The Use of Socioeconomic Data to Predict Teenage Birth Rates

An exploratory study in Massachusetts

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A STUDY OF TEENAGE BIRTH RATES in 24 Massachusetts cities began with two basic assumptions: adolescent fertility varies by geographic area, a fact that is obvious from even a cursory glance at vital statistics data; this variation is associated with certain socioeconomic factors, a conclusion that can be drawn from other area analyses of fertility.

Review of Selected Area Analyses

In previous fertility analyses, attempts have been made to use Federal Government regions, States, or counties as the units of analysis, with varying results. Brann tried to predict "unintended" or "excess" fertility among teenagers from data on the need for and use of family planning services and on the use of abortion services, but he found no significant correlation between the "percent unmet need [for family planning services] and excess fertility when either the states . . . or the regions were examined" (*1*). However, he achieved highly significant results in a later study (*2*) in which the percentage change from 1970 to 1974 in age-specific fertility rates for women 15 to 19 years old by State constituted the dependent variables and several family planning variables were used as the predictors of these rates. Brann found that per capita income, the contraception to conception ratio, and the percentage of a State's teenagers who were black had strong positive associations with the dependent variable: high levels of these variables were predictive of large decreases in teenage fertility.

Moore and Caldwell (*3*), using out-of-wedlock birth rates as the dependent variables and States as the units of analysis, were able to explain slightly less than half the total variance in birth rates ($R^2 = 0.42$) for whites aged 15 to 19 and slightly more than half of the variance ($R^2 = 0.58$) for blacks of the same

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ages. These authors included a variety of welfare, education, employment, and income variables in their regression analysis but found only the family planning variables to be significantly related to out-of-wedlock birth rates.

Udry and associates (*4*) used a county-level analysis to study the effect that (*a*) the dollar expenditure per target woman for subsidized family planning services and (*b*) a new patient index had on changes that had occurred between 1969–70 and 1974 in use of physician-administered contraceptive services, spacing between births, the number of unwanted births, and general fertility rates. The investigators derived most of these dependent variables from surveys, although they calculated the general fertility rates from vital statistics data. They found no significant relationship for either whites or blacks between a number of sociodemographic control variables and the dependent variables.

Using counties separately as well as aggregated into "statistical analysis units," Cutright and Jaffe (*5*) found consistently significant relationships between the level of enrollment of women of lower socioeconomic status in family planning programs in 1969–70 and their fertility: higher levels of enrollment predicted lowered fertility. This significance held for women 15 through 19 years old as well as for older women. In a carefully constructed model, these authors controlled for a variety of nonprogram factors, largely socioeconomic, that they believed might also affect fertility. The discrepant results of these two sophisticated studies may be accounted for in several ways. First, Cutright and Jaffe studied the effects of family planning services on 1969–70 fertility, whereas Udry and associates used 1969–70 as their base period and sought the effects in a later year. It may well be that the bulk of the impact of these services on fertility had been achieved by 1970. Second, the variables used by Cutright and Jaffe may have been more sensitive. Third, Udry and associates used data from their own survey as well as from secondary sources, whereas Cutright and Jaffe used only secondary data.

Because considerable difficulty is encountered in analyzing fertility-related data within a single State, such analysis has been attempted in relatively few studies (*6–9*). In terms of relevance to social policy and planning, particularly with regard to the geographic location of contraceptive services for adolescents, such studies, however, are critically important.

Several studies in the area of child welfare have contributed significantly to the methodology for analysis within a State. Using multiple regression models, Kogan and Jenkins (*10*), Foltz and associates (*11*), and Garbarino (*12*) all achieved highly significant results in attempts to predict measures of child health and welfare from socioeconomic variables. Kogan and Jenkins studied indicators of child health and welfare in counties in New York State and in community districts in New York City. Garbarino examined child abuse in New York counties only. Foltz and associates analyzed the distribution of health resources in towns in Connecticut.

Study Design

We used two easily available data sources in this study: census reports and birth certificates.

