

VITAL and HEALTH STATISTICS
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Fertility and Educational Attainment

Puerto Rico - 1962

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An analysis of fertility and characteristics of births associated with the educational attainment of the parents of children born in Puerto Rico in 1962.

Washington, D. C.

September 1967

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
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Secretary

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William H. Stewart
Surgeon General



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IN THIS REPORT statistics are presented and interpreted on the education of parents of children born in Puerto Rico in 1962.

In 1962, Puerto Rico became the first area of the United States Birth Registration System to report the educational attainment of parents on the birth certificate. This report illustrates the usefulness of such data as indexes of socioeconomic status, to which the fertility rates of the mothers and the characteristics of the newborn infants are related.

With increasing levels of education, the annual fertility rates reported here tend to decline, but only among women near the beginning or the end of their childbearing period. In between, roughly between the ages of 20 and 34, birth rates are relatively high for women of intermediate and high levels of educational attainment. The factors associated with this high concentration of fertility of the more highly educated women are (1) a relatively late age at marriage, which delays childbearing, and (2) disproportionately few high-order births, which limits fertility in the older ages.

Order of birth is an important characteristic of the newborn infant which declines with rising education of the parents. Other characteristics which are also found to decline are immature or postmature birth weight infants and illegitimacy. Those characteristics found to increase with the parents' educational attainment are residence in a metropolitan area, a legal as opposed to a consensual form of marriage, and the occurrence of the birth in the last quarter of the calendar year. The medical, psychological, and socioeconomic implications of these relationships are discussed.

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FERTILITY AND EDUCATIONAL ATTAINMENT PUERTO RICO, 1962

Frank H. Godley, *Division of Vital Statistics*

INTRODUCTION

One of the serious gaps in birth statistics for the United States is information on the socioeconomic status of the parents. It is accurately known how many children are born and the age, race, residence, and other characteristics of their parents. But no ready index of their socioeconomic standing exists. Hence, it is difficult to make meaningful statements about the quality of the social environment in which children are born and raised and to determine how rapidly certain important segments of our population are growing.

To be useful, any index of socioeconomic status must be easily stated and defined in essentially the same way in all parts of the country. Also, the definition should be the same in both vital statistics and the census-based population estimates so that valid birth rates may be computed.

The birth certificates used in most States have asked for the occupation of the father, but this characteristic has proved to be of little use in analyzing fertility statistics. People giving information on the birth certificates do not know the technical definitions or the terms for many occupations. Therefore, it has not been possible to relate with acceptable accuracy the information entered on the certificates to any standard occupational categories, such as those used in statistics of the U.S. Bureau of the Census.

For several reasons, the use of "educational attainment of parents" on the birth certificate

has been proposed as an alternative to "father's occupation" as an index of socioeconomic status. A number of recent interview surveys show that the parents' education (most tabulations use that of the mother) is more closely related to fertility variables (number of children ever born, spacing of births, and effectiveness in controlling pregnancy, for example) than any other single measure of socioeconomic status, such as father's occupation, father's income, and family income. Furthermore, most people know the meaning of the standard educational categories (grade school, high school, and college) and can report how many years they have completed in each. Such reports are easy to code and can be directly related to the categories of educational attainment used by the Bureau of the Census.

For these reasons, the latest revision of the U.S. Standard Certificate of Live Birth (recommended for adoption by all registration areas as of January 1, 1968) asks for the educational attainment of the mother and the father and does not include any item on father's occupation.

Even before it was decided to add educational attainment to the standard certificate, two registration areas independently added the item to their certificates. Minnesota did so in 1965 and Puerto Rico in 1962. In this report, Puerto Rican data for 1962 are used to illustrate the uses of data on educational attainment. In the future, it may be possible to make similar analyses for the entire United States.

Source

This report is based on registered live births in the Commonwealth of Puerto Rico during the calendar year of 1962. Births abroad to residents of Puerto Rico are excluded. The official live-birth certificates were filed with the Puerto Rico Department of Health, Division of Demographic Registry and Vital Statistics. Copies were micro-filmed and sent to the National Center for Health Statistics, where a 50-percent sample of the birth records was coded and edited for reporting errors. The observed frequencies were then doubled for final presentation.

Classification by Educational Attainment

Educational attainment is defined as "the number of years of school completed." The intent is to include only those years completed in the formal educational system of public schools or the equivalent in accredited private schools. The educational system of Puerto Rico is structured

like that of the United States. Grades 1-8 constitute elementary school and grades 9-12, high school. Further education, 13 years of school or over, represents college.

The number of years of school completed is determined from the following question, asked of mothers and fathers, on the birth certificate: "¿Cual fue el último grado escolar que completó?" ("What was the last school grade that you completed?") The answer is recorded by marking one of the 14 categories of grades, which are numbered singly from 0 through 13+.

The replies are classified into six categories exclusive of the "unknowns." The category "0 years of school completed" is a rough approximation to those who are totally illiterate, while the category "1-4 years" largely represents the functionally illiterate.¹ The balance with an elementary school education are included in the group with 5-8 completed years of school. Persons with a secondary education are divided into non-graduates (9-11 years of school) and graduates (12 years). One or more completed years of

Table 1. Age-specific birth rates, by education of mother: Puerto Rico, 1962

Age of mother	Years of school completed by mother ¹						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
	Live births per 1,000 women in specified age group						
Total, 15-44 years ² -----	144.8	153.8	144.9	159.6	137.7	143.8	96.1
15-19 years-----	99.7	155.9	136.8	122.6	81.4	38.5	13.3
20-24 years-----	266.9	261.0	284.7	319.9	305.2	237.8	111.8
25-29 years-----	192.5	189.7	178.6	206.7	180.5	219.5	174.1
30-34 years-----	125.6	155.9	131.6	132.1	109.2	112.4	92.2
35-39 years-----	99.1	142.0	112.1	98.7	55.2	54.5	54.6
40-44 years-----	40.7	52.6	50.9	36.4	18.1	15.4	12.8
45-49 years-----	6.9	11.0	7.3	6.0	4.2	-	1.3

¹ Rates by education exclude women for whom the number of years of school completed was "not stated."

² All live births divided by the female population aged 15-44 years.

