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Family Socioeconomic Status and Early Life Mortality Risk in the United States

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Abstract

Objectives—We examine the association between several dimensions of parental socioeconomic status (SES) and all-cause and cause-specific mortality among children and youth (ages 1–24) in the United States.

Methods—We use Cox proportional hazard models to estimate all-cause and cause-specific mortality risk based on data from the 1998–2015 National Health Interview Survey-Linked Mortality Files (NHIS-LMFs), restricted to children and youth ages 1–17 at the time of survey followed through age 24, or the end of the follow-up period in 2015 (N=377,252).

Results—Children and youth in families with lower levels of mother's education, father's education, and/or family income-to-needs ratio exhibit significantly higher all-cause mortality risk compared with children and youth living in higher SES families. For example, compared to children and youth living with mothers who earned college degrees, those living with mothers who havenot graduated high school experience 40% higher risk of early life mortality over the follow-up period, due in part to higher mortality risks of unintentional injuries and homicides. Similarly, children/youth whose fathers did not graduate high school experience a 41% higher risk of dying before age 25 compared to those with fathers who completed college.

Conclusions—Today's children and youth experience clear disparities in mortality risk across several dimensions of parental SES. As the U.S. continues to lag behind its high-income peers in health and mortality, more attention and resources should be devoted to improving children's health and well-being, including the family and household contexts in which American children live.

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Keywords

Mortality; Early life; Socioeconomic status; Disparities; National Health Interview Survey

Objectives

Socioeconomic status (SES) is a fundamental cause of mortality (Link & Phelan, 1995) for adults (Krueger, Tran, Hummer, & Chang, 2015; Masters, Hummer, & Powers, 2012; Montez, Hummer, & Hayward, 2012) and infants (Frisbie, Hummer, Powers, Song, & Pullum, 2010; Gage, Fang, O'Neill, & DiRienzo, 2013); but little work has investigated the SES-mortality association in early life (i.e. ages 1–24) in the United States. And while early life mortality is relatively rare and generally declining, its occurrence is still unacceptably high (Howell, Decker, Hogan, Yemane, & Foster, 2010). Indeed, in the 2001–10 decade, the U.S. mortality rate for ages 1–19 was the highest of 20 developed countries, and was 55% higher than the average of the 19 comparison countries (Thakrar, Forrest, Maltenfort, & Forrest, 2018). Furthermore, the death of a child is particularly traumatic for parents and changes their life in multiple ways (Price, Jordan, Prior, & Parkes, 2011), and such deaths also have consequences for the community and social contexts in which they occur (Song, Floyd, Seltzer, Greenberg, & Hong, 2010).

Higher SES is associated with greater access to the flexible resources capable of decreasing mortality risk (Link & Phelan, 1995). Children and youth rely on their parents' store of flexible resources to avoid early mortality (McLanahan, 2004). Specifically, parent educational attainment and family income represent important indicators of the quality and quantity of flexible resources families can leverage to protect the safety and health of their children. Prior studies have found that each of these components of SES influences child well-being (Hauser, 1994). For example, independent of financial resources, mothers with higher educational attainment can better navigate institutions and optimize a child's environment (Augustine, Cavanagh, & Crosnoe, 2009).

Unfortunately, there is sparse evidence regarding socioeconomic disparities in early life mortality in the 21st century United States. The majority of studies examining socioeconomic disparities in U.S. early life mortality rely on aggregate measures of SES from the county-level (Currie & Schwandt, 2016; Singh, Azuine, Siahpush, & Kogan, 2012; Singh & Kogan, 2007). While valuable because they provide descriptions of the association between aggregate-level measures of SES and early life mortality, such studies cannot elucidate the links between family-level measures of SES and early life mortality. Identifying associations between family-level measures of SES and early life mortality across the United States thus provides an improved understanding of socioeconomic disparities in early life mortality and provides an important complement to studies using aggregate measures. Moreover, a better understanding of the association between family-level measures of SES and early life mortality risk provides potentially important information for policymakers in the effort to improve child well-being and survival in the United States.

