

A RAND NOTE

ACCOUNTING FOR THE EDUCATIONAL SHORTFALLS
OF MOTHERS

Gus W. Haggstrom, David E. Kanouse,
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February 1986

N-2452-NICHD

Prepared for

The National Institute of Child Health
and Human Development

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Accounting for the Educational Shortfalls of Mothers

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This study examines how marriage and parenthood occurring soon after high school affect postsecondary educational pursuits. Young women who form families differ markedly from other teenagers. As high school seniors, the soon-to-be wives and mothers rank low among their classmates on academic aptitude, scholastic performance, and socioeconomic status. Subsequent educational shortfalls are due as much to these preexisting differences as to whatever burdens family formation may impose. Allowing for these differences, we find that while both marriage and parenthood adversely affect postsecondary educational attainments, on average the effects of marriage are more pronounced than those associated with parenthood.

Women who become mothers at an early age complete less formal schooling, on average, than their peers who delay childbearing. The association is well documented (see, for example, McCarthy and Radish, 1982), but the process by which that educational shortfall develops and the factors that underlie it are poorly understood (see Marini, 1984, for a thorough review). Motherhood—or marriage alone—might deflect a young woman

from her intended educational pursuits. Equally possible, many women who form families early in life may have been on a different course beforehand, one that leads away from educational pursuits whether or not a new family member arrives on the scene. For other young women whose interest in further education wanes, motherhood may provide an excuse for ending their schooling.

The findings reported here derive from a broader study (Haggstrom et al., 1981) of how late-teenage parenthood affects the educational, vocational, and personal development of young women and men. The research was supported by Contract N01-HD72819, awarded to the Rand Corporation by the National Institute of Child Health and Human Development. The authors thank several colleagues who have commented on earlier versions of this manuscript: Arleen Leibowitz, Toni Richards, Linda J. Waite, and Will Harriss of Rand; Larry L. Bumpass (University of Wisconsin-Madison); Ronald R. Rindfuss (University of North Carolina at Chapel Hill); and several anonymous reviewers. The authors also thank Thomas Blaschke and William Lisowski for their assistance in carrying out the statistical calculations for this study.

As these possibilities illustrate, the reasons for the relationship between early family formation and educational attainment are ambiguous. Recent research has probed deeply enough to discern that the causal pattern is complex (see, for example, Alexander and Reilly, 1981; Card, 1977; Card and Wise, 1978; Elder and Rockwell, 1976; McLaughlin, 1977; Marini, 1984; Moore and Waite, 1977; Moore et al., 1979, in press; Waite and Moore, 1978; Hofferth and Moore, 1979; Rindfuss, Bumpass, and St. John, 1980) but the ambiguity remains unresolved. The present study focuses on a central aspect of this puzzle: What role do preexisting differences play in explaining the relationship between early family formation and the process of educational attainment? How much of the educational shortfalls of young wives and mothers are due to marriage and parenthood, and how much to preexisting personal attributes?

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It is distinctly possible that early parents may differ from their peers on background factors

(e.g., socioeconomic status and academic ability) that would lead them to follow markedly different educational paths whether or not they became parents. Preexisting differences that foreshadow less schooling among early mothers-to-be have been found along socioeconomic, scholastic ability, cognitive, and personality dimensions (Wilson, 1980; Kiernan, 1980; Card, 1977; Card and Wise, 1978; Gispert and Falk, 1976).

NLS DATA BASE

This research is based on an analysis of the National Longitudinal Study of the High School Class of 1972 (NLS), a large panel study of more than 22,000 high school seniors who were followed up in 1973, 1974, and 1976. The NLS data are well suited to showing how high school seniors who would soon become mothers differed beforehand from their peers, and how those differences shaped educational pursuits during the first four years after high school.

The NLS provides a comprehensive data base for studying the educational, vocational, and personal development of high school graduates as they pass through the critical years of early adulthood. It began in the spring of 1972 with a base-year sample of 19,001 seniors from 1,061 high schools. Data were collected via questionnaire and a test battery measuring verbal and nonverbal abilities. The schools were asked to provide further information about the seniors from their student record files. Three follow-up surveys were available: one administered in the fall of 1973 (around 14 months after high school, when most respondents were 19 years old); the next in the fall of 1974; and the third in the fall of 1976. Response rates of over 85% were achieved on all four surveys. (For further technical details on the NLS, see Levinsohn et al., 1978.) Our study is based on 11,336 female members of the class of 1972 for whom data were available from one or more of the surveys.

For our purposes, the NLS affords a narrow but highly detailed view of family formation during the first four years after high school. The interval covered begins in the spring of respondents' senior year (around age 18) and extends for 52 months thereafter to around age 22. Although the earlier years of adolescence lie outside this interval and the NLS affords no information on the consequences of parenthood for high school dropouts, the data do furnish a high-resolution look at the influences of family formation in the four-year period following high school graduation.

Several features of the NLS influenced our choice of methodology and imposed qualifications on our conclusions. Among the strengths of

the NLS are that (a) the NLS provides data on various groups (e.g., nonparents, married parents, married nonparents, and single nonparents); (b) the NLS furnishes a broad range of individual and family characteristics that are needed to distinguish the effects of parenthood from those of background characteristics that may predispose parenthood early in life; and (c) the NLS provides measures on respondents' postsecondary aspirations, expectations, and attitudes.

Offsetting these strengths are three important limitations: (a) The NLS sample does not include high school dropouts, many of whom undoubtedly became parents. (b) The NLS can elucidate only the near-term consequences of parenthood—those that have shown up by about age 22. (c) Information on unmarried mothers is incomplete, making it difficult to identify unmarried high school seniors who were already mothers.