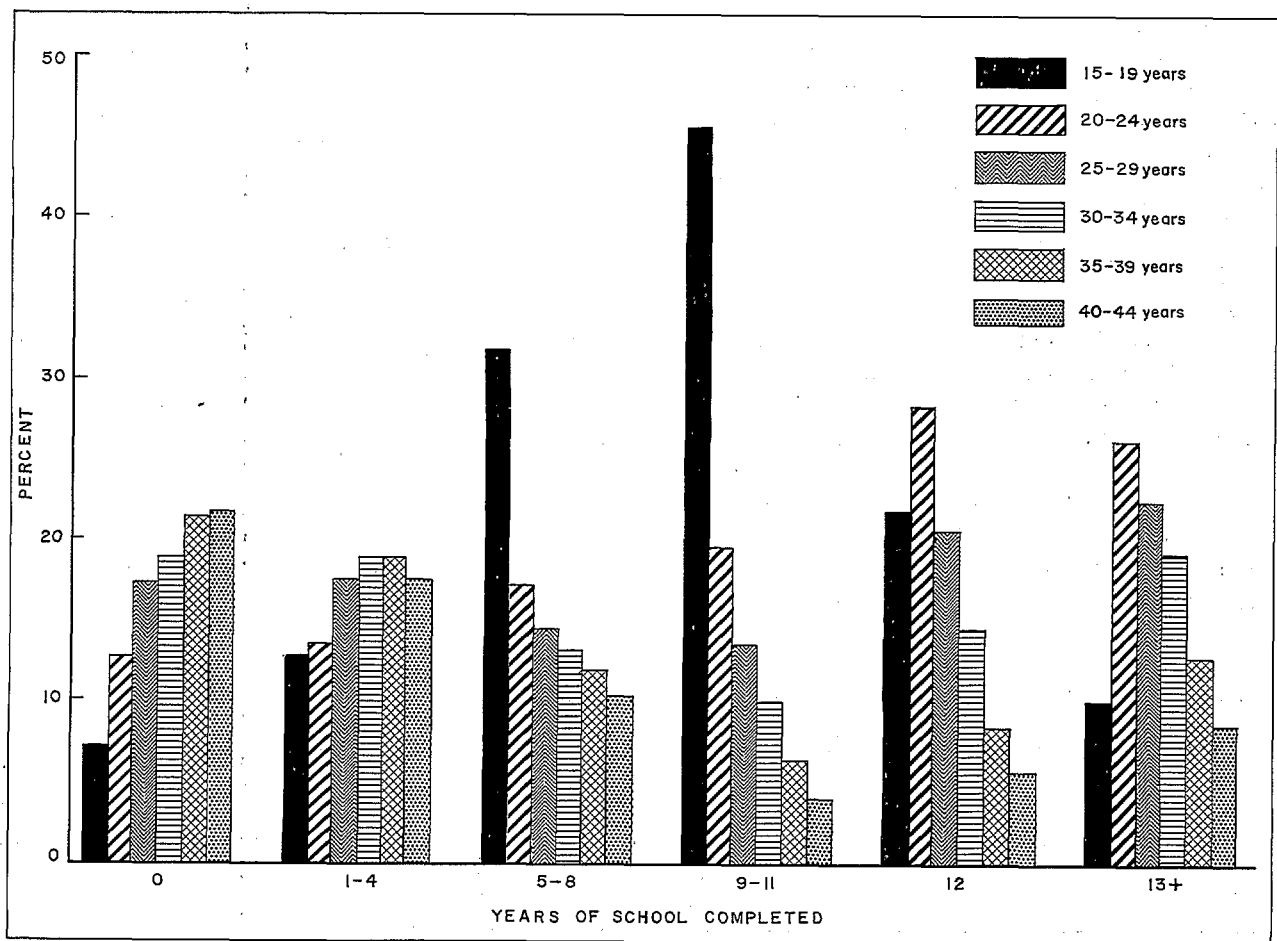


Figure 1. Age distribution of women of specified educational attainment.

higher education, college, are denoted by the group with 13 years or more of school completed.

DIFFERENTIAL FERTILITY

Differentials in Age-Specific Fertility

Differences in family size associated with educational attainment have been frequently noted in Puerto Rico.²⁻⁷ All evidence points to an inverse differential: fewer children are borne by women with more education than by women with less education. But these statistics relate to numbers of children ever born over a span of years. Do similar differentials exist when fertility rates are based on children born in a single year to women whose ages span the child-bearing period?

It is possible that the two sets of measures may show somewhat different relationships between fertility and educational attainment because women in different educational groups space their children quite differently over their child-bearing years. The extended education of the higher classes, for example, ordinarily postpones early marriage and childbearing. It is conceivable that when these women begin their families, their annual birth rates will be temporarily higher than those for women with less education, despite the higher ultimate fertility of the latter.

The general fertility rates (births per 1,000 women 15-44 years of age) shown in table 1 give a misleading impression of educational differences in fertility because the age distributions within the age range 15-44 years are quite different for the educational categories (see fig. 1).

In general, proportionately fewer less-educated women tend to fall in younger age groups than the better-educated women. Hence, the high age-specific fertility rates at the younger ages are weighted more heavily for the more-educated than for the less-educated women. It is clear, therefore, that age-specific fertility rates must be examined to avoid distortion due to widely different age distributions within the childbearing years of life.

Age-specific birth rates for the education groups shown in figure 2 and table 1 give the general impression of an inverse relationship. It is clear, however, that this is true only within certain age groups. (The semilogarithmic scale of figure 2 facilitates comparison among the widely separated birth rates in the various age groups.) In the age groups 20-24 and 25-29 years, where the rates are highest and average more

than 200 births per 1,000 women, class variation is small and inconsistent. There is no regular decline of the rate with rising education within these age groups. In other age groups, however, the usual negative fertility differentials are found, especially in the extremely young and old childbearing age groups, 15-19 and 40-44 years. Low rates at the younger ages are expected, since higher levels of education ordinarily entail a postponement of marriage and childbearing. Low birth rates are also expected for the better-educated women of the oldest ages, say 35-39 and 40-44 years, where fertility must be curtailed in order to limit family size.

Table 2 and figure 3 show the relative contribution of each age group to the total fertility rate of each educational class. (The total fertility rate is the sum of the age-specific birth rates; this gives an unweighted average of age-

Table 2. Total fertility rates and their percentage distribution in specified age groups, by education of mother: Puerto Rico, 1962

Age of mother	Years of school completed by mother						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
	Total fertility rate ¹						
Total, 15-44 years-----	4,122	4,785	4,473	4,582	3,747	3,391	2,293
	Percentage distribution						
Total, 15-44 years-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0
15-19 years-----	12.1	16.3	15.3	13.4	10.9	5.7	2.9
20-24 years-----	32.4	27.3	31.8	34.9	40.7	35.1	24.4
25-29 years-----	23.3	19.8	20.0	22.6	24.1	32.4	37.9
30-34 years-----	15.2	16.3	14.7	14.4	14.6	16.6	20.1
35-39 years-----	12.0	14.8	12.5	10.8	7.4	8.0	11.9
40-44 years-----	4.9	5.5	5.7	4.0	2.4	2.3	2.8

¹Total fertility rates are the sums of birth rates by 5-year age group of mother multiplied by 5 and are expressed per 1,000 women.

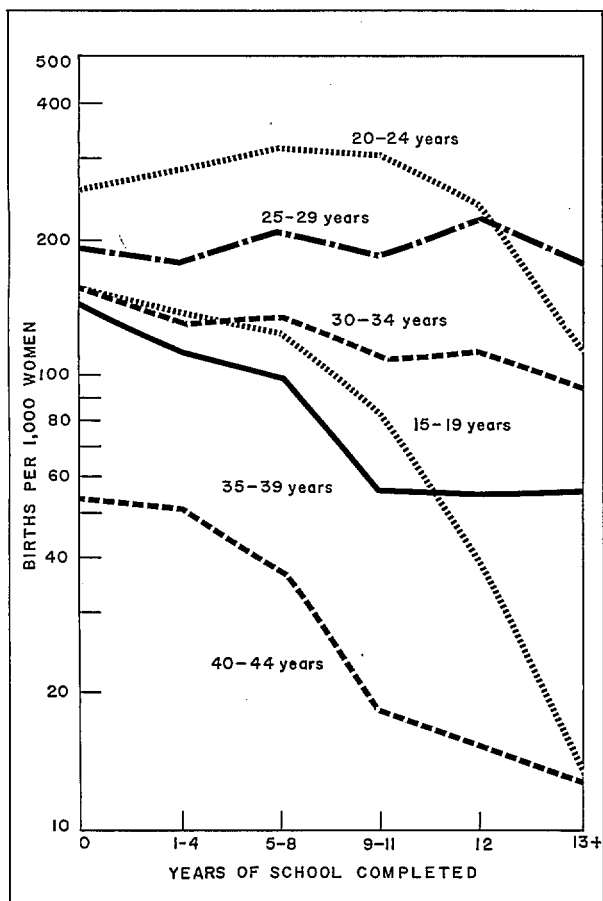


Figure 2. Age-specific birth rates, by education of mother.

specific fertility in each educational class.) Here, the age-specific birth rates within the class are expressed as a percentage of their total. The relative contribution of intermediate age groups tends to rise with education. The percentage of the total fertility rate for each educational class for women between the ages of 20 and 34 years, for example, is 63.4 among women with no schooling, 66.5 among women with 1-4 years of school, 71.9 among those with 5-8 years, and 79-84 among those with 9 years or more of school completed (see table 2).