Dependent variables. The dependent variables used were the age-specific birth rates for 24 Massachusetts cities. Denominator data for construction of these rates, that is, the numbers of teenage girls by city or town of residence, were not available, nor could they be reliably calculated, for years subsequent to the 1970 U.S. Census. Since this study was intended as exploratory research, aimed at determining whether significant relationships existed between socioeconomic variables and teenage fertility, we used the 1970 data. These data afford a high degree of reliability, but they do not include information on a number of subjects that would have been of considerable interest, for example, abortion rates and availability of family planning services.

Using 1970 census data and 1970 birth certificates, we constructed rates for the 24 cities and towns in the State that had experienced at least 100 births to teenagers in the study year. To aggregate large enough numbers for valid rate construction and to have categories relevant to current social policy, the teenagers were combined into three age groups: 13 and 14 years, 15 through 17 years, and 18 and 19 years. The youngest teenagers face severe social and health consequences from childbearing, those 15 through 17 years face primarily social consequences, and the oldest teenagers, if married, are engaging in behavior that is accepted in this country. Since there were substantial numbers of births to nonwhites in only three cities, a race-specific analysis was not possible, and we studied whites and nonwhites together. However, because the communities studied had relatively small nonwhite populations, the undercount of minorities in the 1970 U.S. Census should not have significantly affected the analysis. Table 1 presents the number of births and the age-specific birth rates for the three teenage groups by city or town. The analyses that follow, however, are limited

Table 1. Number of births and age-specific birth rates for Massachusetts teenagers in 24 cities and towns, 1970

Town	Number of births			Birth rate		
	13- and 14-year-olds	15–17-year-olds	18- and 19-year-olds	13- and 14-year-olds	15–17-year-olds	18- and 19-year-olds
Boston	31	570	1,098	2.1	39.6	59.8
Brockton	0	56	145	0	26.1	109.7
Brookline	0	6	21	0	5.9	16.0
Cambridge	1	39	98	.6	20.5	43.3
Chicopee	1	29	96	.5	16.3	79.2
Fall River	1	50	194	.4	21.1	118.2
Fitchburg	0	34	81	0	28.7	73.5
Framingham	0	23	62	0	14.5	43.1
Haverhill	4	29	83	3.2	25.6	84.6
Holyoke	1	47	111	.7	36.5	124.4
Lawrence	1	49	141	.6	31.0	123.1
Lowell	0	78	235	0	31.0	137.4
Lynn	2	61	181	.8	26.3	128.3
Malden	0	26	76	0	18.2	89.4
Medford	0	18	51	0	11.6	45.0
New Bedford	1	67	159	.4	26.8	96.2
Newton	0	14	33	0	5.4	12.7
Pittsfield	1	38	86	.6	23.1	97.5
Quincy	0	36	94	0	16.3	59.8
Somerville	0	40	124	0	19.1	69.3
Springfield	13	159	343	2.8	35.3	106.3
Taunton	0	24	75	0	20.3	110.8
Waltham	0	29	83	0	19.0	59.1
Worcester	2	96	252	.4	20.7	68.3

to the two older age groups, since there were too few births in the 13- and 14-year-old group to permit meaningful analysis.

Independent variables. Five independent variables were selected for the analysis based on their ready availability in the 1970 U.S. Census material; their relatively straightforward meanings and ease of interpretation; and literature suggesting that they might be related to adolescent pregnancy and childbearing.

Economic variables. Two variables were selected that reflect a community's economic status: the median income of all families and the percentage of families on welfare. A negative correlation was expected between median income and teenage birth rates. Kantner and Zelnik (*13*), in their 1971 nationwide study of never-married women aged 15–19, found an inverse relationship between family income and sexual experience, but a positive relationship between family socioeconomic status and a teenager's likelihood of using contraception. Thus, wealthier teenagers are not only less likely to be sexually active, but they also have easier access to contraceptive services, and are more likely to use them (*14*). Others have shown that they are also more likely to have access to, and to use, abortion services (*15*).

The percentage of families on welfare was expected to show a positive relationship with teenage births. Teenage mothers tend to come disproportionately from areas of low socioeconomic status (*16–18*), and therefore it seems reasonable to assume that the larger the proportion of families receiving benefits under Aid to Families with Dependent Children and Supplemental Security Income (exclusive of Social Security), the lower will be the socioeconomic status of the geographic area.

