginal row, that is irrespective of husband's family size, increase consistently from 2.63 where the wife's family size is small, to 4.41 where it is very large, Similarly, inspection of the last column reveals that the averages also increase when the association between the family size of the husband and the number of his children is studied irrespective of the number of his wife's brethren. But in the latter case the variation covers a much smaller range: from 2.98 to 3.89. That is to say the wife's family size seems to exert a stronger differentiating effect. The main body of the table shows, with a few insignificant exceptions, a definite pattern, which makes it clear that the relationship holds for each variable when the other is held constant. There is no doubt that the fertility of the second generation depends to some extent on that of the first. In the search for the cause of this phenomenon we can

Table 1.¹ Average number of live births according to husband's and wife's family size. All marriages of at least fifteen years duration.

HUSBAND'S FAMILY SIZE	WIFE'S FAMILY SIZE				ALL
	Small	Medium	Large	Very Large	
Small	2.05 (20)	3.06 (66)	3.07 (58)	3.53 (15)	2.98 (159)
Medium	2.38 (66)	2.85 (176)	3.55 (174)	4.08 (49)	3.17 (465)
Large	2.72 (72)	3.42 (183)	3.58 (280)	4.77 (90)	3.60 (625)
Very Large	4.14 (14)	3.17 (54)	4.01 (82)	4.37 (52)	3.89 (202)
ALL	2.63 (172)	3.13 (479)	3.58 (594)	4.41 (206)	3.44 (1451)

Omissions:

Number of husband's brethren	26
Number of wife's brethren	2
Use of birth control	3
All	31
Included	1,451
Grand Total	1,482

¹ In this and in the following tables the figures in parentheses indicate the number of marriages on which the average is based.

HUSBAND'S FAMILY SIZE	WIFE'S FAMILY SIZE				ALL
	Small	Medium	Large	Very Large	
Small	2.10 (10)	3.27 (30)	3.96 (24)	3.89 (9)	3.41 (73)
Medium	2.81 (27)	3.23 (73)	3.86 (80)	4.52 (29)	3.60 (209)
Large	3.08 (36)	3.93 (81)	3.90 (128)	5.13 (53)	4.03 (298)
Very Large	4.89 (9)	3.84 (19)	4.46 (46)	4.70 (30)	4.45 (104)
ALL	3.07 (82)	3.57 (203)	3.99 (278)	4.79 (121)	3.89 (684)

Table 2. Average number of live births according to husband's and wife's family size. Non-controllers only.

divide our marriages into two groups: birth-controllers and non-controllers. The first group, which includes those couples who, according to the statement of the wife at interview, have at any time during their reproductive history used some method of birth control⁵ constitutes 53 per cent of the whole sub-sample.⁶

Examination of Table 2 (non-controllers) and Table 3 (birth controllers) shows that the pattern displayed in Table 1 repeats itself in each group. In particular, among non-controllers the average number of children increases the larger the family size of the husband from 3.41 to 4.45 and from 3.07 to 4.79 in the case of wives. Among the controllers the corresponding range is 2.62 to 3.29 for husbands and 2.22 to 3.88 for wives. Again, in both cases the effect of the wife's family size seems to be stronger. We can state then, that both the "biological" and the "sociological" factors seem to be present with respect to both parents. This conclusion, based on the analysis of aver-

⁵ The following definition of birth control was adopted: "Contraception (birth control) is the use by either sex of any means whatsoever whereby coitus may be experienced, while at the same time the fusion of the ovum with the spermatozoon may be averted so that conception does not take place." It will be seen to include all chemical and mechanical methods, coitus interruptus and the use of "safe period." Abstinence of periods of more than six months was also treated as birth control.

⁶ There are grounds to believe that this proportion has been understated, that is to say that some of the couples recorded as Non-controllers did in fact use some methods of birth control, but it is impossible to state the magnitude of this error.