A comparison of figures 2 and 3 shows a general tendency for age-specific birth rates to follow the pattern of these percentages across educational groups. This parallel can be traced to a mathematical relationship. When multiplied

by the total fertility rate, the percent of total fertility in an age group is equal to the birth rate in that age group. This parallel tends to break down in the two highest educational groups because the unusually high percent-contribution to total fertility there of the middle childbearing ages 20-34 is more than offset by unusually low total fertility rates. The result is relatively low age-specific birth rates in these uppermost educational groups.

While this analysis of the distribution of fertility over the childbearing ages illuminates some irregularities observed in age-specific fertility differentials, it should not be taken as

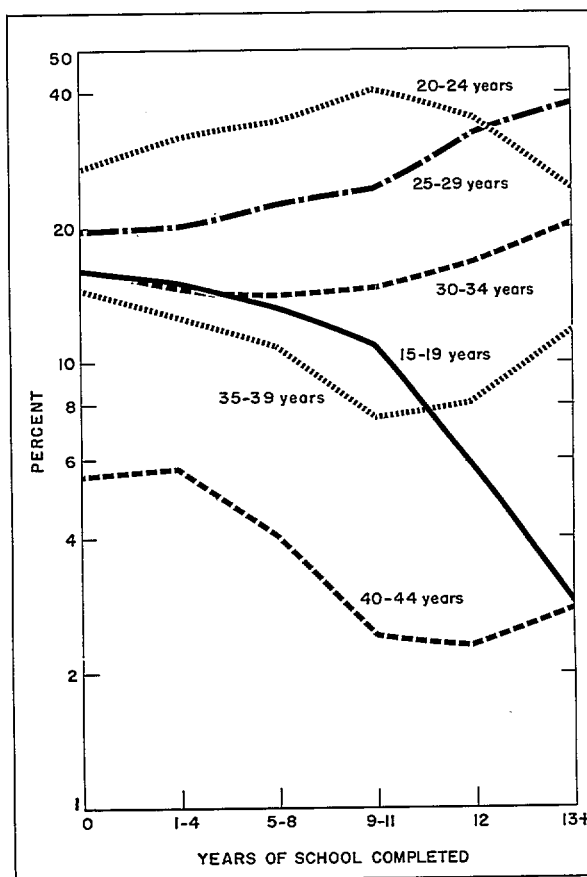


Figure 3. Percent of total fertility rate in specified age group, by education of mother.

an accurate representation of actual timing patterns of childbearing for two fundamental reasons. First, the data do not refer to the same group of women as they proceed through the childbearing ages, but rather to a mélange of various cohorts, each observed in only one age group. Ideally, reproductive patterns are studied by observing the actual fertility of a cohort in several age groups. Obviously, the data reported here cannot satisfy these ideal conditions. But they do represent the beginning of an annual series of birth rates by educational class, which will eventually make year-by-year cohort analysis possible. (If the youngest age group of Puerto Rican women is observed until their fertility is completed at ages 40-44, the final year of observation will be 1987. The later adoption of education on the U.S. Standard Certificate of Live Birth has extended this date to 1993 for the United States.)

Second, the rates reported here are subject to considerable variation from year to year. This, too, limits the extent to which they represent actual childbearing patterns. A variety of factors underlie variation in annual rates. One ever-present factor is reporting error, which may affect both the reported number of women giving birth and the reported or estimated number in the population of a given age-education subgroup. A second factor might be termed the variation attributed to the particular circumstances of the data collection year, 1962.

On the positive side, annual age-specific birth rates for educational classes have the important advantage of recency. Consequently, memory does not affect the number of births per woman in a calendar year, as it does among women reporting on past numbers of children ever born. The annual rates also have the advantage of referring to the characteristics of the woman at the time of her confinement. Consequently, her age, parity, length of marriage, place of residence, and education, for example, can be more accurately used as control variables than would be the case among women who have completed their childbearing. And last, because they are current measures, the annual age-specific birth rates include the fertility of women who eventually emigrate. This is especially important in Puerto Rico because of the large volume of people moving to and from the Island. The relatively

low fertility of women who have emigrated to the United States,⁸ for example, leaves those with substantially higher fertility to report on the number of children ever born.⁹ Retrospective studies may, therefore, exaggerate the actual fertility differentials.

Differentials in Marital Fertility

The proportion of women who have ever married varies with educational attainment in Puerto Rico. According to the 1960 census, for example, among women aged 35-44 years, the proportion ever married was 85 percent for those with 9 years or more of school compared with 91 percent for those with less school. Rates based on all women, therefore, exaggerate the higher fertility of the less-educated. This is shown in figure 4, where the total fertility rate for each class is taken as a ratio to that for women with 13 years or more of school completed. Ratios for all women compared with those for married women show the inflation of fertility among the less-educated.

Although the educational differentials in fertility are somewhat less for ever-married women than for all women, they are still substantial. This is shown by the total fertility rates for ever-married women in 1962, represented by the solid line in figure 5. These rates may be interpreted as the average number of births that would occur to ever-married women living to the end of the childbearing age in a population constantly subject to the age-specific marital fertility rates of 1962. (These rates were computed by dividing the estimated population of women in a given age group—whether married or unmarried—into the number of births to married women in the age group. To obtain the total fertility rate for ever-married women, these rates were summed, multiplied by five, and divided by the proportion of women aged 35-44 who had ever married, which was taken from the 1960 census.)

Figure 5 (broken line) also shows the actual average number of children ever born, reported in the 1960 census by ever-married women aged 35-44 years (the 1916-25 cohorts, approximately). These rates, too, show an inverse relation to education, but the range is much greater: 2.3 to 6.7 children ever born, compared with a range of 2.7 to 5.0 for the 1962 hypothetical rates.

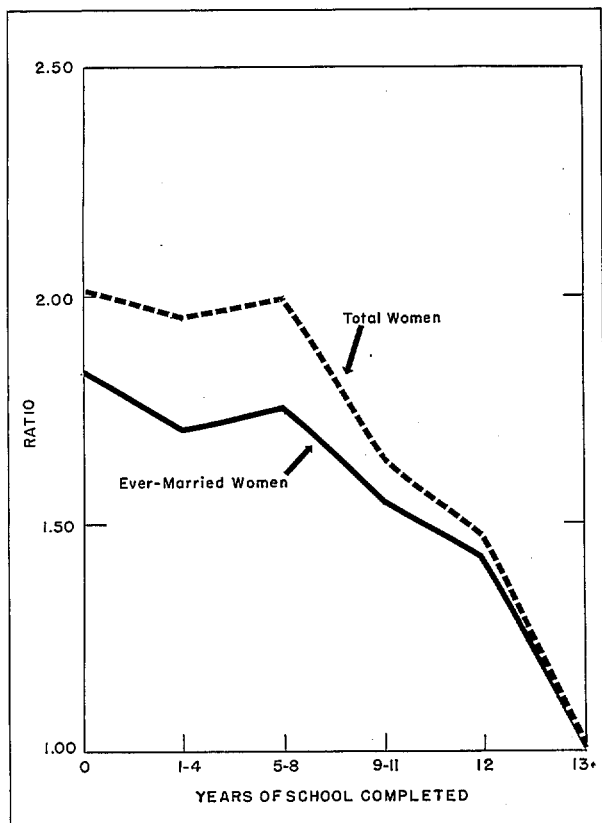


Figure 4. Ratio of total fertility rates by education of mother to total fertility rate for women with 13 or more years of school.

