Early Childbearing, Marital Status, and Women's Health and Mortality after Age 50*

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This article examines the relationship between a woman's childbearing history and her later health and mortality, with primary focus on whether the association between them is due to early and later socioeconomic status. Data are drawn from the Health and Retirement Study birth cohort of 1931–1941. Results indicate that, conditional on reaching midlife and controlling for early and later socioeconomic status, a first birth before age 20 is associated with a higher hazard of dying. In addition, having an early birth is associated with a higher prevalence of reported heart disease, lung disease, and cancer in 1994. Being unmarried at the time of the first birth is associated with earlier mortality, but this association disappears when midlife socioeconomic status is controlled. The number of children ever born does not significantly affect mortality but is associated with prevalence of diabetes.

Recent years have seen a growing appreciation of the influence of early-life-course events and socioeconomic status on midlife health and mortality (e.g., Elo and Preston 1992; Blackwell, Hayward, and Crimmins 2001). This development has broadened the long-standing sociological focus on the significance of early events to include the complex relationship between social and biological processes. The research reported here extends the early-event focus to adolescence and young adulthood by examining the relationship between aspects of childbearing history and later midlife mortality and health. Specifically, the analysis examines the relationships between elements of a woman's childbearing history—her age at first birth, marital status at first birth, and number of children ever born—and her hazard of dying and reported health conditions in midlife, conditional on her surviving to her fifties.

THEORY AND EVIDENCE

The Links between Childbearing and Later Health

Three processes potentially link childbearing and later health: the biological effects of childbearing, the correlation of childbearing patterns and health with early and later socioeconomic status, and the social effects of childbearing through its effects on social integration or stress (Wadsworth 1997; Grundy and Tomassini 2005).

There is a growing body of evidence that early events may have long-term biological consequences (Wadsworth 1997). In the case of childbearing, this argument is supported by research that finds death from specific diseases is positively associated with parity, including diabetes (Beral 1985; Green, Beral, and Moser 1988) and heart disease (Beral 1985; Ness et al. 1993; Kvåle, Heuch, and Nilssen 1994). Effects of parity on cancer are more complex, with increases in some types and decreases in others (Beral 1985; Kvåle et al. 1994; Madigan et al. 1995). Evolutionary biology provides one

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theoretical route for understanding the physiological effects of timing and levels of childbearing through genetic mechanisms that produce a trade-off between early reproduction and later survival. Childbearing may have a direct physiological effect that becomes apparent only after the childbearing years (Partridge and Harvey 1985; Kirkwood and Rose 1991; Westendorp and Kirkwood 1998).

There are also competing social hypotheses. Foremost among these is the possibility that the association between childbearing and later health is produced by their common correlation with socioeconomic status. The association between childbearing and later health may be spurious if it is produced by their common correlation with socioeconomic status before the time of childbearing. Early socioeconomic status is associated with childbearing patterns (Koo, Suchindran, and Griffith 1987; Retherford and Luther 1996), and early socioeconomic status may also affect health through other mechanisms such as poor nutrition *in utero,* in infancy, or in childhood, or through childhood level of air pollution (Elo and Preston 1992; Wadsworth 1997; Blackwell et al. 2001; Crimmins and Seeman 2004; Hayward and Gorman 2004). Causal interpretation of the association of later socioeconomic status, childbearing, and health is much less certain. Because the ages of typical completion of schooling and childbearing overlap, there is no clear causal order between them. However, each is related to midlife socioeconomic status (Taniguchi 1999; Hofferth, Reid, and Mott 2001; Olausson et al. 2001). In turn, midlife socioeconomic status also has a well-established association with health and mortality (Davey Smith and Egger 1992; Keil et al. 1992; Sorlie, Backlund, and Keller 1995; Lantz et al. 1998; Smith 2004; Steptoe and Marmot 2004).

Finally, childbearing patterns may also produce later-life health and mortality through the social relationships resulting from reproduction (Grundy and Tomassini 2005). Parenthood is an integrative mechanism and may be related to later marital status, social support from children, and stress levels. The level of integration and the long-term effects of parenthood may depend on marital status at the time of childbearing. While there is an extensive literature on the importance of social support for health showing that supportive relationships reduce stress (e.g., Umberson et al. 1996), there is also evidence for negative effects of parenthood on well-being (McLanahan and Adams 1987). Social support may affect health through social pathways; for example, encouragement of appropriate health behaviors may improve health, or it may lower stress and have beneficial physiological effects (e.g., Crimmins and Seeman 2004).