HUSBAND'S FAMILY SIZE	WIFE'S FAMILY SIZE				ALL
	Small	Medium	Large	Very Large	
Small	2.00 (10)	2.89 (36)	2.44 (34)	3.00 (6)	2.62 (86)
Medium	2.08 (39)	2.57 (103)	3.28 (94)	3.45 (20)	2.82 (256)
Large	2.36 (36)	3.02 (102)	3.31 (152)	4.24 (37)	3.22 (327)
Very Large	2.80 (5)	2.80 (35)	3.44 (36)	3.91 (22)	3.29 (98)
ALL	2.22 (90)	2.81 (276)	3.22 (316)	3.88 (85)	3.03 (767)

Table 3. Average number of live births according to husband's and wife's family size. Birth-controllers only.

ages, will be confirmed later by regression analysis. Before its results are shown, however, let us introduce another variable, that of social class, defined according to the occupation of the husband at the time of the interview⁷. The subjects were classified in the original sample according to the Registrar General's five grade scale, out of which three groups were formed: Non-manuals, Skilled Manuals and Semi or Unskilled Manuals. The fertility of completed marriages according to the social class and family size of the husband is shown in Table 4, and according to the family size of the wife in Table 5. The effect of the class differentials can be seen within each family size, since the averages increase for lower classes. What is more important here, however, is that within each class the averages increase with the increase in the size of the family from which the husband (Table 4) or the wife (Table 5) comes.⁸

Until now the technique used in the analysis has been that of showing the average number of children born to the second generation according to four broadly and arbitrarily defined

⁷ In a small number of cases where the husband was recorded as "Not gainfully occupied" at the time of the interview, his occupation in 1939 was considered when available.

⁸ Our sample size is too small to allow the breakdown by social class according to both the husband's and wife's family size.

HUSBAND'S FAMILY SIZE	SOCIAL CLASS			ALL
	Non-manuals	Skilled Manuals	Semi or Unskilled Manuals	
Small	2.31 (42)	2.99 (72)	3.58 (38)	2.95 (152)
Medium	2.45 (100)	3.00 (206)	3.84 (132)	3.13 (438)
Large	2.81 (89)	3.34 (287)	4.27 (211)	3.59 (587)
Very Large	2.57 (30)	3.44 (93)	4.68 (65)	3.73 (188)
ALL	2.56 (261)	3.21 (658)	4.15 (446)	3.39 (1365)

Table 4. Average number of live births according to husband's family size and social class. All marriages.

size-groups of the first generation. The run of the averages indicated in each case the existence of positive correlation between our two main variables. In Table 6 the product-moment correlation coefficients can be compared between Birth-controllers, Non-controllers and three social classes. It will be seen that all but one of the coefficients show a significant positive correlation between the sizes of our two generations.⁹ In each

Table 5. Average number of live births according to wife's family size and social class. All marriages.

WIFE'S FAMILY SIZE	SOCIAL CLASS			ALL
	Non-Manuals	Skilled Manuals	Semi or Unskilled Manuals	
Small	1.95 (37)	2.35 (77)	3.18 (45)	2.49 (159)
Medium	2.38 (104)	2.89 (205)	3.90 (144)	3.09 (453)
Large	2.73 (95)	3.28 (290)	4.26 (184)	3.50 (569)
Very Large	3.39 (28)	4.44 (90)	4.91 (78)	4.48 (196)
ALL	2.55 (264)	3.21 (662)	4.15 (451)	3.39 (1377)

⁹ Significance of individual coefficients was tested by using Fisher's formula $t = r\sqrt{(N-2)/(1-r^2)}$.

social class the correlation seems to be slightly stronger among the birth controllers than among the non-controllers. At the same time, among skilled manuals the correlation is stronger than in the other social groups. These differences are not, however, statistically significant.¹⁰ On the whole the coefficients arrived at by Pearson in his study of a thousand families extracted from the British Peerage (5), are very much of the same order. R. R. Huestis and A. Maxwell (6) found the correlation coefficient of +.124 among 638 families sending children to the University of Oregon.

What proportion of the total variance in the number of children born to the second generation can be explained by the family size of the first generation? The answer to this question is provided by computing the coefficients of determination (r^2) multiplied by a 100. These are shown in Table 7 and it will be seen at once that they are rather small. For this the heterogeneity of our material may be partly to blame. Several factors are present which screen the effect of the inheritance of fertility on one hand and of the traditional continuity on the other. Let us concentrate for a while on the inheritance issue. It is an established fact that the age at marriage has

Table 6. Comparison and significance of correlation coefficients between the number of live births and the number of wife's brethren.