In the two lowest educational classes, the hypothetical rates show the ever-married woman eventually bearing 1.5 fewer children than her elders actually bore by 1960. Why should this be? Two explanations are likely: (1) that completed marital fertility of young women, those 34 years and under in 1962, will eventually decline in the lowest educational classes relative to the upper (roughly, grade-school versus high-school educated women); and (2) that in the lower classes young women, unlike those in the upper classes, are not advancing their births to younger ages, but upon completing childbearing will nevertheless exceed the fertility of the upper classes by the same margin as their elders did in 1960.

The first explanation remains a hypothetical possibility until the women now under age 34 complete their childbearing and can be compared with older cohorts to see whether ultimate family

size has in fact decreased among the lower classes, while decreasing more slowly (or increasing) among the upper classes. The second explanation, that the timing of births only temporarily favors increased fertility of the upper educational classes and at ages below 35, is consistent with the finding reported above that the concentration of fertility between the ages of 20 and 35 years tends to reverse the overall inverse fertility differentials. As education increases, fertility rates for ages 20-34 tend to be increasingly inflated by the concentration of total fertility in these age groups rather than by its overall level. The same appears to hold true for married women as for all women.

Data on the length of the interval between marriage and giving birth are also consistent with the hypothesis that better-educated Puerto Rican

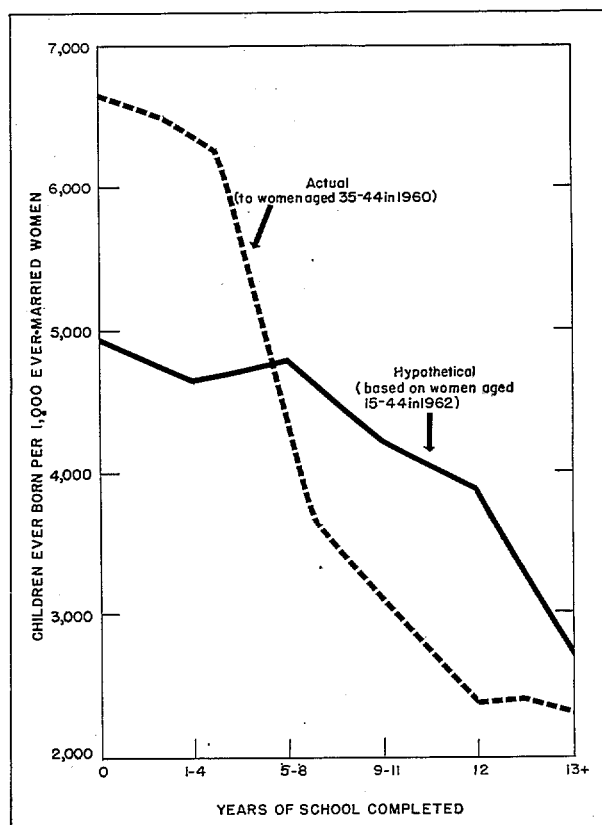


Figure 5. Actual and hypothetical numbers of children ever-born per 1,000 ever-married women aged 35-44 years.

women concentrate their births more heavily in the intermediate childbearing ages than do the less-educated. Table 3 shows that the time between marriage and birth declines with rising educational attainment for every age group. In the group 25-29 years, for example, the years from marriage to birth fall from 8.1 to 3.9 as education rises.

How is this reconciled with the relatively low total fertility of upper and middle educational classes? Shouldn't they have relatively *high* total fertility if, at each age, birth follows relatively soon after marriage? The explanation of this paradox lies partly in those wives who did not give birth in the calendar year and who, therefore, are not included in the data. Also, part of the explanation is that the higher proportion of the births to better-educated women are first and second births, which follow soon after marriage.

First, consider the women who do not give birth in a given calendar year. The age-specific birth rates shown in table 1 suggest that at ages 35 and above, the proportion of women who did *not* give birth rises with education. It is likely that from year to year a considerable proportion of women who choose not to have children are the *same* women. These wives are not included in the data for length of time between marriage and birth. Thus, in a given calendar year, there are disproportionately few well-educated women becoming mothers long after marriage.

Second, the well-educated women who give birth in a given year are having disproportionately many first and second births, which generally occur relatively soon after marriage. Figure 6 shows that the interval between marriage and the first birth is nearly the same for all educational groups. Among higher-order births, the interval is relatively long for the two highest educational classes. Thus, the time between marriage and giving birth does not decline with education, but the order of birth does. This reconciles the problem, since a decline in order of birth implies a limitation of fertility. This is consistent with the decline of both fertility and the length of time between marriage and giving birth.

Differences in age at the time of last marriage among the women giving birth can be deduced from table 3. If, in the age group 25-29 years, for

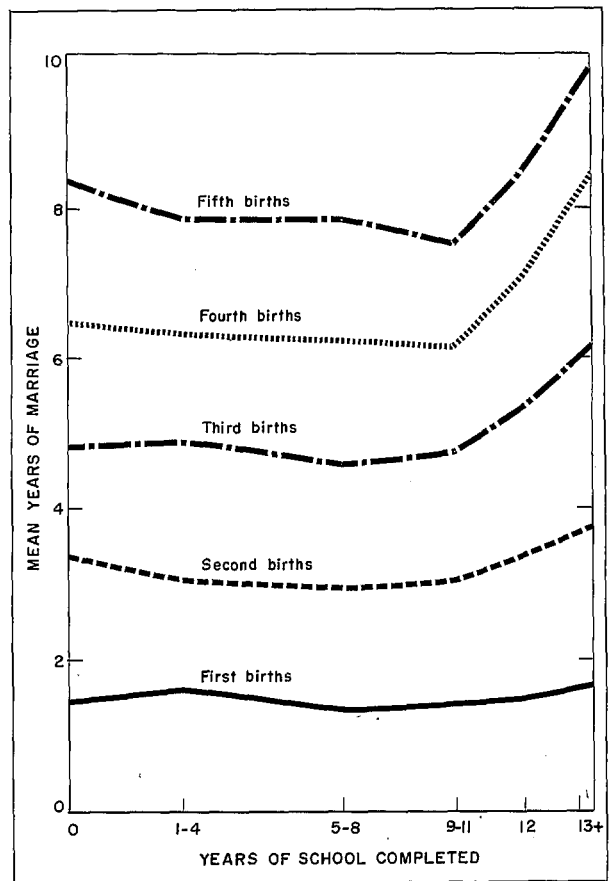


Figure 6. Mean years of marriage prior to specified order of live birth, by education of mother.

example, the mothers are assumed to have a median age of 27.5 years, then the median interval between marriage and giving birth can be subtracted from this value. The resulting median age at marriage is seen to rise with education from 19.4 to 23.6 years. Table 4 shows that similar median ages at the time of last marriage tend to rise with the educational attainment of every age group of women giving birth.