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To our knowledge, no study has examined family-level socioeconomic disparities in early life U.S. mortality using a nationally representative sample for at least 20 years. The two most recent studies to do so used data from children and their parents from the June 1975 Current Population Survey (CPS) and data from an early version of the National Longitudinal Mortality Study, which pooled CPS data from 1979 to 1981 to examine family-level association between SES and early life mortality (Hussey, 1997; Mare, 1982). The first study (Mare, 1982) relied on mother's retrospective reports of child mortality before age 20 while the second study (Hussey, 1997) linked the CPS to the National Death Index between 1979–1989. Both studies documented large socioeconomic disparities in early life mortality, especially from death due to unintentional injuries (Hussey, 1997; Mare, 1982). Since that time, there are completely new cohorts of children and youth, as well as substantially reduced overall early life mortality (Xu, Murphy, Kochanek, Bastian, & Arias, 2018). Thus, a new assessment of parental SES and early life mortality risk is sorely needed. We seek to advance our understanding of the relationships between family SES and early life U.S. mortality by investigating the links between mother's educational attainment, father's educational attainment, and the family's income-to-needs ratio with the risk of death among children and youth in the 21st century U.S.

Methods

We use pooled data from the 1998–2014 National Health Interview Survey (NHIS), merged with the restricted-use 1998–2015 Linked Mortality Files (LMFs). The NHIS is a nationally representative, household-based repeated cross-sectional study of the United States (National Center for Health Statistics [NCHS] & Office of Analysis and Epidemiology, 2018). We limit analyses to individuals aged 1–17 at the time of interview who were eligible for vital status follow-up. Eligibility for vital status follow-up is based on the identifying information provided by NHIS participants or their parents when respondents are under the age of 18. The LMFs do not include information on the mortality status of individuals with insufficient identifying data. Thus, as recommended by NCHS and in accordance with the weights provided by NCHS, such cases are excluded from the analytic sample (NCHS 2018). Survey responses for children and youth were provided by a parent or responsible adult. Information on the timing and cause of death come from the LMF, compiled by the NCHS from vital records. The LMF passively assessed the mortality status of the surveyed individuals until their 25th birthday, the end of the year 2015, or their death, whichever occurs first. The resulting dataset consists of 377,252 children and youth aged 1–17 at the time of the survey, of whom 2,009 died before reaching their 25th birthday or the end of the follow-up period. Study approval was granted by the Institutional Review Board at the University of Colorado Boulderand informed consent was obtained by NCHS.

The dimensions of SES used are mother's educational attainment, father's educational attainment, and the household's income-to-needs ratio. Mother's and father's educational attainment are each separated into five categories, four representing the highest level of education the respective parent completed and the fifth indicating the absence of that parent in the household. These categories are: completed a four-year college degree or more (the reference group in all analyses), completed some college, graduated from high school or earned a GED, completed less than a high school degree, and non-resident mother/father.

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The final measure of family SES is a household income-to-needs ratio, which reflects the ratio of household income in which the child lives relative to the U.S. Census-defined poverty threshold for that year and household size. We use four categories that compare households in which the total household income exceeds the needs of all household members by 400% or more (the reference category in all analyses) to households with income-to-needs ratios between 200% and 399%, 100% and 199%, and less than 100% of the poverty threshold.

Although the SES measures are correlated, we found no evidence of problems due to collinearity. The correlation coefficient was .67 for mother's and father's education, .55 for mother's education and household income, and .54 for father's education and household income. Furthermore, in large samples, increases in the variance of parameter estimates due to potential multicollinearity is offset by increases in the sample size (Wooldridge, 2008, pp. 96–100). Thus, given the large sample size and moderate correlations we include all three measures of SES to best assess the extent to which different dimensions of SES are associated with early life mortality risk.

We examine all-cause and cause-specific mortality, with cause-specific mortality categorized as unintentional injuries, homicide, suicide, and other causes of death. All-cause mortality is based on any reported death in the NHIS-LMF, including the 19 cases in which the cause of death was unknown. Classification of cause-specific mortality is based on the World Health Organization's 10th revision of the *International Statistical Classification of Diseases, Injuries, and Causes of Death (ICD-10)* (World Health Organization, 2011). Unintentional injury deaths include those from vehicular crashes, falls, drownings, and unintentional poisonings. Homicides and suicides represent deaths resulting from assault and intentional self-harm, respectively. We classify all remaining deaths, including the 19 cases missing ICD-10 codes, as other causes. External causes— primarily comprised of unintentional injuries, homicide, and suicide — encompass the majority of early life deaths; other cause categories are too small to examine separately.