SOCIAL CLASS	BIRTH-CONTROLLERS	NON-CONTROLLERS	ALL	CRITICAL RATIO
Non-Manuals	.183 ^a (165)	.125 ^d (99)	.154 ^a (264)	} 0.93
Skilled Manuals	.225 ^c (367)	.203 ^c (295)	.219 ^c (662)	
Semi or Un-skilled Manuals	.153 ^a (221)	.122 ^a (230)	.143 ^b (451)	} 1.29
ALL CLASSES	.199 ^c (753)	.174 ^c (624)	.187 ^c (1377)	

^a P between .05 and .10.

^b P between .001 and .005.

^c P smaller than .001.

^d Not significant at .10 level.

¹⁰ Successive pairs of values were compared by means of Z-test.

SOCIAL CLASS	BIRTH-CONTROLLERS	NON-CONTROLLERS	ALL
Non-Manuals	3.3	1.6	2.4
Skilled Manuals	5.1	4.1	4.8
Semi or Unskilled Manuals	2.3	1.5	2.0
ALL CLASSES	4.0	3.0	3.5

Table 7. Percentage of the total variance explained by wife's family size ($r^2 \times 100$)

tended to increase during the last half century. Consequently, even if fecundity were "perfectly" hereditary, fewer children would be born in the younger than in the older generation. This factor certainly affects the position of the regression line and it might also reduce the size of the correlation coefficient if the incidence of later marriages fell more heavily on the individuals coming from large families. Again, nothing is known about the duration of marriage in the paternal generation and consequently we are not, in fact, comparing *idem cum idem*. In some, admittedly few, cases the parents of our subjects may be still alive and capable of reproduction. In these circumstances, the coefficients should be looked upon as the lowest numerical expression of heredity.

Some light may be thrown on the family tradition aspect of

Table 8. Average number of children planned at marriage according to wife's family size and social class.

WIFE'S FAMILY SIZE	SOCIAL CLASS			ALL
	Non- Manuals	Skilled Manuals	Semi or Unskilled Manuals	
Small	1.89 (19)	2.19 (21)	2.00 (7)	2.04 (47)
Medium	2.26 (27)	2.47 (58)	2.00 (23)	2.31 (108)
Large	2.32 (22)	2.43 (47)	2.55 (30)	2.43 (89)
Very Large	1.75 (4)	2.29 (15)	2.67 (12)	2.35 (31)
ALL	2.15 (72)	2.39 (141)	2.34 (62)	2.31 (275)

the parent-offspring correlation by studying the relationship between the size of the family of origin and the number of children planned at marriage. The latter information has been provided in only about 20 per cent of the marriages included in our sub-sample. In Table 8 the average number of children planned at marriage is shown according to the social class and family size of the wife. The averages increase slightly for medium and large families and then show a tendency to decrease. It may be that people coming from very large families are unfavourably affected by their size and wish, at least at the time of their marriage, to have fewer children, but the differences found are statistically not significant and may be due to sample fluctuations.

SUMMARY

1. The analysis of our material confirms the thesis that family size tends to run through generations.

2. The associations between the number of children born and the size of the family from which the parents themselves come has been found to exist both with respect to the husband's and to the wife's family size, but the effect of the latter seems to be stronger.

3. The relationship holds within each of the three classes studied: Non-Manuals, Skilled Manuals and Semi or Unskilled Manuals. The strength of this relationship does not seem, however, to vary significantly between classes.

4. The presence of positive correlation among "Non-controllers" suggests the view expounded by Karl Pearson and others that human fertility is hereditary in the biological sense of the word. On the other hand the analysis of family planners has shown that family building habits are also "inheritable."

5. The percentage of the total variance in the fertility of the second generation "explained" by the size of the family of the first generation has been found to be comparatively small. In all probability this figure is in fact higher, but the full effect of the independent variable is screened owing to a number of factors which could not be taken into account, such as the age

at marriage, duration of marriage and the practice of birth control in the older generation, etc.

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