To summarize, proportionately fewer of the Puerto Rican women of high educational attainment marry than those of lesser educational attainment. Among the married giving birth in a particular year, the less-educated have married at relatively young ages, have had several children, and as a consequence give the illusion of a relatively slow pace of childbearing. The better-

Table 3. Median years from marriage to giving birth, by age and education of mother:
Puerto Rico, 1962

[Medians are the number of years, to the nearest anniversary, between the last marriage of the mother and birth of her child, irrespective of birth order. Refers to wives giving birth during the year]

Age of mother	Years of school completed by mother						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
Total, 15-44 years-----	4.6	8.9	7.1	4.4	3.4	3.1	3.7
15-19 years-----	2.0	2.2	2.3	2.1	1.9	1.7	1.6
20-24 years-----	3.5	5.0	4.5	3.9	3.4	2.4	2.0
25-29 years-----	6.1	8.1	7.8	7.1	5.9	4.2	3.9
30-34 years-----	10.3	12.1	11.7	10.8	9.1	6.2	6.6
35-39 years-----	15.3	15.9	16.2	15.4	12.7	9.3	10.7
40-44 years-----	20.3	20.0	21.1	20.6	14.7	14.0	15.6

Table 4. Estimated median age at last marriage, by current age and education of mother:
Puerto Rico, 1962

[Refers to wives giving birth during the year]

Age of mother	Years of school completed by mother						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
15-19 years-----	15.5	15.3	15.2	15.4	15.6	15.8	15.9
20-24 years-----	19.0	17.5	18.0	18.6	19.1	20.1	20.5
25-29 years-----	21.4	19.4	19.7	20.4	21.6	23.3	23.6
30-34 years-----	22.2	20.4	20.8	21.7	23.4	26.3	25.9
35-39 years-----	22.2	21.6	21.3	22.1	24.8	28.2	26.8
40-44 years-----	22.2	22.5	21.4	21.9	27.8	28.5	26.9

¹Median age at last marriage is the difference between the midpoint of the reported age group and the reported length of current marriage expressed in years.

educated, in contrast, have married at older ages, are childless or have borne very few children, and as a consequence are having their births relatively soon after marriage. Proportionately fewer of these better-educated women go on to have more children in future years and, consequently, their completed fertility is relatively low.

CHARACTERISTICS ASSOCIATED WITH BIRTH

Education of the parents is related not only to annual rates of reproduction, but also to characteristics associated with birth. In this section, statistics are presented on the seasonal variation of births, legitimacy, metropolitan-nonmetropolitan residence, order of birth, and birth weight in relation to educational attainment.

Some of the birth characteristics are discussed in relation to the father's education. As the head of the household, the father and his level of education are closely related to two other major components of socioeconomic status—occupation and family income. Thus, the education of the father is a meaningful indicator of the socioeconomic environment in which the newborn infant begins life.

Season of Birth

Births tend to concentrate in the final quarter of the year in Puerto Rico. In a study of the season of birth, the maximum incidence of births was found to shift from May in 1941-46, to August in 1946-50, and to September in 1951-61.¹⁰ Data for 1962 show this trend toward the last quarter to be true in all educational classes, but especially so for mothers in the middle and upper educational groups. Figure 7 shows that the

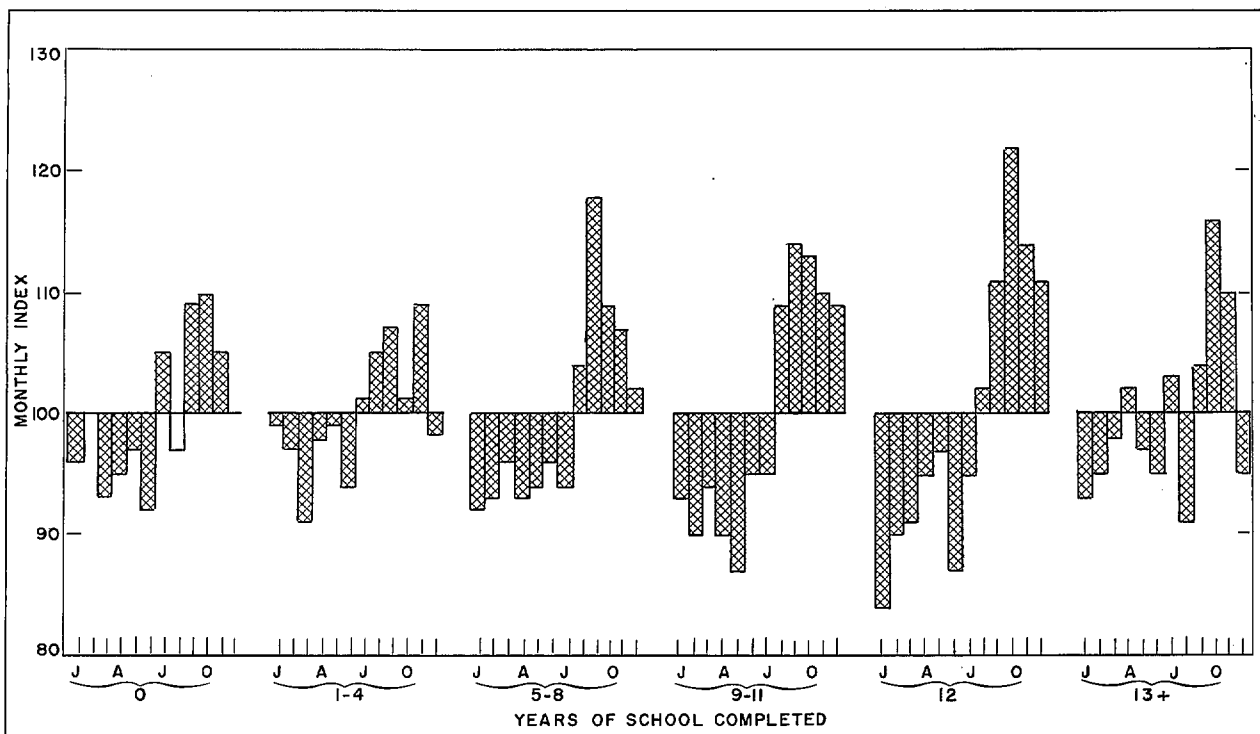


Figure 7. Monthly indexes of live births, by education of mother.
(Ratio of monthly daily average to annual daily average as 100)

index of births in the final quarter of the year is above 110 among mothers with 9 years or more of school and about 105 among mothers with less school. (The monthly index of birth is the ratio of the daily average number of births in the given month to the daily average in the calendar year. The ratio is multiplied by 100.)

In order to strike a balance, the upper and middle educational classes must have fewer births in the earlier months of the year. These deficits, too, tend to be more concentrated with advancing education, though there are some exceptions. As a result, increasing education tends to be associated with an increasing amount of seasonal variation. This can be measured by the standard deviations of monthly indexes from a mean of 100. The standard deviation is about 6 in the lowest educational classes, rises to 12 for high-school graduates, and drops back to 7 only in the highest class (13 years or more).

Data for other years are needed to confirm the association between education and seasonal variation. At present, the association between education and the amount of seasonal variation in Puerto Rico is opposite that indicated for the United States, where the lowest socioeconomic groups have the largest amount of seasonal variation.¹¹ The U.S. data, however, are based on

white-nonwhite and regional comparisons, where nonwhite persons and residents of the South were found to have unusually large seasonal variation. More direct and valid comparisons among socioeconomic groups in the United States and between the United States and Puerto Rico will be possible when educational data are available from all registration areas.

Marital Status

There are two types of marriage in Puerto Rico. One is legal marriage, in which the couple is married formally in a civil or religious ceremony. The other is consensual marriage, in which the couple lives together in an informal union under common law. Approximately three-fourths of all parents of children born in 1962 were legally married, while one-fifth were consensually married. When added together, both types of marriage accounted for 96 of every 100 births.

This means that about 4 out of every 100 births were illegitimate. Table 5 shows that this percentage varies considerably according to the age and educational attainment of the mother. Although the percentage of births to unmarried mothers declines with age, it also declines with educational attainment.