The first limitation restricts our conclusions to the universe of young women who attained their senior year in high school. The second limitation restricts our attention to short-term aspects of the educational attainment process. Since the third limitation threatened to create selectivity biases in our sample, we restricted our analysis to ever-married mothers.

DESCRIPTION OF MEASURES

Information on marital and parenthood status was collected on all three follow-up surveys but not on the base-year survey. Each follow-up survey elicited the respondent's marital status, date of marriage, and number of children as of the first week of October in the year of the survey. Thus, the date of marriage is known to the month, but the timing of parenthood must be inferred from changes over time in the number-of-children responses. Respondents were asked how many children they "have"; accordingly, when we use the term "parent" or "mother" in reference to NLS participants, it is in the social rather than biological sense.

Of the 11,336 women in the 1972 base-year sample, 3,123 had become mothers by October 1976. The 887 who were mothers by October 1973 are referred to hereafter as *teenage mothers*; the 836 who became mothers between November 1973 and October 1974, as *early adult mothers*; and the remaining 1,287 who did so between November 1974 and October 1976, as *adult mothers*.¹

A close analysis of the 887 teenage mothers' responses to certain items on the 1972 and 1973 surveys identified 277 (31%) who *probably* were mothers while still in high school (hence at the time they responded to the base-year survey),

although exactly when they became mothers cannot be ascertained.³ To avoid this ambiguity about timing, we deliberately excluded these probable *early-teenage* mothers from our analysis, leaving 610 *late-teenage* mothers—that is, ones for whom the timing of parenthood could be ascertained with a high degree of confidence as falling between 0 and 16 months beyond high school. Also excluded from the analysis are respondents whose marital or parenthood status in October 1976 was unknown, those who became mothers at some indeterminate point before October 1976. The combined effect of these three exclusions reduced our original sample by 14%.

Our analysis focuses on the following outcome measures:

Years of educational attainment, 1976: number of years of schooling in 1976, estimated from responses to the question “As of the first week of October 1976, what was your highest level of education or training?” Values range from 12 (“finished high school”) to 20 (“Ph.D. or advanced professional degree”).

Expected years of educational attainment (1972, 1973, 1974, 1976): number of years of education expected, estimated from responses to the questions “As things stand now, how far in school do you think you actually will get?” Values range from 12 (“high school only”) to 20 (“Ph.D., M.D., or equivalent”).

The means, standard deviations, and sample sizes are given in Table 1. The variation in sample sizes across measures results primarily from the fact that the base-year questionnaire was not ad-

ministered to 19% of the members of the NLS samples.⁴

Table 2 lists the background variables incorporated in our analysis; most are self-explanatory. The ability composite score is the sum of the scaled scores for four tests on vocabulary, reading, letter groups, and mathematics that were administered to NLS seniors in the spring of 1972; each test score was scaled to have a mean of 50 and a standard deviation of 10. The Duncan SEI score of father’s occupation is an index of occupational status corresponding to the census code for the father’s occupation. Because analogous codes were not available for the mother’s occupation, two indicator variables were created to categorize it. One indicates whether she was a homemaker. Another indicates whether she was a professional worker (doctor, lawyer, teacher, social worker, scientist, etc.).

TABLE 1. SAMPLE MEANS AND STANDARD DEVIATIONS OF THE OUTCOME MEASURES

Outcome Measure	Year	Mean	Standard Deviation	N
Years of educational attainment	1976	13.30	1.40	10,111
Expected years of educational attainment	1972	14.41	1.99	6,319
	1973	14.28	2.16	10,133
	1974	14.42	2.25	9,698
	1976	14.78	2.40	9,461
Planning a professional career	1972	0.47	0.50	6,587
	1973	0.40	0.49	9,791
	1974	0.38	0.49	9,602
	1976	0.36	0.48	9,657

TABLE 2. BACKGROUND VARIABLES

<u>Race/Ethnicity Classification</u>	<u>High School Program</u>
American Indian	Academic or college preparatory
Black	Vocational-technical
Mexican-American, Puerto Rican, other	General
Latin-American	<u>Socioeconomic Status</u>
Oriental or Asian-American	Father’s educational attainment
Other minority	Mother’s educational attainment
White	Duncan SEI score of father’s occupation
<u>Region</u>	Mother’s professional status
Northeast	Mother’s homemaker status
South	Logarithm of family income
West	<u>Other</u>
North Central	Number of siblings
<u>Religion</u>	Number of siblings in college
Roman Catholic	College plans of close friends
Jewish	
All others	
<u>Ability and Scholastic Performance</u>	
Ability composite score	
Percentile rank in class	

Note: See Haggstrom et al. (1981), Table 3-3 and Appendix A, for exact definitions of variables.

METHODOLOGY FOR ASSESSING EFFECTS OF EARLY PARENTHOOD

We estimate the effects of family formation on education using an "individual effects" model that is based on two premises: (a) The effects of marriage and parenthood may vary from woman to woman in an unpatterned way, depending on numerous factors; and (b) these effects can be estimated for a particular woman by comparing changes over time in her outcome measures with estimates of the expected changes for women with similar characteristics in a suitably chosen comparison group.

The Appendix provides a multivariate analysis of covariance model that embodies these premises. It is implicit in this model that the individual effects of marriage and parenthood are defined as deviations from the pattern for similar individuals in a comparison group. The selection of a suitable comparison group therefore is a matter of some importance. For the results reported here, we provide detailed comparisons between the late-teen parents and two groups of NLS members who remained childless through October 1976: (a) those who had married before October 1973, and (b) those who had not yet married by October 1976.