Education variables. Two variables were selected that reflect a community's educational status: the percentage of residents who are high school graduates and the percentage of 14–17-year-olds in high school. Inverse relationships were anticipated between these variables and teenage fertility. It was hypothesized that the higher the proportion of the community's residents who had completed high school and the higher the proportion of residents of high school age actually attending high school, the more likely the community's adolescents would be to value completion of their education, and therefore, to wish to avoid early child-

bearing. Kantner and Zelnik (*13,14*) found that the educational level of an adolescent girl's parents or guardians was related inversely to her sexual experience and directly to her contraceptive use.

Population variable. The variable used to indicate the general level of fertility in the community was the number of children ever born per 1,000 women aged 35 to 44 (cumulative fertility). A positive relationship was expected between the fertility of the preceding generation (that is, the mothers of 1970's teenagers) in a given city or town and the teenage fertility in the same area. Young women often follow the fertility patterns and traditions of their parents and of the community at large. Thus, if older women in the area have had many children (high parity being generally associated with a relatively early start to childbearing), the younger women may also begin having children early (*18*).

The dependent and independent variable sets were tested for skewness. Neither of the dependent variables and only two of the five independent variables were significantly skewed. Median income was positively skewed ($g_1 = 1.771$, $P < 0.01$), and cumulative fertility was negatively skewed ($g_1 = -1.813$, $P < 0.01$). Logarithmic transformations were calculated for these two variables; however, the transformed variables were also significantly skewed and therefore were not used in the analysis.

Results

The relationships between birth rates and the independent variables were first examined through simple correlation coefficients (table 2). For each birth rate, significant correlation coefficients were found for all five independent variables. If these coefficients alone are considered, the most important predictors of birth rates for the 15–17-year-olds were the two income variables: the median income of the community explained 56.7 percent of the variance in birth rates, and the percentage of families on welfare explained 55.2 percent. With regard to birth rates for the 18- and 19-year-olds, the community's median income and the percentage of high school graduates in the population were the most important predictors: median income explained 52.4 percent of the variance, and the percentage of high school graduates, 53.0 percent. However, most of the independent variables were significantly correlated with each other, thus raising the possibility that correlations between the dependent and independent variables were confounded by relationships among the independent variables.

Partial correlation analysis was used to determine the extent to which relationships between dependent and independent variables were attributable to relationships among the independent variables (table 3). Because of the small sample size, only one control variable could be used in each partial correlation. In addition, no analyses were conducted using an independent variable and a control variable from the same category, such as income.

Birth rates for 15–17-year-olds. When median income in the community was the control variable, the partial correlations between the birth rate for the 15–17-year-olds and each of the education variables were not statis-

Table 2. Pearson product-moment correlations for birth rates and socioeconomic variables

Birth rates and socioeconomic variables	Birth rates		Economic variables [1]		Education variables [1]		
	15–17-year-olds	18- and 19-year-olds	Median income	Percent of families on welfare	Percent high school graduates	Percent of 14–17-year-olds in high school	Population variable: cumulative fertility [1]
Birth rates:							
15–17-year-olds	1.000	[2] 0.689	[2] −0.753	[2] 0.743	[3] −0.559	[4] −0.374	[3] 0.569
18- and 19-year-olds		1.000	[2] − .724	[3] .519	[2] − .728	[3] − .496	[2] .682
Economic variables: [1]							
Median income			1.000	[2] − .655	[2] .866	[3] .518	[4] − .463
Percent of families on welfare				1.000	[3] − .501	− .239	[4] .379
Education variables: [1]							
Percent high school graduates					1.000	[3] .485	[4] − .451
Percent of 14–17-year-olds in high school						1.000	− .089
Population variable: cumulative fertility (number of children ever born per 1,000 women aged 35–44) [1]							1.000

[1] Variables are based on entire community, not just teenagers, unless otherwise stated. [2] $P < 0.001$. [3] $P < 0.01$. [4] $P < 0.05$.