Table 5. Live births to unmarried mothers as a percent of total births, by age and education of mother: Puerto Rico, 1962

Age of mother	Years of school completed by mother						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
Total, 15-44 years-----	4.1	5.3	4.3	5.2	4.0	2.1	0.8
15-19 years-----	7.1	10.4	7.3	7.8	5.6	5.6	3.1
20-24 years-----	4.2	6.8	4.7	5.2	4.1	2.3	0.9
25-29 years-----	3.1	4.9	3.9	4.1	2.8	1.4	0.8
30-34 years-----	2.9	4.9	3.3	3.1	1.7	1.5	1.0
35-39 years-----	3.1	3.9	3.1	3.3	3.2	2.0	-
40-44 years-----	2.3	2.6	2.7	2.0	-	-	-

Table 6. Live births to married parents as a percent of total live births, by type of marriage and education of mother and father: Puerto Rico, 1962

Type of marriage and years of school completed by mother	Years of school completed by father						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
<u>Married</u>							
Total-----	95.8	96.6	97.2	96.0	95.7	95.7	97.7
0 years-----	94.7	96.6	96.2	94.6	92.5	87.1	66.7
1-4 years-----	95.7	97.4	97.7	95.7	94.2	92.7	84.6
5-8 years-----	94.8	95.2	96.8	96.1	94.7	92.4	92.1
9-11 years-----	96.0	97.1	97.7	96.2	97.2	95.5	93.9
12 years-----	97.9	94.7	98.1	98.4	97.3	98.3	98.8
13+ years-----	99.2	-	100.0	100.0	99.1	99.2	99.4
<u>Legally married</u>							
Total-----	75.8	65.4	71.1	71.3	77.4	87.1	95.5
0 years-----	61.0	64.0	63.3	58.2	58.8	54.8	22.2
1-4 years-----	69.5	66.5	73.4	66.8	69.1	74.4	67.3
5-8 years-----	72.4	63.7	71.1	73.0	73.4	77.8	85.8
9-11 years-----	79.9	70.2	72.6	75.2	81.5	86.1	89.5
12 years-----	92.9	78.9	85.7	87.0	89.9	95.2	97.0
13+ years-----	98.2	-	100.0	92.9	97.4	98.2	98.6
<u>Consensually married</u>							
Total-----	20.0	31.3	26.1	24.7	18.3	8.6	2.2
0 years-----	33.7	32.6	32.9	36.4	33.7	32.3	44.4
1-4 years-----	26.2	30.9	24.3	28.9	25.1	18.2	17.3
5-8 years-----	22.4	31.5	25.7	23.1	21.3	14.6	6.3
9-11 years-----	16.1	26.9	25.1	20.9	15.6	9.4	4.4
12 years-----	5.0	15.8	12.3	11.4	7.4	3.1	1.8
13+ years-----	1.1	-	-	7.1	1.7	1.0	0.7

The percentage of births to consensually married mothers also declines with education. Table 6 shows that this is true for the education of the father as well as that of the mother. Below the ninth-grade level, about 1 in every 3 to 4 births occurs to consensually married couples. Where the husband and wife are of different educational levels, the percentage of consensually married diminishes as the education of either spouse rises. Childbearing in a consensual union is largely a phenomenon of the lower educational classes.

This is not surprising since births in consensual unions can be viewed as a form of il-

legitimacy. In the strict legal sense, births in a consensual marriage are just as illegitimate as those to a never-married mother. The difference is that the consensual union is domiciliary (the father lives with the mother and is not "just visiting"). As educational levels of the general population continue to rise, more Puerto Rican women are likely to find the consensual union unacceptable and to choose legal marriage. As a result, illegitimacy should decrease each year as it has in the past in Puerto Rico. The current percentages of legitimate births by parents' educational attainment are shown in table 6 under "legally married."

Metropolitan-Nonmetropolitan Residence

Puerto Ricans, like other modernizing people, are moving from rural to urban areas. One measure of the degree of urbanization is the proportion of the population living in metropolitan areas. In 1960, 34.8 percent of the population of Puerto Rico lived in one of the three standard metropolitan statistical areas on the Island, Mayaguez, Ponce, and San Juan.⁹ Most of the growth of the metropolitan population is attributed to migration rather than to births. It is therefore appropriate to ask in what proportion the newborn are added to metropolitan areas and how this varies by educational class.

In 1962 the proportion of births occurring to metropolitan residents was 34.2 percent, about the same as the percentage of the total population living in metropolitan areas. Urbanization, therefore, seems to be more dependent on migration than on births.

Education of the father affects the chances of the newborn infant beginning life in a metropolitan area. Fewer than 2 out of 10 children born to fathers with no schooling have metropolitan residence, as compared with 6 out of 10 born to fathers with some college education. Table 7 shows that this relationship is stronger for legitimate births. In most educational classes, consensual marriage reduces class differences in the proportion of births occurring in metropolitan areas.

Order of Birth

Education of the father is inversely related to the birth order of the child. This inverse relationship is summarized by the median order of birth, which shows that children born to the two lowest educational classes were preceded by twice as many births as compared with children born to the two highest classes. Table 8 shows median birth order and the percentage distribution of births by order for each educational class of the father. The percentage of births in the first three orders declines with increasing education. Fourth-order births show no relationship to education. Fifth or higher order births account for more than 50 percent of all live births to fathers in the two lowest educational classes, but less than 15 percent of the births to fathers in the two highest classes (fig. 8).

The frequency of high-order births in the lower educational classes of Puerto Rico adds to the economic disadvantages found there. Each birth represents a reduction in income for each family member, increasing the inequalities of gross family income. More frequent sacrifice of basic needs in the child's environment for economic reasons is well documented in Puerto Rico. In a 1954 sample survey of the heads of 1,000 households, the percentage giving "lack of economic resources" as the reason for the child's leaving school was found to be inversely related

Table 7. Percent of all live births to residents of metropolitan areas, by type of marriage and education of father: Puerto Rico, 1962

[By mother's residence in standard metropolitan statistical area]

Type of marriage	Years of school completed by father						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
All parents ¹ -----	34.2	17.2	22.6	31.3	40.3	44.2	60.7
Legally married-----	34.8	15.1	20.9	30.6	40.3	44.1	61.4
Consensually married-----	32.8	22.1	27.0	33.8	42.7	47.2	46.6

¹Includes married and unmarried parents.

Table 8. Number of live births, median birth order, and percentage distribution of live-birth order, by education of father: Puerto Rico, 1962

[Live-birth order refers to number of children born alive to mother]

Live-birth order	Years of school completed by father						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
	Number of live births						
Total-----	76,596	5,318	18,278	21,774	12,586	11,378	6,510
	Percentage distribution						
Total-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0
First births-----	22.7	10.3	11.9	21.7	29.9	31.9	34.4
Second births-----	20.3	10.9	13.0	20.0	25.8	26.1	28.5
Third births-----	15.2	11.7	12.1	14.9	17.2	18.1	19.3
Fourth births-----	10.1	9.8	10.6	10.4	9.6	9.4	9.7
Fifth births-----	7.4	9.8	9.4	7.9	5.5	6.1	4.1
Sixth births-----	5.6	7.7	8.4	6.1	3.8	3.4	2.0
Seventh births-----	4.5	8.2	7.6	4.6	2.3	1.9	0.7
Eighth births-----	3.7	8.0	6.2	3.8	2.0	1.2	0.8
Ninth births-----	2.9	6.2	5.1	3.0	1.3	0.8	0.2
Tenth births and over-----	7.6	17.1	15.6	7.3	2.4	1.0	0.2
Median-----	3.5	5.7	5.2	3.5	2.8	2.7	2.5

to the father's education.¹ Another sample survey of 1,000 Puerto Rican families in 1946 linked low socioeconomic status with poor housing conditions, poor diets, and poor health practices. Low income was associated with the infant's not being examined by a doctor, with dietary deficiencies (especially in high-protein foods), and with room-crowding.² Medical attention and hospital care, however, do not at present appear to favor high socioeconomic position, as Puerto Rico's social medicine program provides drugs and hospital and doctor care at little or no cost to those unable to afford the ordinary expense. A 1958-59 sample survey of 2,951 Puerto Rican families found no significant class differences in the average number of physician visits or hospital stays.¹²