We use Cox proportional hazards models to estimate the associations between mother's education, father's education, and family income (measured as the income-to-needs ratio) and early life mortality risk over the follow-up period. We conduct analyses for all-cause mortality and four categories of cause-specific mortality using Stata version 15 (StataCorp, 2017). In Table 2 below, which examines all-cause mortality, Models 1–3 estimate the respective associations between each individual measure of parental SES and early life mortality risk in an iterative process to show the association between each measure of SES and all-cause mortality risk while controlling for a common set of measured confounders. The fourth model for all-cause mortality includes all three measures of parental SES simultaneously, along with the same measured confounders from Models 1–3. This model assesses the associations between our three measures of parental SES and mortality risk, while controlling for one another and the other measured confounders. Due to the cross-sectional nature of NHIS data and the potential for unobserved confounders this model is associational and reported estimates should not be interpreted as causal effects between the different dimensions of SES and mortality risk. Nonetheless, Model 4 provides the most up-to-date and comprehensive extant estimate of the associations between key dimensions of

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parental SES and child/youth mortality risk in the United States. Table 3 subsequently focuses on cause-specific mortality and provides hazard ratio estimates for the analogous version of Model 4 for each cause. We do not find evidence of a violation of the proportional hazards assumption in any of our models.

The Cox proportional hazards models use age as the time scale, which accounts for age implicitly, and, compared to models that include age as a covariate, produces less bias in model estimates (Thiébaut & Bénichou, 2004). All analyses adjust for complex sampling design using weights provided by NCHS, including clustering and strata. We control for race/ethnicity, nativity, and sex of children/youth in the sample, and include census region and year fixed effects (accounting for differences in early life mortality by year and region of the country). We caution against the interpretation of the confounder variables, since they are not the focus of these analyses (Westreich & Greenland, 2013); nonetheless, for transparency, we provide the hazard ratios for the confounders in the all-cause and cause-specific mortality models. To account for missing data (0.8% for race/ethnicity, 0.1% for nativity, 2.6% for mother's education, 4.3% for father's education, and 16.3% for household income-to-needs ratio), we perform multiple imputation based on a multivariate Monte Carlo Markov Chain approach with five imputations. The reported 95% confidence intervals were calculated based on Rubin's (1987) rules as implemented in Stata's mi estimate command.

In results not shown here, we conducted robustness and sensitivity checks. We re-estimated both the all-cause and cause-specific mortality analyses to examine: (1) different specifications of parental/household educational attainment, (2) sex differences in the associations between parental SES and early life mortality, (3) health insurance coverage as a covariate, and (4) potential multiplicative disadvantages for children/youth when neither parent finished high school. The two additional operationalizations of education we examined were highest parental educational attainment and highest household educational attainment in place of mother's and father's educational attainment. In both cases, the substantive results are unchanged. Consequently, we chose to report analyses that provide greater detail in family SES to best understand potential actionable targets of policy intervention. The robustness checks did not show statistically significant sex differences in the associations between parental SES and early life mortality. Health insurance coverage was not significantly associated with mortality risk in any model; because the meaning and context of child health insurance differs across the study period, we do not present results from models including this variable. Lastly, there was no statistical evidence in support of a multiplicative disadvantage for children/youth whose mother and father did not complete high school.

Results[1]

Descriptive data in Table 1 show that U.S. children live in diverse socioeconomic conditions. Fifteen percent of children/youth lived with a mother who did not complete high school,

[1]We report p-values for estimated coefficients in the body of the text, however due to the problematic history of interpreting p-values and by extension statistical significance (Wasserstein, Schirm, & Lazar, 2019), for full transparency we report the corresponding 95% confidence intervals for all parameter estimates in the respective tables.

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whereas 12% of children/youth lived with a father who did not complete high school. About one-quarter of children/youth lived in households in which their father was not present, whereas only 6% lived in households in which their mother was not a resident. Nearly 20% of children/youth in the sample were living below the U.S. poverty line at the time of survey, with another 23% living in households that have an income-to-needs ratio between 100% and 199% of the poverty line.