Previous Research on Childbearing Patterns, Mortality, and Health

Previous research has found associations among childbearing patterns, health, and mortality. High parity has generally been associated with higher mortality (Kvåle et al. 1994; Friedlander 1996; Westendorp and Kirkwood 1998; Doblhammer 2000; Smith, Mineau, and Bean 2002; Grundy and Tomassini 2005) across a range of periods and nations, though there are some exceptions to this general finding (Muller et al. 2002; McArdle et al. 2006). This finding is supported by other research outlined earlier that finds death from specific diseases associated with higher parity. However, null parity has also been associated with higher mortality (Green et al. 1988; Doblhammer 2000; Grundy and Tomassini 2005) in some studies, though Friedlander (1996) found the opposite.

Associations between timing of births and health and mortality have also been found. Early childbearing is associated with higher mortality in a number of studies. These include married members of the British aristocracy born before 1876 (Westendorp and Kirkwood 1998) as well as contemporary populations in England and Wales (Doblhammer 2002; Grundy and Tomassini 2005) and Austria (Doblhammer 2000). Early childbearing has also been associated with more reported health problems in midlife (Waldron, Weiss, and Hughes 1998) and higher levels of functional limitation (Kington, Lillard, and Rogowski 1997). Late childbearing has been associated with later survival in some studies (Westendorp and Kirkwood 1998; Perls, Alpert, and Fretts 1997; Doblhammer 2000; Muller et al. 2002; Smith et al. 2002; McArdle et al. 2006) but earlier mortality in others (Cooper, Baird, and Weinberg 2000). Grundy and Tomassini (2005) hypothesize that closely spaced births may increase physiological, social, and psychological stress and find that women with short birth intervals also had elevated mortality.

The current research literature suffers from a number of limitations. First, most of the recent studies of the association between parity, birth timing, and mortality use European data (e.g., Doblhammer 2000; Grundy and Tomassini 2005) or focus on historical or highly specialized populations (e.g., Westendorp and Kirkwood 1998; Smith et al. 2002; McArdle et al. 2006), leaving open the question of whether the relationships among socioeconomic status, childbearing patterns, and midlife mortality are the same among recent cohorts in the United States. Among the recent studies of mortality in contemporary populations, measurement of socioeconomic status has been limited. Only Grundy and Tomassini (2005), using data for England and Wales, include good measurement of education and midlife socioeconomic status, but they have no information on socioeconomic status preceding first birth and marital status at the time of first birth. Friedlander (1996) used U.S. data, but her sample was limited to a white, middle- to upper-middle class population born in 1880–1929. Moreover, her only control for socioeconomic status was a midlife measure of occupation of head of household.

SOCIAL CONTEXT: THE 1931–1941 BIRTH COHORT

The cohort to be examined, the 1931–1941 birth cohort, is ideally suited for examining the effects of parity and early fertility timing. Cohort members entered adolescence in the years following World War II, and, compared to today's young adults, marriage took place earlier, rates of teenage childbearing were much higher, and most births were marital births. The proportion with a birth before exact age 20 (i.e., before her 20th birthday) ranged from 27.9 to 32.9 across the one-year birth cohorts, and slightly more than 10 percent of women had a first birth before exact age 18 (Heuser 2005). In the 15 years after World War II, more than 80 percent of births to women ages 15–19 occurred in marriage (National Center for Health Statistics 2001). Bachu (1999) estimates from Current Population Survey data that among first births to women ages 15–19 during the 1950s, 61–65 percent were conceived after marriage, 19–20 percent were conceived before marriage but the birth occurred in marriage, and 16–19 percent were premarital births. In sum, marriage and having a marital birth before age 20 constituted a common life course pattern for the cohort.

Total fertility of the cohort was also substantially higher than preceding or following cohorts. Total cohort fertility by age 40 peaked in the 1933 birth cohort at 3.2 children and gradually declined to 2.6 in the 1941 cohort (Heuser 2005). Early childbearing and high total fertility are linked. During the 1950s, a first birth to a teenager was associated with a faster rate of subsequent childbearing and higher total fertility (Trussell and Menken 1978), but this relationship is much weaker for later cohorts (Morgan and Rindfuss 1999).

Some analysts have argued that low fertility in modern populations may mask the relationship between fertility and survival (Westendorp and Kirkwood 1998). Data from the 1931–1941 cohort are particularly useful in this regard because, compared to other twentieth-century cohorts, they experienced early and high fertility. Greater variation in covariates allows more sensitive tests of their effects on mortality and health. In addition, early marriage and the high levels of early marital childbearing in this cohort mean that early marital childbearing was a very common feature of the life course, and therefore it is less likely that early childbearing and mortality both result from selection on some unusual (and unmeasured) characteristic in the population.

GOAL OF THIS RESEARCH

The analysis presented here extends existing research on fertility patterns and health in several ways. The data set, the Health and Retirement Study (HRS) for the U.S. birth cohort of 1931–1941, provides a combination of measures of socioeconomic status preceding first birth, respondent's own education, and midlife status that are not found in other studies of childbearing patterns and mortality. These allow a more thorough examination of whether any relationship between childbearing and later health is due to their mutual correlation with early or midlife socioeconomic status. In addition, the HRS data allow measurement of marital status at first birth, adding an important measure of birth circumstances to the literature. Also, the HRS allows a more comprehensive analysis than much of the existing research because it includes measures of both midlife health conditions and mortality.