Table 3. Partial correlation coefficients and *P* values for social and demographic characteristics of the community that were related to age-specific birth rates for teenagers

Independent and control variables [1]	Birth rates for 15–17-year-olds		Birth rates for 18 and 19-year-olds	
	Partial correlation	*P* value	Partial correlation	*P* value
Percent high school graduates and median income	0.2830	0.095	−0.2945	0.086
Percent of 14–17-year-olds in high school and median income	.0281	.449	− .2045	.175
Percent high school graduates and percent of families on welfare	− .3212	.068	− .6331	.001
Percent of 14–17-year-olds in high school and percent of families on welfare	− .3025	.080	− .4478	.016
Cumulative fertility [2] and				
—median income	.3781	.038	.5672	.002
—percent of families on welfare	.4641	.013	.6135	.001
—percent high school graduates	.4287	.021	.5785	.002
—percent of 14–17-year-olds in high school	.5802	.002	.7376	< .001

[1] Variables are based on entire community, not just teenagers, unless otherwise stated.
[2] Number of children ever born per 1,000 women aged 35–44 years.

tically significant: the percentage of high school graduates in the community explained only 8 percent of the variance compared with 31.2 percent that was explained without any control variables; the percentage of 14–17-year-olds in the community in high school explained less than 1 percent (0.08 percent) of the variance, compared with 14 percent without controls. Similarly, when the percentage of families in the community on welfare was used as the control variable, effects of the two education variables were no longer significant. The partial correlation coefficients showed that the percentage of high school graduates accounted for only 10.3 percent of the variance in birth rates, whereas the percentage of 14–17-year-olds in high school accounted for 9.2 percent. These results indicate that the apparent relationships between birth rates and the two education variables were due to the association between measures of income and education. Thus, the education variables were not important independent predictors of birth rates for the 15–17-year-olds.

When we examined the population variable—the cumulative fertility of women aged 35–44 in the community—using each of the income variables and the education variables one at a time as controls, each of the four partial correlations was statistically significant. This result indicates that the effects of cumulative fertility were essentially independent of the effects of education or income. According to the simple correlation coefficient, cumulative fertility accounted for 32.4 percent of the variance in the birth rates for the 15–17-year-olds. With the median income of the community controlled, the proportion of the variance due to cumulative fertility dropped to 14.3 percent; with the percentage of families on welfare controlled, it dropped to 21.5 percent; with the percentage of high school graduates controlled, it dropped to 18.4 percent; and with the percentage of 14–17-year-olds in high school controlled, the proportion of variance due to cumulative fertility increased slightly to 33.7 percent. Although there was some overlap between cumulative fertility and the remaining independent variables, cumulative fertility still made a significant independent contribution to birth rates for 15–17-year-olds.

Thus, according to the partial correlation analysis, income measures were the most important predictors of birth rates for 15–17-year-olds; median income and the percentage of families on welfare were approximately equal in predictive power. Although less important than income measures, cumulative fertility explained a substantial proportion of the variance in birth rates even after the effects of the income variables were controlled.

Birth rates for 18- and 19-year-olds. When the effects of median income of the community were controlled, the partial correlations for the percentage of high school graduates and for the percentage of 14–17-year-olds in the community in high school were not statistically significant. This result indicates that the effects of education on birth rates were due to the association between education and median income.

When the percentage of families on welfare was used as the control variable, each of the education variables had a significant partial correlation with birth rates. The percentage of high school graduates was clearly the stronger predictor: it explained 40.1 percent of the variance in birth rates when the percentage of families on welfare was controlled, compared with the 20.1 percent explained by the percentage of 14–17-year-olds in high school.

For 18- and 19-year-olds, as for 15–17-year-olds, the cumulative fertility of the older generation of women had significant partial correlations with birth rates, even after the effects of income or education were controlled. The simple correlation coefficient indicated that 46.5 percent of the variance in this group's birth rates was explained by cumulative fertility. Nor was this proportion drastically reduced when controls were added: 32.2 percent of the variance was still accounted for by cumulative fertility after the community's median income was controlled; 37.6 percent after the percentage of families on welfare was controlled; and 33.5 percent after the percentage of high school graduates was controlled. The proportion of variance due to cumulative fertility actually increased to 54.4 percent after the percentage of 14–17-year-olds in high school was controlled.