All-Cause Early Life Mortality

Table 2 shows that each of the three measures of family SES are significantly and substantively associated with all the household income-cause early life mortality. When mother's education, father's education, and to-needs ratio are separately included in the model, each is associated with the risk of early life mortality net of age, sex, race/ethnicity, nativity, and regional and year fixed effects (see Models 1–3 in Table 2). All three indicators of family SES retain a significant, albeit attenuated, association with the risk of all-cause early life mortality when jointly included in analyses (see Model 4 in Table 2).

More specifically, Model 4 shows that children and youth whose mothers completed, at most, some college are 28% more likely to die in early life compared to their peers whose mother completed college or more education (HR=1.28 $p<0.01$), net of the other family SES measures and the other covariates in the model. Comparatively, children whose mothers, at most, completed high school, did not graduate from high school, or who were absent from the home are 37%, 40%, and 48% more likely to die before age 25 over the follow-up period than their peers whose mothers completed college (the respective hazard ratios are: HR=1.37 $p<0.001$; HR=1.40 $p<0.01$; HR=1.48 $p<0.01$).

With the exception of high school graduates, the patterning of the association between father's education and early life mortality is similar to that of mother's education. Compared to children whose fathers graduated from college, children whose fathers at most completed some college, did not graduate from high school, or were absent from the home are respectively 23%, 41%, and 40% more likely to die during the follow-up period, net of all other covariates (the respective hazard ratios are: HR=1.23 $p<0.05$; HR=1.41 $p<0.01$; HR=1.40 $p<0.01$). Breaking from this pattern, children and youth whose fathers graduated from high school do not experience a statistically significant increase in early life mortality risk compared to children/youth whose fathers completed college or more education (HR=1.08 $p=0.502$).

Similar to the parental educational attainment associations with all-cause mortality, lower levels of household income are also associated with increased risk of mortality during the follow-up period, after controlling for parental educational attainment and all other covariates. Compared to their peers whose household income is greater than 400% of needs, children/youth who live in households in which the total household income is between 100% to 199% and less than 100% of household needs experience an increased risk of early life mortality of 37% and 38% respectively (the corresponding hazard ratios are: HR=1.37 $p<0.001$ and HR=1.38 $p<0.001$). However, children and youth who live in households in which income is between 200% and 399% of household needs do not show a statistically

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significant difference in their relative risk of early life mortality compared to children/youth in households with an income-to-needs ratio of 400% or more (HR=1.15 p=0.104).

Cause-specific Early Life Mortality

The patterning of associations between family SES and risk of early life mortality vary across causes of death. Table 3 shows the full models for each of the four cause of death categories that consider all three measures of SES. Mother's education demonstrates strong associations with early life mortality due to unintentional injuries. Compared to children whose mothers have a college degree or more, those whose mothers have less than a college degree exhibit between 43% and 66%higher risk of death, and those who live in a household without their mother present exhibit a 93% higher risk of death due to unintentional injuries over the follow-up period. Children/youth living in families without a residential father, with a father who did not complete high school, or in a household with income between 100% and 199% of the poverty line also demonstrate an increased risk of death from unintentional injuries compared with their higher SES peers. For suicides and other causes of death, mother's and father's education do not display significant associations with mortality (see the respective columns in Table 3), although many of the confidence intervals are wide due to the relatively small numbers of deaths due to homicide and suicide. Notably, though, children/youth who lived in poverty at the time of survey have an increased risk of homicide (HR=1.91 $p<0.05$) and other causes (HR=1.49 $p<0.05$) of early life mortality.

Discussion

A small body of literature has uncovered sizable differences in U.S. early life mortality rates by aggregate measures of SES (Singh et al., 2012; Singh & Kogan, 2007). But very little work has examined SES disparities in early life mortality at the individual level using a rich array of family-level SES measures. The two investigations of early life mortality in the U.S. using individual-level measures of parental SES that we were able to identify, both published over 20 years ago, found wide SES disparities in deaths due to unintentional injuries (Hussey, 1997; Mare, 1982). Our study unfortunately finds that 21st century U.S. children and youth are also characterized by wide SES disparities in early life mortality. And while U.S. early life mortality has decreased since those studies from the 20th century, it is clear that mortality among children and youth is still too high and contributes to the U.S. life expectancy disadvantage compared to peer countries (National Research Council and Institute of Medicine, 2013). Thus, understanding contemporary socioeconomic disparities in early life mortality provides important insight into the high mortality experienced by U.S. children and youth more generally and to a more comprehensive understanding of the association between SES and mortality across the full life course in the United States.