Based on the research literature, it is expected that having an early birth and high parity will be associated with poorer health and earlier mortality. The key research question is whether these associations remain net of socioeconomic status before childbearing, marital status at the time of the first birth, and midlife socioeconomic status.

DATA

Data are drawn from the first six waves of the HRS, collected between 1992 and 2002. The HRS is a panel study of the U.S. population that tracks individual change in the domains of health and physical functioning, employment, income and wealth, and family structure (Juster and Suzman 1995). The sample used here consists of the original cohort born 1931–1941. The first interview, in 1992, occurred when women were ages 51–61. Respondents were then followed until 2002, and these data are used to estimate mortality. The data are linked to the National Death Index up to 2002. The National Death Index provided the date of death for all deceased respondents, except for nine respondents for whom date of death was available only in the survey data.

Models for mortality are estimated using Cox regression. While respondents are observed from 1992, in this analysis their period of risk of dying begins with the month of the 1994 interview and continues until death or censoring at the last interview in which they participated. Hence, women were 53–63 when their risk of death is first analyzed. The start date is 1994 because a central variable for the analysis, children ever born, was not asked until 1996. The 1994 start time ensures that parity data are available for all respondents, because data on children ever born for decedents between 1994 and 1996 were gathered in the post-death proxy interview. Fourteen percent of the 1992 female respondents were not living or deceased respondents in 1996 and are therefore lost to the analysis, reducing the sample from 5,156 to 4,414. While only two women lacked data on date of death, missing data on other covariates reduced the sample a further 2 percent, to 4,335.

A comparison of continuing respondents with those lost to the analysis indicates that low socioeconomic status, measured by the variables included in the models in this article, is associated with dropout. Controlling for socioeconomic status, Hispanic and other (i.e., not African American and not Hispanic) minority status, and partnered or separated marital status are associated with not being present in the sample. Women not married at the time of their first birth are also more likely to drop out. Other birth timing variables were not associated with leaving. The variables associated with leaving the study are included in the models below; this inclusion addresses the issue of disproportionate dropout on the assumption that dropout is otherwise random.

Variables

Respondent's age. The HRS includes month and year of birth, and respondent's age is calculated as completed years as of the 1992 interview date. Inclusion of this variable allows estimation of age differences in health and mortality within the restricted age range of this cohort.

Respondent's race and ethnicity. Race/ethnicity is a four-category variable differentiating white, black, Hispanic, and other respondents. In coding respondents on this varable, Hispanic ethnicity takes precedence over the other three categories.

Father's education. Father's education was collected in years and is coded into six groups: 0–5, 6–8, 9–11, 12, 13 or more years, and missing. Slightly more than 10 percent of respondents answered "don't know" to this question, and there were a handful of respondents who refused to answer. It is likely that the missing responses would have fallen in the lower part of the education distribution.

Respondent's nativity. Nativity is a dummy indicator of whether the respondent was born in the United States.

Respondent's education. Education is coded as number of years of schooling.

Children ever born to respondent. The number of children born to the respondent was collected in 1996 and reported by each respondent individually.

Respondent's fertility history. I use dummy variables to tap three different dimensions of each respondent's fertility history. *Timing of first birth* indicates whether the first birth was before age 20 (coded 1) versus age 20 or older (0). As reported later, use of a more detailed age breakdown did not result in an improvement in model fit. *Births after age 39* is coded 1 for those with births after age 39 (0 otherwise), and *shortest birth interval between 0–23 months* is coded 1 for those whose shortest interval between births is less than two years (0 otherwise). The birth-timing variables are based on a roster of living children and thus do not fully measure fertility as discussed in the data limitations section below. Child's age is measured in completed years, thereby dictating the width of the birth interval measure. Depending on the date of the interview relative to the children's birthdays, children who differ in age by one completed year could have been born up to 23 months apart. The child roster, including own and stepchildren of each spouse, was reported by one respondent in a household; in married households, this was almost always the female respondent. Timing measures are based on a woman's own children.

Marital status at the time of the first birth. Marital status at first birth is coded as married (0) or not married (1). The variable is derived from the birth year of the oldest living biological child and the respondent's marital history, which includes start and stop dates of each marriage.

Income and wealth. I measure income as the log of total household income reported at the 1992 interview. I measure wealth as the log of the 1992 value of household assets (including housing assets) minus debts. These measures are proxies for the long-term midlife socioeconomic status of the respondent.