In interpreting these comparisons, one must bear in mind that entry into marriage, like entry into parenthood, is not a random process, but is characterized by considerable selectivity. For that reason, neither comparison group affords the information that would be provided by a true "control group." The individual-effects analyses are supplemented by an analysis of covariance using the gains between 1972 and 1976 dependent variables, and other factors in addition to parenthood and marital status as independent variables. This analysis permits contrasting the average effects of family formation with those associated with other postsecondary experiences, such as attending a four-year college or entering military service.

RESULTS

Background Differences

The NLS illuminates many important differences between the soon-to-be mothers and their peers. The data in Table 3 enable us to compare single nonparents with their ever-married counterparts who became parents and with those who did not. The mothers (especially the earlier groups) ranked lower than their classmates in ability, class rank, and socioeconomic status. Married nonparents were close to the single nonparents in ability and class rank. However, a far smaller pro-

TABLE 3. MEANS OF SELECTED BACKGROUND CHARACTERISTICS BY TIMING OF WOMEN'S SUBSEQUENT FAMILY FORMATION

Characteristic	Single Nonparents				Ever-Married Parents				Ever-Married Nonparents				
	All	Initially Mothers as:			All	Initially Mothers as:			All	Initially Married as:			
		Adults	Early Adults	Late Teens		Adults	Early Adults	Late Teens		Adults	Early Adults	Late Teens	
Percentage who are black	14	11	19	22	18	11	19	22	6	7	6	6	7
Percentage who live in South	31	43	42	46	44	43	42	46	39	32	38	49	70
Percentage who are Catholic	33	29	26	24	26	29	26	24	29	32	30	22	14
Ability composite score	210	195	185	190	190	195	185	190	204	208	204	198	190
Percentile rank in class	64	51	55	49	51	55	49	48	61	63	61	57	59
Percentage in academic program	52	23	17	18	19	23	17	18	36	44	34	24	12
Father's education (years)	12.9	11.3	11.6	11.2	11.3	11.6	11.2	11.2	12.4	12.6	12.4	12.0	11.6
Mother's education (years)	12.6	11.5	11.6	11.5	11.5	11.5	11.5	11.2	12.1	12.3	12.1	11.8	11.7
Father's occupational status score	44.4	33.9	36.0	31.7	33.9	36.0	33.3	31.7	41.0	43.0	39.8	39.4	31.3
Mother's professional status indicator	0.14	0.08	0.08	0.10	0.08	0.08	0.07	0.10	0.09	0.10	0.09	0.08	0.06
Number of siblings	2.7	3.2	3.1	3.3	3.2	3.1	3.3	3.3	2.7	2.6	2.8	2.7	3.0
Percentage whose close friends have college plans	69	47	39	37	42	47	39	37	58	65	58	47	37
Percentage with postsecondary educational plans (1972)	74	43	33	31	36	43	33	31	59	70	62	40	21

portion of the married nonparents than single nonparents were in academic programs, indicating that most did not plan to attend college even before they married.

Consistent with Card and Wise (1978), we also detected important background differences in postsecondary education plans, elicited from respondents while still in high school (June 1972); these plans are useful pre-family-formation benchmarks because they were measured at least 16 months prior to a late-teenage marriage and at least 7 months prior to any late-teenage conception. Among the nonparents, proportionally fewer of the wives-to-be had further postsecondary schooling plans as high school seniors. Among ever-married parents, fewer still of the mothers-to-be had such plans, with those who were to become mothers earlier registering successively lower percentages. These preexisting differences may well have influenced subsequent family formation and its timing.

These simple comparisons show how markedly the women who were to start their families as teenagers differed from those who were to remain single nonparents through late 1976. Clearly, the backgrounds of the early mothers-to-be were far

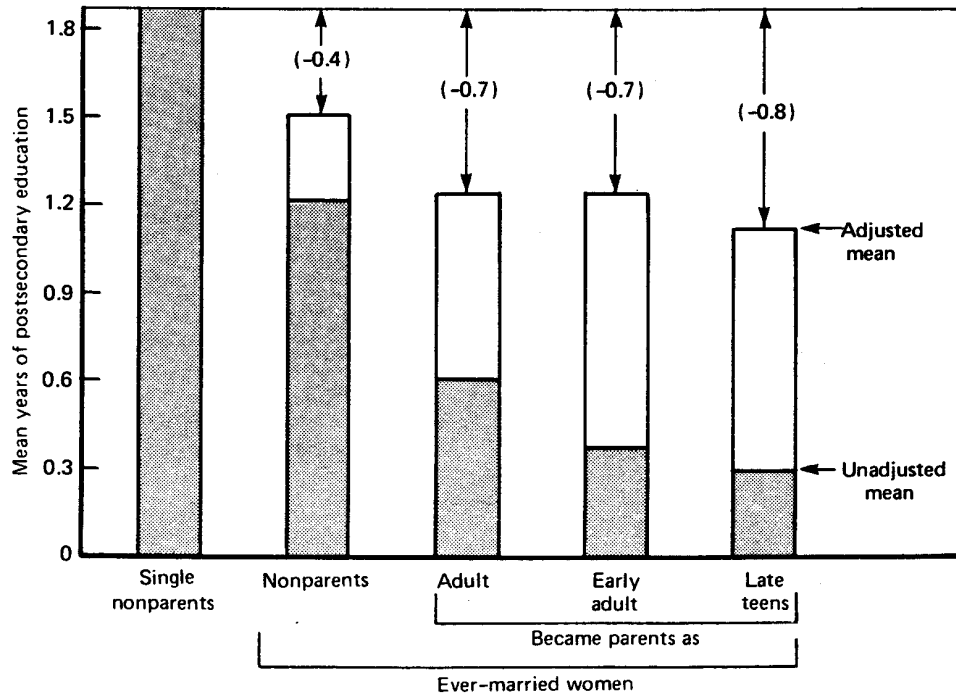
less conducive to college curricula than were those of their peers. Not surprisingly, these respondents exhibited substantially different postsecondary educational attainment patterns by marital status and timing of parenthood, as documented in the next section. These background differences are factors whose collective influence must be accounted for in assessing the net effects of early family formation.