Order of birth, in addition to causing a reduction in income for each member of the

family, may also reduce the emotional support that can be given the child. Apart from socioeconomic status, both birth order and size of family (which approximates order at the time of birth) were found to be negatively correlated with mental achievement in studies outside Puerto Rico. These findings were reported in the intelligence test scores of Swedish males called for universal military service at the age of 20.¹³ Similar findings were reported for 11-year-old school children in the 1947 Scottish Mental Survey, which found the relationship between family size and intelligence score to hold regardless of the mother's age, reducing the likelihood of bias due to incomplete fertility.¹⁴ In the United States, the first-born are overrepresented among the gifted, among the eminent scientists, among the National Merit Scholarship Finalists, and among college student populations in undergrad-

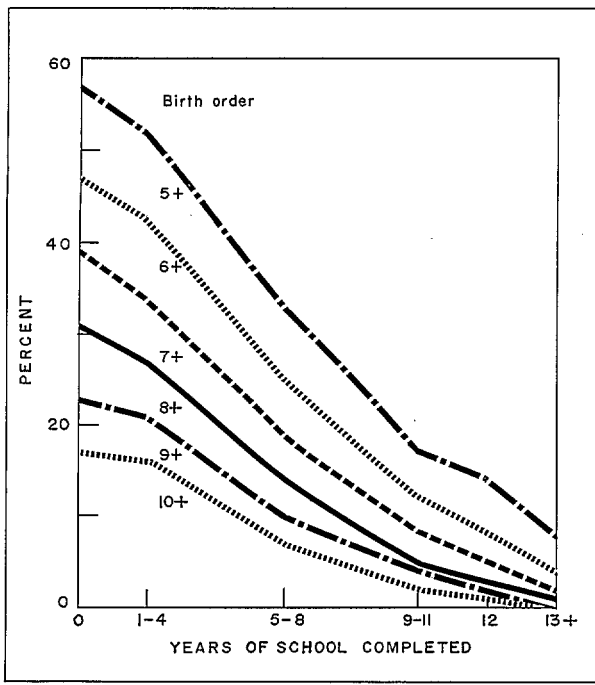


Figure 8. Cumulative percentage of live births of specified order or higher, by education of father.

uate, graduate, and professional schools.¹⁵ The international nature of this evidence suggests that birth order may also be correlated negatively with educational achievement in Puerto Rico. This may hinder social mobility by limiting the educational achievement of children born to less-educated parents.

Birth Weight

Education of the father is associated positively with medium-range birth weights of the children. Births in the 2,501-4,500-gram range (about 5½-10 pounds) increase from 85.5 percent among fathers with no schooling to 92.7 percent among fathers with 13 or more years of school. Outside this birth-weight range there is a negative association between the father's education and the relative frequency of births. Table 9 shows that this is true for both very low and very high birth weights. The low extreme (2,500 grams or less) comprises the usual definition of immaturity. The percentage of immature births in the

lowest educational class is 12.1, nearly double that found in the highest class. In the upper extreme (4,501 grams or more), similar differences are found.

These class differentials are concealed by statistics on median birth weight. The median birth weight for each educational class is within 60 grams (2 oz.) of the median for all classes combined. Moreover, the medians for 5 of the 6 groups are within 20 grams (1 oz.) of that for all classes combined. Median birth weights and the percentage distribution of birth weights in 500-gram intervals are shown according to the education of the father in table 10. The highest relative frequency of immaturity and postmaturity in the lower educational classes implies a higher incidence of infant mortality, congenital malformation, especially neurological damage, and consequent mental retardation.

SUMMARY AND CONCLUSIONS

This report illustrates some of the uses of data obtained from birth certificates on the educational attainment of parents. Data on births in Puerto Rico in 1962 are presented here, but similar studies are projected for other birth registration areas of the United States. Later studies may go well beyond the limits of the present study, especially when data for a series of years and different areas become available.

In this report data on education reported on the Puerto Rican birth certificate have been used for two purposes: first, to examine the differential fertility rates of socioeconomic groups in a calendar year, and, second, to describe differences, which are associated with socioeconomic class, for characteristics relevant to birth.

The data indicate certain advantages for those children fortunate enough to be born into high social classes. The advantages of beginning life with a desirable birth weight, few siblings, legally married parents, and a metropolitan residence favor the newborn infant in the better-educated classes. Puerto Rican children beginning life with less-educated parents have disproportionately high frequencies of immature and postmature birth weights, illegitimacy rates, and large numbers of siblings with whom to share the limited family resources.

Table 9. Percentage distribution of live births in selected birth weight classes, by education of father: Puerto Rico, 1962

Birth weight of child	Years of school completed by father						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
Percentage distribution							
Total-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2,500 grams or less-----	9.4	12.1	9.9	10.2	9.4	7.5	6.2
2,501-4,500 grams-----	88.9	85.5	87.8	88.0	89.4	91.4	92.7
4,501 grams and over-----	1.7	2.4	2.3	1.8	1.2	1.1	1.1

Table 10. Percentage distribution of live births, by birth weight, and median birth weight, according to education of father: Puerto Rico, 1962

Birth weight of child	Years of school completed by father						
	Total	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years
Percentage distribution							
All births-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1,000 grams or less-----	0.3	0.3	0.2	0.3	0.3	0.2	0.3
1,001-1,500 grams-----	0.6	0.9	0.7	0.6	0.5	0.4	0.4
1,501-2,000 grams-----	1.4	1.9	1.5	1.6	1.6	1.0	1.0
2,001-2,500 grams-----	7.1	8.9	7.5	7.8	6.9	5.9	4.5
2,501-3,000 grams-----	24.0	24.3	23.9	24.7	25.2	23.5	20.4
3,001-3,500 grams-----	37.7	33.7	35.7	37.3	38.9	39.8	42.1
3,501-4,000 grams-----	21.4	21.1	21.6	20.4	20.5	22.6	24.8
4,001-4,500 grams-----	5.7	6.4	6.6	5.6	4.8	5.4	5.4
4,501-5,000 grams-----	1.5	2.0	2.1	1.6	1.0	1.0	1.0
5,001 grams and over-----	0.2	0.4	0.2	0.1	0.2	0.1	0.1
Median, in grams-----	3,210	3,200	3,220	3,190	3,190	3,230	3,270

The differential rates of reproduction in the various educational attainment classes determine the size and composition of the cohort being born. Of the 1962 Puerto Rican birth cohort, about one-third were born to mothers who are functionally illiterate, that is, had completed less than 5 years of school. Moreover, about one-fifth of the newborn infants had both parents at the level of functional illiteracy.

One principal finding in the case of Puerto Rico is that when viewed in one calendar year, usual negative class fertility differentials may be reversed within certain age groups. Fertility rates between ages 20 and 29 do not decline with education of the mother. This is the result of the concentration of fertility in these intermediate

childbearing years by the better-educated mothers.

A second principal finding is that the annual class fertility differentials in Puerto Rico are distorted by the age structure of the childbearing population. Younger generations are attaining successively higher educational levels than their elders. As a result, less-educated women tend to be relatively old, while the better-educated are relatively young. These age differences are not taken into account by the general fertility rate, which shows a distorted, positive correlation between educational attainment and fertility. Age-adjusted fertility rates are closer to the truth and show a negative differential.