Marital status. Marital status is measured by both marital status at the beginning of the observation period and change in marital status during the period when the respondents are at risk of dying. Marital status is measured at the beginning of the risk period in 1994. The variable categorizes respondents as married, living with a partner, separated, divorced, widowed, and never married. In the mortality analysis, there is also a set of time-varying covariates that indicate a new marital status after this time: new widowhood, new marriage, or new divorce measured to the month of the event. Once a respondent enters a new marital status, she retains the new marital status until she experiences another marital change. The time-varying covariates used in the models allow for multiple events of any one type as well as multiple events of different types.

Health conditions. Health is measured in 1994, the beginning of the observation period. In 1992, respondents were asked the following questions, each including the phrase, "Has a doctor ever told you . . ." (1) ". . . that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?" (2) ". . . that you had a stroke?" (3) ". . . that you have high blood pressure or hypertension?" (4) ". . . that you have diabetes or high blood sugar?" (5) ". . . that you have cancer or a malignant tumor of any kind, except skin cancer?" and (6) "Not including asthma, . . . that you have chronic lung disease such as chronic bronchitis or emphysema?" In 1994, respondents were asked similar questions covering only the period since the 1992 interview. The health measure uses data for both years to measure prevalence as of 1994 (i.e., having reported a disease in either 1992 or 1994).

All results are weighted using individual weights provided in the HRS data set.

Data Limitations

The HRS data on own living children that are used to construct childbearing history measures have several limitations. They exclude children who have died, as well as many of the children who may have been given up for adoption at birth, particularly those adopted by nonrelatives (which were about half of adoptions during the 1950s) (Maza 1984). Omission of adoptions is probably most likely to affect women with unmarried births and younger women. The roster also excludes pregnancies that ended in termination through abortion or miscarriage and pregnancies that ended in stillbirth, though these pregnancies might also have later health consequences. If childbearing history has an association with mortality, the simple assumption that some women with an early birth were misclassified leads to the expectation that childbearing history coefficients would be biased toward zero. More complex effects on childbearing history results are also possible if the adoption or abortion outcomes were based on unmeasured differentials.

The data-collection timing means that the analysis is conditional on respondents having survived to their sixth decade. In addition, the HRS data allow the analyst to follow mortality outcomes only until 2002, when participants were 61 to 71. Thus, the analysis is of mortality of women who survive to their sixth decade but who die at relatively young ages.

The HRS data may underestimate the proportion of cases with a birth before age 20. One-quarter of parous women (and 23 percent of women overall) report a birth before age 20. I compared these data with Heuser's (2005) estimates of cumulative cohort first births. The mean of the single-year birth cohort estimates from Heuser's data, weighted to the HRS sample proportion for individual years of birth, is 31.2 percent; hence, early births in the HRS data appear to be underestimated. However, the relative numbers of nonmarital and marital births are similar to those estimated by Bachu (1999) from Current Population Survey data: Nearly 20 percent of births before age 20 in the HRS were nonmarital, compared to Bachu's period estimate of 16–18.5 percent during the 1950s, and 11.4 percent of all births in HRS were nonmarital, compared to Bachu's period estimate of 8–10 percent during the 1950s.

Possible reasons for the lower HRS estimate of first births before age 20 are the previously discussed likely exclusion of children who have died or who were given up to be adopted by nonrelatives, and the HRS data-collection method for children's age. HRS collected children's current age in completed years, and the respondent's age at child's birth is the difference between the child's age and the respondent's age, both measured in completed years. Depending on the interview date relative to the respondent's and the child's birthdays, the calculation used may underestimate the proportion of respondents having a birth before exact age 20. A birth when the respondent was age 19 would be calculated as having occurred at age 20 if the interview occurs after the respondent's birthday and before the child's birthday because the child will not yet have attained the next completed year of age. This effect will be magnified by the rapid increase in the cumulative proportion with at least one birth in the cohort; between exact ages 19 and 21, this percentage rises from 20.7 to 41.9 in Heuser's (2005) data. It is not possible to gauge the relative importance of these two sources of underestimation, but it does not appear that the underestimate disproportionately affects unmarried births.

RESULTS

Table 1 presents means and distributions of the variables used in the analysis. By 2002, 7.6 percent of the women had died. Data are presented separately for all women and parous women, though there is very little difference between the two groups. One-quarter of parous women report a birth before age 20. Only 11.4 percent were unmarried at the time of their first birth, but this proportion rises to nearly 20 percent for women with a birth before age 20. Less than 4 percent experienced a birth after age 39, and slightly more than one-third of parous women had a short birth interval of less than 24 months. Only 8 percent of the sample were nulliparous, and 36.7 percent had four or more children.