Current Educational Attainment

The educational attainment data elicited from respondents on the latest (1976) survey wave are shown in Figure 1, transformed into the more convenient metric of "mean years of postsecondary education." These group means enable comparisons between married nonparents and married parents, classified by when they became parents. The means are shown in unadjusted and adjusted forms. The latter (which are analogous to the adjusted means sometimes reported in conjunction with analysis of covariance) allow for differences across the groups on the background variables listed in Table 2.

The unadjusted means display lower attainment levels for married than for single nonparents, and

FIG. 1. POSTSECONDARY EDUCATIONAL ATTAINMENT 52 MONTHS AFTER HIGH SCHOOL, BY MARRIAGE AND TIMING OF PARENTHOOD



lower still for married parents, especially the late-teen mothers. The adjusted means show the level each group would have registered had their background characteristics been identical to those of the single nonparents. To facilitate comparisons, Figure 1 also displays the difference between each adjusted mean and the mean for the single-nonparent comparison group. (The standard errors of these differences are all 0.06 years or less, so that all differences shown in parentheses are highly significant.)

It is clear from these adjusted differences that both parenthood and marriage alone are associated with shortfalls in current educational attainment, net of background differences. Women who married and also became mothers in their late teens lagged behind their single-nonparent peers by almost a year of completed schooling. Women who married without becoming mothers lagged by nearly half a year, which suggests that marriage itself accounts for about half the shortfall. Equally noteworthy is the extent to which the raw differences shrink with adjustment. For late-teen parents, for example, the observed 1.6-year unadjusted difference shrank to only a 0.8-year adjusted difference. Thus, about half the difference we observe between the young wives who became mothers and

their single nonparent peers is attributable to background factors.

To focus exclusively on the marriage effect, we next consider the shortfalls associated with timing of marriage among nonparents (with single nonparents again as the control group), shown in Figure 2. It is clear that the educational shortfall (relative to her single peers) is larger the earlier a woman married. It is minimal (0.1) for women who first married as adults but progressively larger for earlier marriage. (See Alexander and Reilly, 1981, for related evidence.) Once again, the degree of shrinkage in observed differences with adjustment shows the importance of background factors in foreshadowing educational attainment.

Considered together, the data in Figures 1 and 2 suggest that shortfalls in educational attainment due to family formation reflect the effects of both marriage and parenthood. Also, the magnitudes of the "adjustments" raise questions about the appropriateness of using single nonparents as the comparison group. To examine the differences in educational attainment associated solely with parenthood, we next restrict our attention to a more homogeneous set of women who first married at about the same time: those 2,541 women who had married by their late teens. We use the

FIG. 2. POSTSECONDARY EDUCATIONAL ATTAINMENT 52 MONTHS AFTER HIGH SCHOOL, BY TIMING OF MARRIAGE (NONPARENTS ONLY)