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APPENDIX

VALIDITY OF THE DATA

Conceptual Limitations

In this report, the most important limitations of the data are connected with time and area. The data refer to the local area of Puerto Rico in a selected calendar year, 1962. Puerto Rico was not selected as representative of class fertility: it is a society neither purely Latin American nor Anglo-American, and it is undergoing rapid social and demographic change. Likewise, the calendar year of 1962 was chosen not for typicality, but for expediency: 1962 was the first year in which education of the parents was included in birth-registration data. It would be hazardous to generalize the class relationships observed here to other calendar years in Puerto Rico or to other areas.

Further, using educational attainment as an indicator of socioeconomic status presents two problems. First, this indicator is based on one person who may not best represent the status of the family. Second, the educational attainment of a person does not completely describe his socioeconomic status. However, it has been shown that educational attainment is highly correlated with income and occupational status, providing a convenient summary of how people differ in all of these respects.¹ Table I shows that, for both men and women, personal income increases with each level in education. Likewise, the median educational attainment of Puerto Rican men and women increases with each step on the income scale.

Compared with income and occupation as two other commonly used indicators of socioeconomic status, education has certain advantages. Education has the advantage over occupation of being a quantitative variable, and so is simpler to classify in rank order. Education also has the advantage over both occupation and income in being relatively fixed for a person's adult life. For some purposes, however, this may be a disadvantage: the educational experience of adults is not very recent and, in the case of women completing childbearing at age 45, reflects the education completed about one-quarter century in the past. Income and occupation are more current indicators of socioeconomic status.

The advantages of an indicator based on education become especially apparent when fertility is analyzed.

Education has been shown in the United States to be more closely related to fertility than either income or occupation.¹⁵ It represents both the mother and the father. And it makes possible meaningful studies of illegitimacy by socioeconomic status, since it is available for unmarried women.

A final advantage of education is the high quality of the statistics. Education has been especially well reported in Puerto Rico. Of the 153,192 parents of live-born infants in 1962, only 1,094 or less than 1 percent failed to report their education on the birth certificate. In view of this excellent reporting and the facility with which it is processed, education has been on balance the best socioeconomic indicator ever used on birth certificates.

Table I. Median income in 1959 of persons 25 years and over, by years of school completed and sex: Puerto Rico, 1960

Years of school completed	Men	Women
	Median income in dollars	
0 years-----	472	180
1 and 2 years-----	690	287
3 and 4 years-----	805	344
5-7 years-----	1,120	540
8 years-----	1,593	846
9-11 years-----	1,813	1,176
12 years-----	2,299	1,726
13-15 years-----	2,746	2,026
16+ years-----	5,510	2,763

SOURCE: U.S. Bureau of the Census, U.S. Census of Population, 1960, Detailed Characteristics, Puerto Rico. Final Report PC(1)-53D. Washington, U.S. Government Printing Office, 1962, table 117, pp. 54-387.

Birth Registration Completeness

Puerto Rico was admitted to the birth registration area of the United States in 1943, which means that registration was at least 90 percent complete in that year. It was 86.5 percent complete in 1940 according to the U.S. Birth Registration Completeness Test. Studies of matched infant records and live birth certificates indicate a birth registration completeness of 95 to 96 percent in the 1950's.^{16,17} However, an inherent bias of these test methods fails to count the unregistered births of infants for whom an infant record is also missing. High rates of infant emigration, underenumeration, and death underregistration make this a serious bias in Puerto Rico as compared with the United States. When this was taken into account, slightly lower levels of birth registration completeness have been estimated for Puerto Rico in recent years.

For the year of this report, 1962, a representative sample of hospitals (hospital births accounting for 82.3 percent of the total) showed registration to be 94.1 percent complete.¹⁷ Since registration of births occurring outside of hospitals is ordinarily less complete, the Island-wide figure may be below 94 percent. The completeness of birth data shown in this report is therefore judged to be in the range of 90-94 percent.

Population Estimates

The fertility rates presented in this report for the calendar year of 1962 are based on estimates of the midyear population of Puerto Rican women by age and educational attainment. The estimating procedure was the following:

1. The number of women and men in 5-year age groups, from 15 to 49 years, was estimated as of July 1, 1962. Here is made the only allowance for mortality and migration (i.e., variation in these components by education was not considered); these age-sex estimates were prepared by the Puerto Rico Bureau of Demographic Registry and Vital Statistics for its *Annual Vital Statistics Report, 1962*.
2. Educational attainment in 1962 was estimated by advancing age cohorts from April 1960, when education was reported in the census; different techniques were used for the cohorts under age 23 and those aged 23 and older, as described below.
3. Cohorts aged 23 and older were assumed to have completed their education at the time of the

Table II. Estimated female population, by age and years of school completed: Puerto Rico, July 1, 1962

Age	Years of school completed							
	Total ¹	0 years	1-4 years	5-8 years	9-11 years	12 years	13+ years	Not stated
	Number in thousands							
Total, 15-49 years-----	586.8	58.5	151.5	169.6	89.1	66.7	50.2	1.9
15-19 years-----	127.8	3.3	16.7	49.6	39.4	14.0	4.8	0.0
20-24 years-----	98.2	5.9	17.6	27.0	17.0	18.2	12.5	0.0
25-29 years-----	89.7	8.0	22.8	22.7	11.8	13.3	10.7	0.4
30-34 years-----	81.7	8.8	24.6	20.7	8.8	9.4	9.1	0.3
35-39 years-----	70.7	10.0	24.6	18.8	5.6	5.4	6.1	0.2
40-44 years-----	60.9	10.1	22.9	16.4	3.6	3.6	4.1	0.2
45-49 years-----	57.8	12.2	22.3	14.4	2.9	2.8	3.0	0.2

¹Puerto Rico Division of Demographic Registry and Vital Statistics, Annual Vital Statistics Report, 1962, p.3.

1960 census. In the next 2 years, the two eldest ages of a 5-year group entered the next higher age group, while the other three remained in the original 5-year group. This relationship was used to extrapolate the 1962 educational attainment of a 5-year age group. Three-fifths was represented by the same age group, and two-fifths by the next younger age group.

4. For cohorts aged 23 years and younger in 1960, the education attained between April 1960 and July 1, 1962, was taken into account. The procedure used for grades 1-12 and for 13 years or more of school completed, differed as described below.
5. For grades 1-12, official school enrollment and promotion rates were applied by single grade of school and single year of age, starting with the 1960 census populations; the revised cohort populations at each educational level were carried forward to mid-1962.
6. A result of the above step was the category "12 years or more of school completed." This was split into 12 years and 13 years or more of school, by age, in accordance with the proportions stated at those ages in the 1960 census. (The lack of higher education enrollment and completion data by age and sex did not permit direct increases in the cohort populations at the 13 years or more of school completed level.)

7. Grouped into 5-year age categories, the resulting mid-1962 population estimates were adjusted to equal the control totals by age and sex. The differences were distributed in proportion to the frequency estimated at each educational level. Table II shows these final population estimates.

Sampling Error

Sampling errors apply both to the number of births and to the population bases on which fertility rates were calculated. The fraction of birth records sampled was 50 percent. The fraction of population (household) records sampled was 25 percent, every fourth household being systematically included in the sample which was questioned about education. In this way, such characteristics as educational attainment are assumed to be selected at random in both samples.

In most instances the sampling error of birth frequencies in this report is negligible. However, for frequencies of 100 or fewer births, the sampling error is likely to deviate above 10 percent.

Fertility rates have a slightly higher sampling error than that of the births on which they are based. The standard error of a fertility rate is approximately the square root of the sum of the squares of (1) the standard error of the number of births and (2) the standard error of the population base. Sampling error (2) may be expected to affect the population estimates in this report by no more than 5 percent and hence is often negligible.



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