The time-varying marital variables measure whether the respondents entered a new marital

TABLE 1. Means and Percentages for Variables Used in the Analysis

	All Women	Parous Women
Died 1994–2002	7.6%	7.5%
Age in 1992	55.8	55.9
Education (years)	12.3	12.2
Born in United States	91.0%	91.1%
Log net worth	10.7	10.8
Log household income	10.4	10.4
Race/ethnicity		
White, non-Hispanic	81.9%	81.9%
Black	10.3%	10.3%
Hispanic	5.7%	5.7%
Other	2.0%	2.0%
Father's education		
0–5 years	13.2%	13.1%
6–8 years	30.8%	30.8%
9–11 years	12.2%	12.3%
12 years	20.6%	20.7%
13 or more years	11.5%	11.1%
Missing	11.7%	12.0%
1994 marital status		
Married	68.5%	70.5%
Live with partner	1.6%	1.5%
Separated	2.0%	2.2%
Divorced	12.8%	13.0%
Widowed	11.7%	11.8%
Never married	3.4%	1.1%
Time-varying variables		
New marriage	3.0%	3.0%
Widowhood	8.9%	9.1%
Divorce	1.6%	1.7%
Children ever born		
None	8.3%	
One	8.8%	9.3%
Two	23.1%	26.8%
Three	23.1%	26.1%
Four	15.8%	17.3%
Five or more	20.9%	20.5%
First birth before age 20	23.0%	25.1%
Married at first birth		
No		11.4%
Yes		88.6%
Nonmarital births as percent of births before age 20		19.6%
Birth after age 39		3.7%
Birth interval 0–23 months		36.3%
Health conditions		
Heart	12.9%	13.2%
Lung	10.4%	10.2%
Cancer	8.9%	8.9%
Stroke	2.7%	2.8%
Diabetes	10.8%	11.0%
High blood pressure	40.5%	40.8%
N	4,335	3,947

status during the period when they are observed to be at risk from dying. The actual time-varying covariate utilizes the type of event and the month and year in which it occurred, but Table 1 indicates only whether a respondent experienced one or more events of a particular type. Multiple events of any one type are measured in the time-varying covariates but are not shown here. Only six respondents had more than one event of any one type, and slightly more than 1 percent of respondents had more than one marital event (e.g., widowhood followed by a new marriage).

Table 2 presents hazard ratios from Cox regression models with robust standard errors (Lin and Wei 1989), as implemented in version 9 of STATA (Stata Corporation 2007). The number of episodes shown in the table is different from the number of observations in the data set because creating the time-varying covariates for changes in marital status involved breaking the respondent's record into two or

TABLE 2. Cox Regression Models for Hazard of Dying, 1994–2002

	All Women					Parous Women				
Independent Variables	1	2	3	4	5	1b	2b	3b	4b	5b
Age		1.10**	1.10**	1.09**	1.09**		1.10**	1.11**	1.10**	1.10**
Race (vs. white)										
Black		1.74**	1.68**	1.59**	1.24		1.53**	1.18	1.16	.94
Hispanic		1.36	1.31	.95	.93		1.34	1.23	.96	.96
Other		1.72	1.67	1.72	1.60		1.77	1.72	1.73	1.66
U.S.-born		1.40	1.37	1.51	1.48		1.47	1.35	1.48	1.39
Father's education (vs. 12)										
0–5 years		1.61*	1.58*	1.30	1.25		1.72*	1.56	1.35	1.29
6–8 years		1.47*	1.45	1.33	1.34		1.60*	1.55*	1.43	1.45
9–11 years		1.26	1.25	1.21	1.19		1.34	1.28	1.24	1.23
13 or more years		.99	.99	1.15	1.13		1.06	1.10	1.24	1.23
Missing		1.52	1.52	1.25	1.16		1.73*	1.52	1.33	1.24
Education (years)				.91**	.95*				.92**	.96
First birth before 20						1.59**		1.58**	1.45*	1.42*
Unmarried at first birth						1.59**		1.49*	1.41*	1.26
Birth after age 39						.88		.81	.79	.80
Birth interval 0–23 months						1.11		1.15	1.15	1.13
Children ever born (vs. 2)										
None	1.43		1.33	1.36	1.52					
One	1.19		1.09	1.08	1.04	1.19		1.14	1.13	1.10
Three	1.33		1.08	1.07	1.08	1.08		1.04	1.03	1.05
Four	1.17		1.08	1.04	.99	1.04		.98	.96	.92
Five or more	1.56*		1.28	1.14	1.06	1.25		1.08	1.01	.95
Log net worth					.94**					.94**
Log income					.93*					.91**
1994 marital status (vs. married)										
Live with partner					.42					.51
Separated					1.24					1.23
Divorced					1.05					1.01
Widowed					1.39					1.39
Never married					.46*					.56
Marital change after 1994										
New widow (time-varying)					1.22					1.23
New marriage (time-varying)					.53					.46
New divorce (time-varying)					.56					.52
Episodes	4,906	4,906	4,906	4,906	4,906	4,480	4,480	4,480	4,480	4,480
Pseudo log likelihood	–2707.8	–2679.0	–2679.0	–2679.0	–2648.8	–2372.5	–2362.0	–2350.2	–2345.5	–2327.5

* $p < .05$; ** $p < .01$

more episodes to reflect different hazards before and after each event.