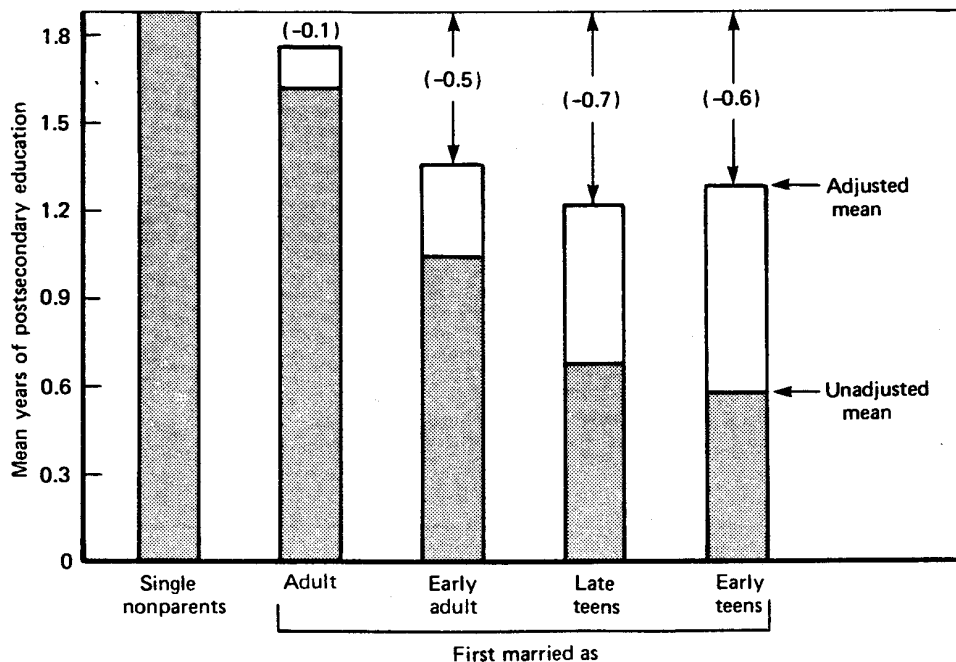
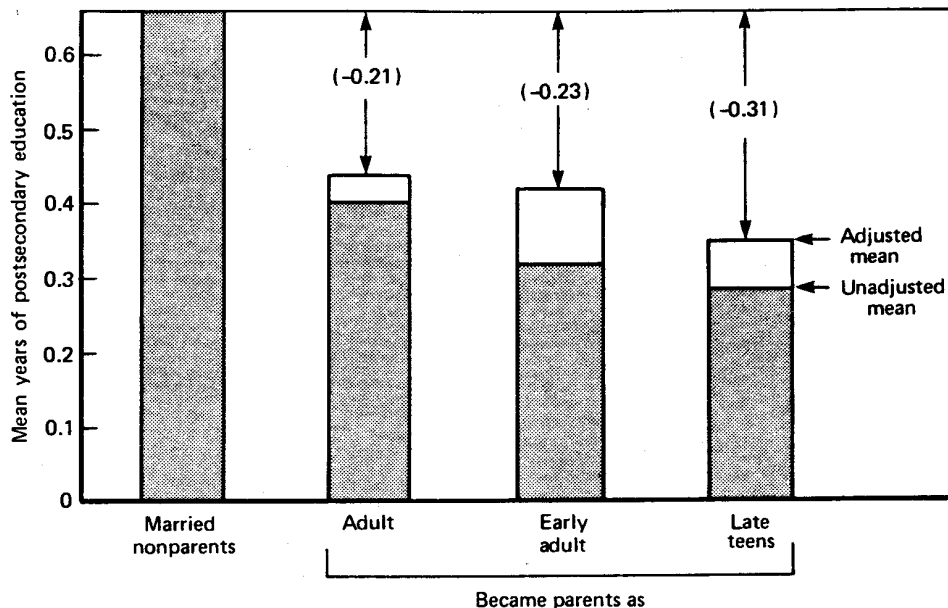


FIG. 3. POSTSECONDARY EDUCATIONAL ATTAINMENT 52 MONTHS AFTER HIGH SCHOOL, BY TIMING OF PARENTHOOD, FOR WOMEN MARRIED BY LATE TEENS



nonmothers among these married women as the comparison group (Fig. 3).

Here, the educational shortfalls associated with early parenthood are considerably smaller than those depicted in Figure 1. The adjusted parent-nonparent differences range from two-tenths to three-tenths of a year of completed schooling. While these differences are statistically significant (the standard errors are approximately 0.05 in all three cases), the differences associated with parenthood are quite small—only about half as large as the corresponding differences associated with marriage alone, shown in Figure 2. Although the late-teen parents lag somewhat more than the other parents, the differences among the three parental groups in Figure 3 are not statistically significant, indicating that the fact of parenthood matters more than its timing.

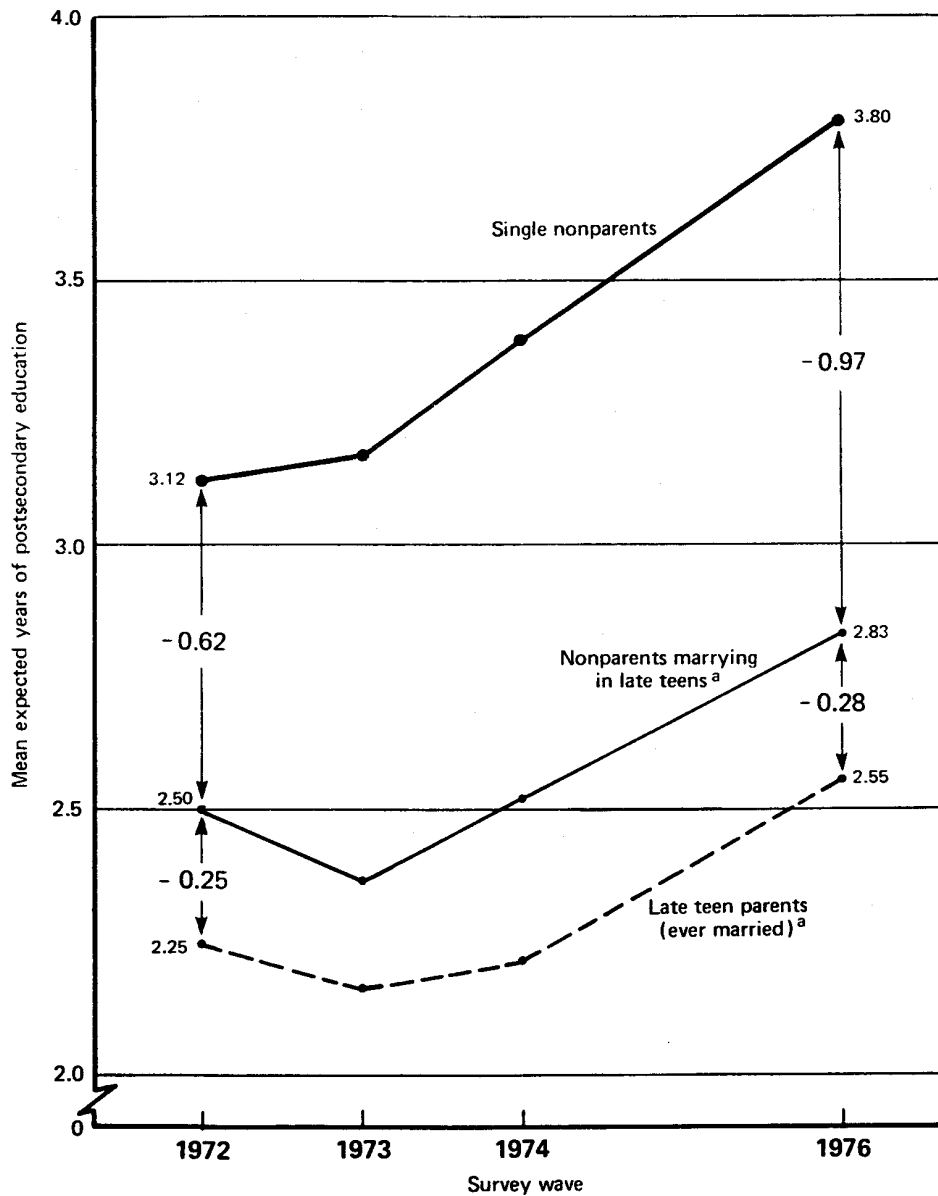
To summarize, the shortfalls in educational attainment registered by early parents four years after high school appear to reflect both background differences and the effects of early family formation (i.e., parenthood and/or marriage). The comparisons imply that (a) at least half of the overall shortfalls observed are attributable to background differences, and (b) the remaining portion arises mostly from early marriage, whether or not parenthood is involved.