Analysis showed that among the 18- and 19-year-olds, income measures were again the strongest predictors of birth rates and that median income was a more powerful predictor than the percentage of families in the community on welfare. Education measures were not found to be important predictors when they were considered in conjunction with median income, but they did have independent effects on birth rates when used in conjunction with the percentage of families in the community on welfare. Thus, education measures were more closely tied to a direct measure of income than to a more indirect measure like the proportion of families on welfare. The cumulative fertility of the older generation of women was also an important predictor of birth rates for the 18- and 19-year-olds, although it was less powerful than median income.

Discussion

This exploratory study has shown that census data can help explain variations among communities in adolescent birth rates. In the Massachusetts cities studied, economic variables, particularly the median income of all families in the community, were the most important predictors of fertility among adolescents 15 to 19 years of age. These data confirm at the macro level the association that has been found in several household surveys between family income or poverty status on the one hand, and adolescents' sexual activity, contraceptive practice, and use of abortion on the other.

We found that the fertility of the older generation of women in the community was also significantly associated with adolescent birth rates. The relationship between the fertility patterns of older women and of teenagers has been noted in other analyses of birth rates (*19*). Social workers and others who work with pregnant adolescents often comment on how frequently a daughter is found to be repeating her mother's pattern of an early first birth—even when the mother says she had hoped her daughter would delay pregnancy until her twenties and had warned her to avoid premature childbearing.

Finally, although education variables also explained adolescent birth rates, their significance was markedly reduced when economic factors were controlled.

Some degree of confounding may have occurred between several of the independent variables and the dependent variables. Specifically, the proportion of families on welfare in a given community might have increased if a large number of women in that community had become mothers as teenagers; or the proportion of teenagers in high school might have been reduced if a large proportion of girls had dropped out because of pregnancy. It seems unlikely, however, that either of these possible confounding effects, which could not be investigated within this analysis, would have been strong enough to weaken substantially our basic results, which are highly significant statistically and of considerable public health import. Our analyses suggest that in communities with low median income, with a high proportion of families on welfare, and with high fertility in the previous generation, teenagers will bear children at a higher rate than in communities with the opposite characteristics. These relationships have obvious implications for the targeting of family planning services. They also suggest that schools, religious groups, youth agencies, and other organizations may have to assume a more active role in instructing young people about the problems of premature childbearing if the generational pattern is to be broken.

Conclusion

In this study we explored the relationship between census data and adolescent birth rates in a relatively small State at a time before contraceptives and abortions were readily accessible to adolescents. Availability of the 1980 U.S. Census data should make it possible to examine how recent trends in the provision of family planning and abortion services have affected adolescents nationwide and in individual States and communities. In view of the economic and population factors that our study has shown to be significantly associated with adolescent fertility, particular attention should be paid to the effect of such services in communities that are at risk of high rates of adolescent births.

Researchers will need to explore further the relationship between low income and high birth rates. More-

over, as legislators determine priorities for the funding of social welfare programs, they will need to acknowledge that adolescent parenthood may be one consequence of poverty.

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SYNOPSIS

PERLMAN, SYLVIA B. (Brandeis University), KLERMAN, LORRAINE V., and KINARD, E. MILLING: *The use of socioeconomic data to predict teenage birth rates. An exploratory study in Massachusetts. Public Health Reports, Vol. 96, July–August 1981, pp. 335–341.*

In an exploratory study of adolescent fertility in 24 Massachusetts cities, age-specific birth rates constructed specifically for the study constituted the dependable variables. Data from the 1970 U.S. Census provided the independent socioeconomic variables for the analysis. The relationships between birth rates and these independent variables were explored through simple and partial correlation analyses.

Results of the analyses confirm the assumption that rates of birth to teenagers vary systematically in relation to socioeconomic variables. They also confirm at the macro level the results of several earlier household surveys showing an association between family income on the one hand, and adolescent sexual activity, contraception, and abortion on the other. In the current study, economic variables, particularly the median income of all families in the community, were found to be highly significant predictors of fertility among adolescents 15 to 19 years of age. The fertility of the generation to which the teenagers' mothers belonged (that is, women 35 to 44 years old) was also significantly associated with the teenagers' birth rates. The results for teenage mothers 15 through 17 years old and teenage mothers 18 and 19 years old were similar.