The left panel of the table presents results for all women, while the right panel presents results for parous women only. The models for all women include children ever born, while the models for parous women also include parity and marital timing variables. The first model in the left panel includes only children ever born and indicates that high parity is associated with higher mortality. The association of nulliparity with mortality is also substantial but not significant ($p = .11$). Model 2 includes only background measures—age, race, nativity, and father's education—that are unequivocally determined before childbearing, and the model indicates that African Americans and those with low levels of father's education have an increased mortality hazard. Model 3 combines background measures and children ever born. Age, the black-white contrast, and low father's education categories are significantly associated with mortality. The "other" race hazard is large but nonsignificant in all equations of both panels; only 2 percent of the sample fall into this category, and this low number reduces the power of the null hypothesis test. Net of these factors, there is no association between children ever born and mortality. This finding indicates that childhood socioeconomic status explains the association between number of children born and mortality. The inclusion of respondent's own education in model 4 renders father's education nonsignificant. In the final model, model 5, race is nonsignificant after the inclusion of midlife economic status measures, income and net worth. In this equation, the inclusion of marital status at the beginning of the observation period brings nulliparity to near significance ($p = .08$). Never-married women have lower mortality, and inclusion of the never-married indicator results in an increase in the nulliparity coefficient. The marital change hazards are nonsignificant. While the new marriage and new divorce estimates indicate a reduced hazard, a relatively small proportion of the sample falls into these categories. The direction of these coefficients may indicate that women in good health are more likely to contract new marriages and end old marriages through divorce.

In the right-hand panel of the table, model 1b presents an equation that includes children ever born and birth-timing variables. Women with a birth before age 20 have a risk of dying 1.59 times that of women with a first birth at age 20 and older. Being unmarried at the time of a first birth is associated with a hazard of dying equal to the early-birth effect. A test of the interaction between early birth and marital status at first birth was not significant. Unlike model 1, high parity is not significantly associated with higher mortality. Further analysis showed that the inclusion of an early birth indicator is responsible for this result. Women with an early birth are also more likely to be in the high-parity category.

Model 2b includes only background characteristics that are unequivocally determined before the childbearing years. Age, race, and father's education results are similar to equation 2 for all women. Model 3b combines background measures, birth timing, and children ever born measures. The black-white contrast is no longer significant. Further detailed analysis showed that this association becomes nonsignificant when married at first birth is added to the equation.

A low level of father's education is associated with a higher hazard of dying, as it is in the equation for all women. The coefficient for 6–8 years is significant, and the coefficient for 0–5 years is of similar magnitude and is close to statistical significance. However, inclusion of background factors does not reduce the association of birth timing and mortality and reduces the nonmarital birth association by only a moderate amount compared to model 1b. Model 4b adds the respondent's own level of education in a separate step because the relative timing of school completion and giving birth is uncertain. Higher levels of schooling are associated with lower mortality, but inclusion of this variable has only moderate effects on the birth timing and marital status indicators.

Model 5b adds measures of midlife attainments that occur after first birth and that are measured after the respondents' childbearing years. These include midlife economic status measured by household net worth and income, marital status at the beginning of the period during which respondents are at risk of dying, and marital status changes during the period of observation. Both higher net worth and higher income are associated with a lower risk of dying. Compared to model 1b, the hazard for birth before age 20 is slightly attenuated but remains statistically significant. Importantly, marital status at first birth is no longer significant, suggesting it is correlated with later achievements and affects mortality through that pathway. Models using a detailed set of age categories (before 18, 18–19, 20 and over) were estimated for the final model (5b) of Table 2 and compared to the model presented, which combines all births before 20 into one group. Use of the more detailed variable did not result in a significant improvement in fit.

Table 3 presents logistic regression models for respondent-reported diagnosed disease prevalence in 1994. Equations for all women and parous women are shown separately, but the results are very similar for the variables included in both models. The results for race and ethnicity indicate that, among all women, blacks have lower levels of lung disease and cancer but higher levels of diabetes and high blood pressure. Hispanics have a lower level of heart disease and a higher level of diabetes. Further investigation of these results indicated that these associations emerge only when socioeconomic status is held constant. In a model including only age and ethnicity, blacks have higher rates of heart disease, diabetes, stroke, and high blood pressure, and there is a null association with cancer and lung disease. Hispanics have higher levels of diabetes and high blood pressure. When education and midlife economic status are added, the significant negative associations observed in Table 3 emerge.