Expected Educational Attainment

Often, the pursuit of formal schooling in late adolescence and early adulthood is punctuated by delay (Davis and Bumpass, 1976). Since our data do not follow respondents beyond about age 22, they cannot disclose whether women who form families have finally terminated their education or merely postponed it. They do contain important clues, however, to how respondents revised their educational expectations over the near term. Specifically, we can track the shifts that take place over successive survey waves in the respondents' long-term educational expectations. Figure 4 shows adjusted mean years of postsecondary education that respondents expected to attain on each of the four survey waves. The data are shown for single nonparents, nonparents who married in their late teens, and ever-married women who became mothers in their late teens.

The single-nonparent group's expectations are a useful benchmark for comparison: They increase from 3.12 to 3.80 years between the first and fourth survey waves. Women who married in their late teens (but were nonparents) exhibit a broadly similar but somewhat less pronounced rise in their adjusted means; as a result, the adjusted difference between the groups widens (from 0.62 to 0.97 years), implying that the effects

FIG. 4. MEAN EXPECTED YEARS OF POSTSECONDARY EDUCATION, 1972-1976



of late-teen marriage cumulate. The specific pattern shows a drop in expectations between 1972 and 1973 (the year of marriage), which persists thereafter through the fourth wave. For ever-married women who were late-teen parents, the

initial adjusted difference from the single-nonparent group is a further 0.25 years, but the data show no clear-cut widening of that difference over time that would indicate a continuing or cumulative parenthood effect.

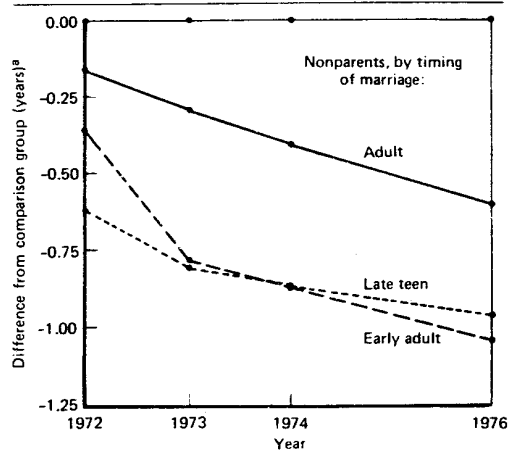
For a closer examination of the separate effects of marriage and parenthood, we show in Figure 5 how the adjusted differences from the comparison groups change over time—an indication of how educational expectations are affected by each of these distinct family-formation events. With respect to the timing of marriage (Fig. 5A), we note first that there are clear-cut preexisting differences in 1972: That is, the adjusted expectations of the wives-to-be were lower to begin with, especially for women who were to marry earlier. For those who were to marry in the late-teen years (1972-73), of course, this 1972 shortfall might be largely an “anticipation” effect, although for those marrying later, the effects of anticipation should be less pervasive. Second, note that the shortfalls increase after marriage. For example, women marrying in their late teens register progressively lower expectations (relative to their control group) after 1973. These relative declines in expectations—which precede and also follow marriage—suggest that progressively more women “give up” on the idea of further education as they become engaged and get married.

The timing-of-parenthood effects (estimated only for those marrying by their late teens) are shown in Figure 5B. Once again, preexisting differences in 1972 are apparent, although they are smaller than those associated with early marriage. Also, adjusted differences widen both before and during the interval when each group became mothers, but stabilize or (in the case of early-adult mothers) narrow slightly. What is remarkable is the absence of a consistent pattern of further relative declines in expectations *after* entry into parenthood—which contrasts sharply with the marriage effect just described.