Our results clearly show that compared with their higher SES peers, children living with lower-educated parents, in low income households, and/or in households with absent mothers or fathers are more likely to die in early life. These disparities are even more striking when considering the high proportion of children living in lower SES households. For example, not only do a higher percentage of children live in poverty than any other age group (DeNavas-Walt, Proctor, Smith, U.S. Census Bureau, & Current Population Reports,

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P60–239, 2011), our descriptive data show that 42% of children/youth either lived in poverty or near poverty at the time they were included in the NHIS. Further, only around 25% of children in our data lived with a college-educated mother and 23% lived with a college-educated father, further suggesting thata substantial portion of U.S. children and youth face the higher levels of mortality risk associated with their parents' lower SES.

We find that mother's education, father's education, and household income each exhibit independent associations with all-cause early life mortality risk, net of age, sex, race/ethnicity, nativity, and region and year fixed effects. Unfortunately, the current study cannot identify the extent to which these associations are causal nor do the data allow us to identify potential mechanisms behind these patterns. However, extensive research has documented the influence of family SES on children's health and well-being, identifying the ways that high SES families spend timeand money, and have greater access to information — to the benefit of their children (Kalil, Ryan, & Corey, 2012; McLanahan, 2004). Such mechanisms identified in prior studies may extend beyond child health and wellbeing to early life mortality risk. Indeed, the largest proportion of early life deaths are unintentional injuries, for which we find very strong socioeconomic disparities. Children living in households less than 200% of the income-to-needs ratio and those with parents with a high school degree or less exhibit the highest risk of death compared with their higher-SES peers. Although our results do not reflect causal estimates, they suggest the possibility that more generous income support policies and policies to enhance educational attainment in the United States could enhance the survival of American children and youth. Moreover, our results show that children and youth living in households where a parent is not present exhibit higher risk of mortality in comparison with children who live with highly educated parents. As such, it may also be important for public policies to help enhance the stability of parental partnerships, and/or provide additional resources to single parent families, for the health, safety, and survival of children.

Notably, our results also suggest that financial resources alone do not adequately capture the relationship between family SES and all-cause early life mortality. Alternatively, we find independent associations between each of the SES measures and early life mortality net of each other and the other covariates included in the analysis. Thus, while the possibility of increasing family financial resources (e.g., poverty reduction programs) has the potential to reduce early life mortality risk, monetary policies and programs alone are unlikely not eliminate all socioeconomic-related disparities in early life mortality. Increasing parental educational levels may also be important. For example, prior research indicates that mother's education has unique benefits for child well-being (Augustine, Cavanagh, & Crosnoe, 2009) because greater education provides mothers with institutional knowledge and/or social networks that can be leveraged for safer child environments. Our results similarly show that father's educational attainment is associated with lower early life mortality risk. And while previous research indicates that father absence is associated with worse child health (Edelblute & Altman, 2018), our results indicate that the absence of either the mother or father from the household is associated with higher early life mortality risk for children and youth, net of family income. Thus, our results suggest that a range of policy options aimed at household income, parental education, and providing support of

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single parent families may be beneficial for helping to reduce early life mortality in the United States.

What might explain the increased mortality risk among youth in lower SES families? Prior research has indicated that SES is associated with a range of factors, including the characteristics of the neighborhood, school, and community of the child, the kind and type of housing, family structure, parenting behaviors, and the parent-child relationship (Mollborn, 2016). While these factors have been shown to influence child well-being, we know little about which of these factors are most important for early life mortality specifically. Additional research is needed to further explore the mechanisms underlying differences documented in this study.