Having a birth before age 20 is associated with a higher probability of reporting cardiovascular disease, lung disease, and cancer. Being unmarried at first birth is positively associated with heart disease and stroke. Late birth and a short birth interval are associated with lower prevalence of heart disease. There are scattered findings for parity across these models. The most consistent result is the association between diabetes and high parity, which is significant for women with four or more children. This finding conforms to previous findings (Beral 1985; Green et al. 1988). The other significant parity coefficients do not lend themselves to a clear interpretation. Among other variables, age has a consistent positive association with condition prevalence for all conditions except stroke. Midlife net worth has a consistent negative association with all conditions except cancer. A low level of father's education is associated with a greater probability of diabetes. This finding is particularly interesting because it is consistent with the hypothesis that poor prenatal and infant nutrition is associated with adult diabetes (Hales et al. 1992).

DISCUSSION

The central findings are that having an early first birth or a nonmarital first birth are associated with a higher hazard of dying among women who survive to late middle age. Having a first birth before age 20 is associated with elevated mortality compared to those with a first birth at age 20 or older. This association is not reduced by the inclusion of background factors—race, nativity, and father's education—that are determined before the childbearing years. Moreover, the association is reduced only moderately and remains significant when respondent's own education is added to the equation. These findings indicate that the association between mortality and early childbearing is not produced by common correlation with measured early social and economic status. Early childbearing has an independent association with mortality, and the relationship is not spurious. The set of included background factors is strong in comparison with much of the previous research on the topic, and examining whether the early childbearing finding is spurious in relation to them is one of the central contributions of this article. Nonetheless, the included measures are not exhaustive. It is possible that more thorough measurement of early childhood circumstances might reduce the association further.

The association of early birth with mortality does not change when measures of midlife socioeconomic status and marital status are added to the equation. Hence, there is no evidence that the early-birth finding occurs because having an early birth sets a woman on a trajectory toward lower economic status or a particular midlife marital status. Here, too, more elaborate measurement of midlife status might reduce the association further.

The finding of a substantial effect for early birth on mortality in this study adds to the research literature because early births were very common in this cohort in the United States. The early age at marriage and the high prevalence of marital teenage births in this cohort militate against the possibility that some unusual and rare unmeasured characteristic produced both early births and higher midlife mortality.

The second central finding of this article is that being unmarried at the time of the first

TABLE 3. Logistic Regression Models for Presence of Disease, 1994

	Heart		Lung		Cancer		Stroke		Diabetes		High BP	
Independent Variables	All	Parous	All	Parous	All	Parous	All	Parous	All	Parous	All	Parous
Age	.08**	.08**	.05**	.05**	.05*	.05**	.04	.02	.07**	.06**	.06**	.05**
Race (vs. white)												
Black	–.06	–.22	–.57**	–.65**	–.60**	–.58*	.23	.03	.72**	.69**	.93**	.93**
Hispanic	–.69**	–.59*	–.46	–.46	–.18	–.11	–.16	–.25	.47*	.43	.24	.26
Other	–.36	–.29	–.19	–.16	–.41	–.34			.73*	.61	.48*	.40
U.S.-born	.03	–.09	.96**	.91**	.39	.36	.22	.28	.18	.225	.18	.10
Father's education (vs. 12)												
0–5 years	.17	.16	.32	.18	.20	.25	.58	.60	.40*	.40*	–.18	–.17
6–8 years	.08	.11	.18	.11	.08	.16	.17	.17	.21	.26	–.1	–.05
9–11 years	.08	.07	.28	.20	–.25	–.11	.49	.58	.18	.26	–.01	–.04
13 or more years	–.17	–.18	.17	.24	.14	.20	.35	.50	.01	.06	.11	.06
Missing	.40*	.34*	.14	–.05	.45*	.49*	.23	.27	.18	.22	–.07	–.02
Education (years)	–.04	–.01	–.08**	–.07**	.01	.03	–.07	–.08	–.06**	–.07**	–.03*	–.02
First birth before 20		.36**		.33**		.30*		–.03		–.19		–.04
Unmarried at first birth		.37**		.11		–.25		.56*		.09		.04
Birth after age 39		–.62*		–.01		–.83		–.05		–.27		–.07
Birth interval 0–23 months		–.28*		–.02		.21		–.33		–.03		.01
Children ever born (vs. two)												
None	–.23		.41		–.08		–.78		.06		–.01	
One	–.04	–.05	.22	.22	.49*	.55**	–.06	–.11	–.01	–.02	.12	.14
Three	.06	.11	.36*	.35	.07	–.01	–.15	–.12	.01	.03	.22*	.22*
Four	.06	.12	.12	.12	.25	.15	.57*	.68*	.33*	.37*	.20*	.20
Five or more	.11	.26	.26	.22	.05	–.11	.31	.47	.42*	.51**	.13	.13
Log net worth	–.08**	–.08**	–.09**	–.10**	–.01	–.02	–.07**	–.07*	–.06**	–.05**	–.07**	–.08**
Log income	–.05	–.05	–.09*	–.08*	.01	–.01	–.05	–.01	–.10**	–.12**	–.06*	–.07*
Marital status (vs. married)												
Live with partner	.32	.42	.23	.20	.21	.06	.27	–.20	–.08	–.06	–.24	–.12
Separated	.10	.02	.17	.19	.93**	.96**	.41	.37	–.25	–.25	–.33	–.37
Divorced	–.03	–.09	.04	.11	.21	.24	.02	–.03	–.06	–.05	–.05	–.09
Widowed	–.09	–.07	.28	.30	–.34	–.29	–.30	–.29	–.06	–.04	.05	.01
Never married	.01	–.09	–.47	.10	.53	.46	.25	.41	–.41	–.19	–.03	.12
Intercept	–4.56	–4.81	–3.32	–3.64	–5.85	–6.00	–4.35	–3.88	–4.31	–3.46	–2.21	–1.91
–2 log likelihood	3,199.3	2,939.7	2,723.4	2,430.4	2,544.4	2,310.0	1,038.1	967.0	2,757.2	2,549.9	5,594.5	5,105.0