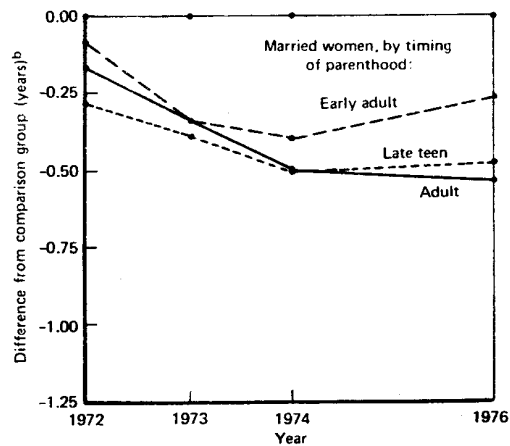
Thus our analysis of short-term changes in long-term educational expectations reveals (a) moderately reduced expectations accompanying early marriage and (b) small further reductions prior to and concurrent with entry into parenthood, but not much thereafter. These reductions may not be solely attributable to early family formation, however; other postsecondary experiences may play a role. To examine their effects and obtain alternative estimates of the effects of early marriage and parenthood, we performed an analysis of covariance using, as the dependent variable, the change in educational expectations between 1972 and 1976.

Table 4 lists the independent variables for this analysis. Indicator variables were included for each of a set of mutually exclusive main activities (e.g., student, homemaker, military service) in October 1972, with participation in the paid civilian labor force serving as the omitted category. The

FIG. 5 LAG IN EXPECTED YEARS OF EDUCATION (ADJUSTED DIFFERENCES FROM COMPARISON GROUP)



A. Marriage effect (comparison group: single nonparents)



B. Parenthood effect (comparison group: nonparents married by late teens)

^aAdjusted difference from single nonparents.

^bAdjusted difference from nonparents married by October 1973.

variable “Expecting to be married” is an indicator variable for NLS respondents who were single in October 1976 but who planned to marry within a year. The variable “Expecting parenthood, 1976” is an indicator variable for respondents who had no children in October 1976 but expected to have a child before October 1977. The variable “Two or more children, 1976” is an indicator variable for parents who had more than one child in October 1976.

TABLE 4. REGRESSION RESULTS FOR THE CHANGE IN EXPECTED YEARS OF EDUCATIONAL ATTAINMENT BETWEEN 1972 AND 1976

Variable ^a	<i>b</i>	<i>t</i>
Constant	-0.677	-2.5
Race/ethnicity		
Black	0.222	2.6
Hispanic	0.110	0.8
Indian	-0.158	-0.6
Oriental	-0.250	-1.0
Other minority	0.305	1.8
Region		
Northeast	0.095	1.3
South	0.086	1.3
West	-0.047	-0.6
High school measures		
Ability	0.0044	3.7
Percentile rank in class	-0.0006	-0.5
Academic program	-0.077	-1.1
Vocational-technical program	0.132	2.0
Family background		
Father's education	-0.0047	-0.4
Mother's education	0.0513	3.0
Father's occupation (SEI)	-0.0012	-0.9
Mother's professional status	0.005	0.1
Postsecondary track (1972)		
4-year student	0.207	2.6
2-year student	0.305	3.5
Vocational-technical student	0.221	2.3
Military	-0.351	-0.7
Homemaker	0.157	1.3
Unemployed	-0.014	-0.1
Marital status (1976)		
Months since first marriage	-0.0026	-1.1
Married	-0.587	-6.7
Divorced, widowed, or separated	-0.153	-1.1
Expecting to be married	-0.476	-5.2
Parenthood		
Parent by October 1973	-0.012	-0.1
Parent Nov. 1973 to Oct. 1974	-0.151	-1.4
Parent Nov. 1974 to Oct. 1976	-0.274	-3.2
Expecting parenthood, 1976	-0.221	-2.0
Two or more children, 1976	0.015	0.1

Note: $R^2 = 0.061$, $S = 1.826$, $F = 11.2$, $N = 5,382$.

The regression coefficients on the marital and parenthood status indicator variables, which provide crude estimates of the average effects of marriage and parenthood, confirm the previous results.⁵ The coefficient on "Married" is substantially larger than the coefficients on the parenthood indicators. The large coefficient on

"Expecting to be married" indicates the negative effect associated with marital plans in October 1976. This coefficient is more than twice as large as the coefficient on "Expecting parenthood, 1976." Because of the possible distortions involved in fitting this equation, the pattern of coefficients on the parenthood indicator variables cannot be interpreted as indicating that the earlier parenthood occurs, the less the effect. In particular, since parenthood before October 1973 often reflected pregnancy occurring before June 1972, reductions in the 1972 measure (EDEXP72) would tend to inflate the difference (EDEXP76 - EDEXP72), thereby confounding the analysis.

SUMMARY AND CONCLUSIONS

Two main findings emerge from this analysis. First, the effects of late-teenage parenthood on young married women's current educational attainments and longer-term educational expectations are less severe than one might infer from comparisons of observed (unadjusted) outcomes for parents and nonparents. Preexisting differences between these two groups would have led to very different outcomes even in the absence of parenthood.

Second, parenthood and marriage have separately identifiable effects, and the latter appear to be the stronger for the universe of women we studied. Indeed, our comparison of young married mothers with their counterparts who married at about the same time but remained childless shows that many of the effects that might be attributed to early parenthood also show up as effects of early marriage alone. This is not to say that we found no consequences associated with late-teen parenthood. Both the current educational attainments and the longer-term expectations of mothers do lag behind those of other married women.

Our results imply considerable self-selection into early marriage and (especially) early parenthood. Young women who form their families early differ from other young women not only in their characteristics at the time they make their choices, but also in the characteristics they are likely to acquire over time. They not only start from a different place, they are headed in a different direction.

The limitations of the NLS data impose important qualifications on these results. First, our findings apply only to women who managed to attain their senior year in high school. Second, our findings about the size of the parenthood effect (depending on timing and relative to the separate effect of marriage) generalize only to the parenthood of *married* women.