Our analysis uncovered one somewhat anomalous finding: that the mortality risk of children and youth whose fathers, at most, completed high school is not statistically different from the risk experienced by peers whose fathers completed college or more education. Such a finding does not comport with the most prominent theoretical framework connecting educational attainment and health (Link and Phelan 1995). One possible reason behind this finding is that unmeasured heterogeneity among fathers who did not pursue education beyond high school is tied to qualitative differences in their interactions with their children and/or inputs into the home environment. For example, it is possible that some fathers who did not pursue education beyond high school work in high skill professions that provide a similar amount of autonomy, work hours, and/or benefits as their more highly-educated peers, resulting in a similar quality and/or quantity of flexible resources available to their children. However, testing such a possibility is beyond the scope of the current study and the NHIS data. We recommend that future research investigate potential mechanisms behind this departure from a strictly graded pattern in the association between father's education and early life mortality.

Despite this study's focus on the relationship between parental SES and early life mortality, we found extreme racial/ethnic disparities in early life homicide mortality even after accounting for SES. Compared to their non-Hispanic White peers, Mexican American and non-Hispanic Black youth are 517% and 557% more likely to be murdered over the follow-up period (HR 6.17, $p < 0.001$; HR 6.57, $p < 0.001$ respectively). These findings are consistent with recent research (Rogers, Lawrence, Hummer, & Tilstra, 2017). Continued patterns of high levels of residential segregation by race/ethnicity and other structural disadvantages faced by Mexican American and African American youth, which cannot be accounted for in our data, are strongly related to such disparities in homicide (Light & Ulmer, 2016).

Our study has several limitations. Most notably, measures of family SES are captured at one point in time for each child/youth, with mortality follow-up extending up to 17 years. While an important limitation to keep in mind, to the best of our knowledge there are no available U.S. data sets large enough to consider both longitudinal measures of family SES and early life mortality risk. A second limitation is that our data do not distinguish between types of nonresident parents. Parents may not be living with their child for a variety of reasons (including divorce/separation, incarceration, and death) and nonresident parents likely differ

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in both their parenting and resourcecontributions, e.g. spending more or less time with and providing greater or fewer financial resources for the child. Despite this, we find that nonresident mothers and fathers captures a meaningful distinction in mortality risk of children/youth. Thus, while the inability to account for the characteristics and inputs of non-resident parents is a potential weakness of this study, it is beyond the capabilities of the data and we leave it to future research to explore these issues further.

The socioeconomic disparities in early life mortality documented here demonstrate the pernicious consequences of social inequality experienced by U.S. children and youth today. Policies and programs intending to reduce disparities in early life mortality should target upstream factors shaping multiple dimensions of risk. Specifically, improving mother's and father's education may have multiple benefits, including increases in total household income as well as their respective accompanying decreases in the risk of early life mortality independent of household income. Moreover, given the strong associations between parental income and mortality among children and youth in this study, poverty reduction programs could potentially have spillover effects that help reduce early life mortality. As the U.S. continues to lag behind its peers in the health and mortality of Americans (National Research Council and Institute of Medicine, 2013), more attention and resources should be devoted to improving children's health and well-being, including the social, economic, and structural contexts of the families and households in which our children live.

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Significance

What is already known on this subject?

A small body of literature has uncovered sizable differences in early life (ages 1–24) mortality rates by aggregate measures of socioeconomic status, such as county-level measures of income. However, there has not been a study of the association between parental socioeconomic measures and early life mortality in the U.S. in over twenty years.

What this study adds?

U.S. early life mortality disparities are wide across categories of mother's education, father's education, and household income, thus demonstrating that the life chances of children and youth in contemporary America are strongly associated with the socioeconomic resources of their parents.