* $p < .05$; ** $p < .01$

birth is associated with higher mortality. This finding is a new contribution to the literature. The unmarried and early-birth coefficients are of similar size before covariates are introduced, but their patterns diverge after covariates are added. The association between mortality and marital status remains significant when background factors are included in the equation, even when the respondent's own education is included. However, the association between mortality and marital status becomes nonsignificant when midlife measures are added to the equation. A nonmarital first birth is associated with a trajectory that leads to lower economic status in midlife, and through that mechanism it is associated with earlier mortality.

The race findings are also important. In the equations for all women, the contrast of blacks and whites is significant until income and net worth are added in the last equation. This finding suggests that higher mortality for blacks is due to the association of race with midlife economic status, a finding that is consistent with research on men (e.g., Keil et al. 1992). The pattern of coefficients in the models for parous women further clarifies this relationship. The black-white contrast becomes nonsignificant when the birth timing variables, particularly marital status at first birth, are added. This finding is important because it suggests a mechanism through which race is associated with higher mortality. As noted above, marital status at first birth has its effect because it produces a trajectory of lower midlife economic status. In addition, African American women have a higher probability of a nonmarital first birth. The higher mortality of black women is mediated by a nonmarital first birth, which is associated with lower midlife economic status. This finding is worth additional examination in future research.

In contrast to birth timing and marital status at first birth, children ever born has no independent effect. The zero order association of high parity with earlier mortality disappears when background factors or birth timing are added to the model.

The models for disease prevalence in Table 3 provide support for the association between early childbearing and mortality. Women with a first birth before age 20 are more likely to report heart disease, lung disorders, and cancer. These findings persist net of background and midlife variables.

Given the provisional elimination of the socioeconomic pathway as an explanation for the early-birth finding, the remaining explanations are the biological and social ones presented earlier. While the data analysis cannot choose between them, it can inform the discussion. The possibility of a physiological link between early birth and later survival is enhanced by the finding in this research that neither measured background factors nor midlife measures of economic and marital status account for the association between early birth and mortality. This interpretation is strengthened by the difference between the early birth and marital status at first birth findings. As noted, parenthood may be associated with later-life health and mortality through the social relationships resulting from reproduction. The results of the analysis suggest that this explanation applies to the association of marital status at first birth and mortality. Age at first birth is not mediated in this way, and the divergence between the two findings highlights the possibility of a physiological mechanism producing the age at first birth finding.

The substantial association of early births and nonmarital births with elevated mortality among women who survive to late midlife suggests the need for further research in three directions. First, the central remaining question with respect to early births is whether a more comprehensive set of early background measures might account for the link between early birth and mortality. This question may eventually be addressed with the new cohorts currently being recruited into the HRS panel study because they are asked a more comprehensive set of childhood background questions than the original participants answered in their early interviews. A second remaining question relates to the marital status at first birth findings and the late birth findings. It would be useful to study the link between marital status and later health and mortality in additional cohorts so that it would be possible to examine whether being unmarried at first birth has the same association in cohorts in which it is relatively common, compared to this study, in which being unmarried at first birth was relatively uncommon and was more highly stigmatized. Similarly, late births were relatively rare in the 1931–1941 cohort but have become more common in recent years. Late births might well have different effects in cohorts in which they are more common. Finally, it would be useful to examine the association of childbearing and mortality throughout the life course. In combination, these studies would bring us closer to understanding the links between childbearing patterns and later health outcomes.

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