Our most general conclusion is that preexisting differences are quite important and merit closer study with more suitable data than ours. For future research to disentangle the complex pattern of causality between early family formation and educational attainment, it must allow for these background differences. Their role in predisposing both marriage and parenthood early in life appears substantial.

FOOTNOTES

1. Establishing the pattern of family formation for some participants was far from straightforward because of missing values, inconsistency among responses, and violation of questionnaire routing instructions. The estimation procedure used to identify the timing of family formation (described in Blaschke et al., 1979) enables us to distinguish the following timing categories as of the October 1976 survey wave: (a) *early teen* (family formation occurred before June 1972), (b) *late teen* (occurred between June 1972 and October 1973), (c) *early adult* (occurred between November 1973 and October 1974), and (d) *adult* (occurred after October 1974).
2. Mothers were classified as probable parents in June 1972 (while still in high school) if (a) they had two or more children in October 1973, or (b) they had one child in October 1973 and either they were married before January 1972 (i.e., several months before high school graduation) or they reported having one or more dependents on the base-year questionnaire. Given our methodology for assessing the effects of parenthood, it was important to isolate this subcategory (whether or not the label "probable early-teen mothers" applied to all 277 women) and remove them from further consideration because (a) their timing of entry into parenthood cannot be precisely defined, and (b) their base-year attitudes and aspirations would be affected by parenthood and therefore would not serve as suitable prescores.
3. This wording was used on the three follow-up surveys. In the base-year survey, the seniors were asked to consider several educational patterns and select "the highest level you plan to attain."
4. The base-year sample was augmented in the three follow-up surveys to include seniors from 257 schools in addition to the 1,061 represented in the base-year survey.
5. In interpreting these estimates, it is important to bear in mind that the choice of postsecondary activities in October 1972 may have been determined in part by marriage and parenthood plans; consequently, these equations may somewhat distort the average effects of marriage and parenthood. Also, the homogeneity-of-slopes hypothesis, which is implicit in our omission of numerous interaction terms from the fitted question, is open to question.

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APPENDIX

The individual-effects model employed in this study differs from the usual multivariate analysis of covariance model for analyzing differences between treatment and control groups (e.g., parents and nonparents) in that the "treatment effects" are permitted to vary over time and across individuals. The model is for the case in which the dependent variable of interest is a vector Y of repeated measures at k points in time such that at least one of the measures occurs before treatment, thereby providing a prescore for assessing later changes.

The observations for fitting the model consist of pairs of measurements (X , Y) on both nonparents and parents such that $X = (1, X_1, \dots, X_p)$ is a vector of explanatory variables and $Y = (Y_1, Y_2, \dots, Y_k)$ is an outcome vector measured at k time points, with both X and Y_1 measured before any of the observed individuals became parents. If $(X_{1i}, Y_{1i}), i = 1, 2, \dots, n_1$, denote the observations on the nonparents and $(X_{2i}, Y_{2i}), i = 1, 2, \dots, n_2$, denote the observations on the parents, then the basic assumption of the individual-effects model is that the observations satisfy the equations

$$\begin{aligned} Y_{1i} &= X_{1i}\beta + e_{1i}, & i &= 1, 2, \dots, n_1; \\ Y_{2i} &= \delta_i + X_{2i}\beta + e_{2i}, & i &= 1, 2, \dots, n_2. \end{aligned}$$

Here, β is a $(p + 1)$ by k matrix of unknown parameters, and the error terms e_{ji} are independent random vectors with zero mean vectors and a common covariance matrix Σ . The individual components δ_{ij} of the k -dimensional vector δ_i represent deviations of the i -th parent's outcome measures from the pattern for nonparents with like characteristics; the first component δ_{i1} reflects a preparenthood difference unaccounted for by the components of X_i . The treatment effects for the i -th parent at the second and later time points are defined by

$$\Delta_{it} = \delta_{it} - \delta_{i1}, \quad t = 2, 3, \dots, k.$$

The individual effects have considerable interest for their own sake, but their estimation requires complete observations on the parents. To cope with the pervasive missing-values problem in the NLS, we have chosen to focus on the average effects defined by

$$\bar{\Delta}_t = \bar{\delta}_t - \bar{\delta}_1$$

where $\bar{\delta}_t = \Sigma \delta_{it}/n_2$.

It follows from the multivariate analog of the Gauss-Markov Theorem (see Timm, 1975: 187) that the best linear unbiased estimator of δ_i is

$$D_i = Y_{2i} - \hat{Y}_{2i} = Y_{2i} - X_{2i}\hat{\beta}$$

where $\hat{\beta}$ is the matrix of component-wise least-squares estimators based on the control group observations only. Thus, the best linear unbiased estimator of $\bar{\delta} = (\bar{\delta}_1, \bar{\delta}_2, \dots, \bar{\delta}_k)$ is

$$\bar{D} = \bar{Y}_2 - \bar{X}_2\hat{\beta} = (\bar{Y}_2 - \bar{Y}_1) - (\bar{X}_2 - \bar{X}_1)\hat{\beta} = \bar{Y}_2 - \bar{Y}_1,$$

where \bar{Y}_2 is the vector of "adjusted means" defined by

$$\bar{Y}_2 = \bar{Y}_2 + (\bar{X}_1 - \bar{X}_2)\hat{\beta}.$$

These formulas, well adapted to handling missing values, were used in this study. For a more detailed treatment of the individual-effects methodology, see Haggstrom et al. (1981).