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Table 1 –

Early Life (Ages 1–17) Characteristics, United States, 1998–2014

Characteristics	Weighted %	95% CI
Mother's education		
College Degree or more	24.98	(24.50, 25.47)
Some college	29.85	(29.53, 30.17)
High school	24.10	(23.80, 24.40)
Less than high school	15.07	(14.71, 15.44)
No resident mother	6.00	(5.86, 6.14)
Father's education		
College Degree or more	23.38	(22.87, 23.90)
Some college	19.84	(19.56, 20.12)
High school	20.09	(19.78, 20.41)
Less than high school	11.67	(11.35, 12.00)
No resident father	25.01	(24.63, 25.40)
Income-to-needs ratio[a]		
≥400%	26.70	(26.18, 27.21)
200–<400%	31.36	(30.98, 31.75)
100–<200%	22.69	(22.33, 23.04)
<100%	19.26	(18.83, 19.69)
Sex		
Female	48.89	(48.69, 49.08)
Male	51.11	(50.92, 51.31)
Race/ethnicity		
Non-Hispanic White	59.90	(59.25, 60.54)
Non-Hispanic Black	15.13	(14.67, 15.60)
Mexican American	13.69	(13.21, 14.19)
Other Hispanic	6.46	(6.25, 6.68)
Other race/ethnicity	4.81	(4.58, 5.06)
Nativity[b]		
Born in the U.S.	95.28	(95.14, 95.41)
Born outside the U.S.	4.72	(4.59, 4.86)
Region		
Northeast	17.14	(16.67, 17.62)
Midwest	23.79	(23.20, 24.40)
South	36.68	(36.00, 37.36)
West	22.39	(21.77, 23.03)
Age at interview		
1 to 5	29.26	(29.05, 29.48)
6 to 14	52.87	(52.67, 53.07)
15 to 17	17.87	(17.71, 18.03)
Unweighted sample size	377,252	

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Characteristics	Weighted %	95% CI
Number of deaths (all causes)	2,009	

[a] Income-to-needs ratio represents the ratio of family income to the U.S. Census-defined poverty threshold for the year in which the interview was conducted.

[b] Individuals born in U.S. territories are included inBorn outside the U.S.

Source: NHIS-LMF 1998–2015

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Table 2 --

Hazard Ratios for All Cause Early Life Mortality (Ages 1–24), United States, 1998–2015

	Model 1	Model 2	Model 3	Model 4
Mother's education				
College Degree or more	1 (Ref)			1 (Ref)
Some college	1.50 (1.27, 1.77)			1.28 (1.06, 1.54)
High school	1.66 (1.41, 1.96)			1.37 (1.13, 1.66)
Less than high school	1.92 (1.61, 2.29)			1.40 (1.14, 1.72)
No resident mother	1.88 (1.50, 2.36)			1.48 (1.16, 1.91)
Father's education				
College Degree or more		1 (Ref)		1 (Ref)
Some college		1.45 (1.21, 1.74)		1.23 (1.00, 1.50)
High school		1.38 (1.15, 1.66)		1.08 (0.87, 1.33)
Less than high school		1.94 (1.62, 2.33)		1.41 (1.13, 1.75)
No resident father		1.90 (1.60, 2.27)		1.40 (1.12, 1.74)
Income-to-needs ratio				
≥400%			1 (Ref)	1 (Ref)
200–<400%			1.31 (1.11, 1.55)	1.15 (0.97, 1.37)
100–<200%			1.70 (1.46, 1.97)	1.37 (1.15, 1.62)
<100%			1.81 (1.54, 2.14)	1.38 (1.13, 1.68)
Sex				
Female	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Male	2.33 (2.12, 2.57)	2.34 (2.13, 2.58)	2.34 (2.12, 2.58)	2.34 (2.12, 2.58)
Race/ethnicity				
Non-Hispanic White	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Non-Hispanic Black	1.44 (1.26, 1.64)	1.32 (1.15, 1.51)	1.34 (1.17, 1.53)	1.24 (1.08, 1.42)
Mexican American	2.05 (1.80, 2.33)	1.99 (1.75, 2.27)	2.02 (1.78, 2.29)	1.82 (1.59, 2.08)
Other Hispanic	1.21 (1.01, 1.44)	1.17 (0.98,1.39)	1.17 (0.98, 1.39)	1.09 (0.91, 1.30)
Other race/ethnicity	1.86 (1.50, 2.30)	1.86 (1.50, 2.30)	1.76 (1.42, 2.18)	1.80 (1.45, 2.23)
Nativity				
Born in the U.S.	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Born outside the U.S.	1.01 (0.86, 1.17)	1.02 (0.88, 1.19)	0.97 (0.83, 1.13)	0.98 (0.84, 1.15)
Region				
Northeast	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Midwest	1.15 (0.97, 1.37)	1.16 (0.98, 1.38)	1.14 (0.96, 1.36)	1.14 (0.96, 1.36)
South	1.37 (1.18, 1.60)	1.38 (1.18, 1.60)	1.36 (1.17, 1.58)	1.35 (1.16, 1.58)
West	1.27 (1.08, 1.49)	1.27 (1.08, 1.50)	1.27 (1.08, 1.50)	1.26 (1.07, 1.48)

Note: All models include year fixed effects an d adjust for com plex sam pling design. The 95% confidence in tervals are in parentheses. N=377,252. Number of deaths=2,009.

Source: NHIS-LMF 1998–2015

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Table 3 --

Hazard Ratios for Early Life Cause-Specific Mortality (Ages 1–24), United States, 1998–2015

	Unintentional	Homicides	Suicides	Other
Mother's education				
College Degree or more	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Some college	1.48 (1.11, 1.97)	1.45 (0.78, 2.71)	0.93 (0.58, 1.50)	1.17 (0.86, 1.59)
High school	1.66 (1.23, 2.25)	1.50 (0.82, 2.76)	1.24 (0.75, 2.04)	1.11 (0.80, 1.55)
Less than high school	1.43 (1.03, 1.99)	1.95 (1.03, 3.67)	1.20 (0.67, 2.12)	1.21 (0.84, 1.74)
No resident mother	1.93 (1.35, 2.76)	1.62 (0.78, 3.36)	1.38 (0.74, 2.58)	1.05 (0.67, 1.63)
Father's education				
College Degree or more	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Some college	1.30 (0.96, 1.75)	1.12 (0.60, 2.11)	1.33 (0.81, 2.19)	1.16 (0.83, 1.63)
High school	1.29 (0.94, 1.76)	0.94 (0.49, 1.79)	0.84 (0.47, 1.49)	1.01 (0.70, 1.45)
Less than high school	1.71 (1.22, 2.40)	1.16 (0.62, 2.17)	1.20 (0.66, 2.18)	1.32 (0.90, 1.94)
No resident father	1.62 (1.18, 2.22)	1.47 (0.79, 2.73)	1.17 (0.69, 1.99)	1.20 (0.83, 1.71)
Income-to-needs ratio				
≥400%	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
200–<400%	1.21 (0.95, 1.55)	1.28 (0.79, 2.08)	1.01 (0.65, 1.56)	1.11 (0.81, 1.53)
100–<200%	1.39 (1.05, 1.82)	1.57 (0.97, 2.53)	1.05 (0.62, 1.80)	1.44 (1.04, 1.98)
<100%	1.32 (0.96, 1.80)	1.91 (1.12, 3.24)	0.81 (0.47, 1.42)	1.49 (1.06, 2.10)
Sex				
Female	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Male	2.26 (1.95, 2.63)	4.81 (3.62, 6.39)	3.60 (2.61, 4.97)	1.57 (1.34, 1.85)
Race/ethnicity				
Non-Hispanic White	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Non-Hispanic Black	0.57 (0.45,0.73)	6.57 (4.43,9.76)	0.82 (0.51,1.30)	1.60 (1.25,2.03)
Mexican American	1.43 (1.17, 1.75)	6.17 (4.06, 9.35)	1.89 (1.27, 2.80)	1.65 (1.29, 2.12)
Other Hispanic	0.75 (0.56, 1.00)	2.66 (1.57, 4.50)	1.36 (0.82, 2.25)	1.32 (0.97, 1.80)
Other race/ethnicity	1.14 (0.78, 1.65)	2.32 (1.07, 5.03)	2.66 (1.55, 4.55)	2.56 (1.83, 3.58)
Nativity				
Born in the U.S.	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Born outside the U.S.	1.16 (0.92, 1.47)	0.92 (0.64, 1.31)	0.66 (0.39, 1.10)	0.93 (0.69, 1.24)
Region				
Northeast	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Midwest	1.14 (0.87, 1.51)	1.01 (0.65, 1.55)	1.32 (0.78, 2.21)	1.16 (0.87, 1.56)
South	1.66 (1.30, 2.12)	0.98 (0.67, 1.43)	1.65 (1.04, 2.62)	1.14 (0.88, 1.49)
West	1.28 (0.98, 1.67)	1.22 (0.81, 1.83)	1.32 (0.80, 2.17)	1.24 (0.94, 1.65)
Number of deaths	825	338	224	622

Note: All models include year fixed effects and adjust for complex sampling design. The 95% confidence intervals are in parentheses. N=377,252.

Source: NHIS-LMF 1998–2015