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Mortality in parents after the death of a child

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ABSTRACT

Objective: The death of a child is a traumatic stressor that takes a toll on the health of parents. This study examined long-term impacts of the death of a child on the risk of early mortality in bereaved parents. In a follow-up analysis, a twin subsample was analyzed to examine potential genetic confounding.

Method: We analyzed data from the Midlife in the United States (MIDUS) study. The primary sample consists of two groups of MIDUS 2 participants (2004–06); (1) parents who experienced the death of a child prior to MIDUS 2 (n = 451) and (2) comparison parents who had not experienced death of any children (n = 1804) (mean age = 63). We also analyzed 52 twin pairs in which one twin experienced the death of a child and 271 twin pairs in which both twins had all living children. Mortality status of parents was assessed in 2017.

Results: Parents who had experienced the death of a child had a 32% higher likelihood of early mortality (defined as dying earlier than life expectancy) than their peers who did not have any deceased children, and they were more likely to die of heart disease. Analyses of the twin subsample revealed significantly lower concordance for early mortality among the pairs with a bereaved twin than among control twins, consistent with non-genetic effects.

Conclusions: The findings suggest that the death of a child has lasting impacts on the risk of early mortality in bereaved parents. This study provides the first U.S. estimate of bereavement effects on mortality extending through the parents' full life course, with significant public health implications. In addition, analysis of concordance of early death rates in the twin subsample suggests the impact on mortality of parental bereavement, net of genetic factors.

1. Introduction

1.1. Mortality in bereaved parents

The death of a child is one of the most traumatic life events, taking a considerable toll on the mental and physical health of parents (e.g., Stroebe et al., 2007). National data from Sweden showed that a vast majority of older bereaved parents (85%) retrospectively reported the death of a child as the most important negative life stressor they ever experienced (Bratt et al., 2018). Other international studies have consistently found greater mortality in bereaved parents relative to non-bereaved parents (Cohen-Mansfield et al., 2013; Harper et al., 2011; Li et al., 2003; Rostila et al., 2012; Schorr et al., 2016), regardless of socioeconomic status, age, and race (Cohen-Mansfield et al., 2013; Schorr et al., 2016).

The potential consequences of child death for parents in the United States deserves particular attention. According to a recent analysis, child mortality is higher in the United States than in the 19 other developed countries in the Organization for Economic Cooperation and Development (OECD) (Thakrar et al., 2018). Specifically, between 2001 and 2010, the risk of infant mortality was 76% greater in the U.S. than in the other OECD countries, and the risk of death between the ages one and 19 was 57% greater. Between 1961 and 2010, declines in child mortality rates worldwide have been slower in the United States than other wealthy nations, which the authors attribute to lagging policy and support programs for peri- and neo-natal heath care, a relatively weak social safety net, and other policies that put children at risk. For example, the risk of gun homicides for children ages 15–19 was 82 times greater in the U.S. than in other OCED countries.

In addition, the final 2015 mortality data from the Centers for Disease Control and Prevention revealed that life expectancy in the U.S. had dropped for the first time in 22 years (Xu et al., 2016). A separate analysis of these data revealed that the decrease is accounted for by deaths among middle-aged white non-Hispanic men and women due to

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substance abuse and suicide (Case and Deaton, 2015), which are highly traumatic circumstances for surviving parents (Feigelman et al., 2012). Thus, in the U.S. increasing numbers of parents are experiencing the death of a child and these parents must cope with this trauma without the policies and support programs that exist in many other countries.

In contrast to the international interest in whether parents who have experienced the death of a child have higher mortality rates, to-date only one U.S. population-based study has been conducted on this question. Espinosa and Evans (2013) conducted a nine-year follow up of 69,224 mothers aged 20 to 50 from the National Longitudinal Mortality Survey to examine whether there was a heightened mortality for mothers after the death of a child. They found that bereaved mothers had a 2.3 times increased risk of dying, with the risk being greatest during the first two years following the death. Although this research provides further support for heightened maternal mortality associated with child death, it has important limitations. For example, it only followed bereaved mothers for nine years after the loss of the child. Therefore, it is unknown whether the mortality continues to remain high or even begins to climb decades after the loss of a child because of cumulative stress associated with parental bereavement (Rogers et al., 2008; Song et al., 2010) and changes in stress and resources associated with aging (Floyd et al., 2013). Second, the sample was restricted to mothers who had a child die when the mothers were in young adulthood or early middle age. Thus, it is unknown whether early mortality would also be experienced by bereaved mothers whose child died after the mother reached later midlife and old age. Third, the Espinosa and Evans sample did not analyze mortality among fathers.

In the present study, we analyzed mortality data from the Midlife in the United States study (MIDUS; Radler and Ryff, 2010). The MIDUS study allows us to overcome the limitations of the Espinosa and Evans research because (1) MIDUS collected data on both mothers and fathers who experienced the loss of a child; (2) the sample captures parents over nearly the entire adult life course (ages 35 to 84) rather than being restricted to parents in young adulthood and early mid-life, and (3) MIDUS includes a twin sample that allows us to explore unmeasured genetic risk factors associated with mortality.

1.2. Gender differences in mortality of bereaved parents

In studying the effects of parental bereavement on mortality, past research has produced mixed results on whether the loss of a child differentially impacts the mortality of mothers versus fathers. Whereas Schorr et al. (2016) found that both mothers and fathers experience a significantly heightened risk of mortality, others found significantly higher mortality for bereaved mothers relative to bereaved fathers (Cohen-Mansfield et al., 2013; Li et al., 2003; Rostila et al., 2012). In addition, older women who experienced both the deaths of a spouse and of a child rated their child's death as relatively more traumatic, whereas older men saw the death of a child as less traumatic relative to the death of their spouse (Bratt et al., 2018). According to symbolic interactionism's role salience hypothesis (Thoits, 2012), the loss of a central role results in greater distress and physical health problems than the loss of a less salient role because the former impinges more strongly on an individual's role identity. Given the greater role salience of parenting for mothers than for fathers in general (e.g., Stueve and Pleck, 2001), we hypothesize that there will be a more pronounced impact of child death on the mortality of mothers than of fathers.

1.3. Cause of death in bereaved parents

Researchers have also examined the cause of death in parents. Schorr et al. (2016) found that in the decades after the death of a child, coronary heart disease was a major cause of death for bereaved mothers and circulatory disease was a major cause of death for both bereaved mothers and bereaved fathers. The current study uses data from the National Death Index (NDI plus) to explore cause of death among bereaved parents, and extends past research by including a longer follow-up period, when different causes of death may emerge.

1.4. Genetic vulnerability in bereaved parents

A potential confound is that the deaths in both generations could be caused by inherited vulnerabilities shared within families. One research strategy to examine shared familial vulnerabilities is to evaluate twins who have had different life experiences. That is, if parental mortality is primarily caused by familial genetic vulnerability, then non-bereaved co-twins of bereaved parents should show similar rates of early mortality as their twin who experienced child death. If early mortality also results from the experience of parental bereavement, then rates of early mortality should be greater in bereaved parents than in their non-bereaved co-twins. Thus, we examined subgroups of twins in our nationally representative data to explore whether mortality rates differed within twin pairs, one of whom experienced a child's death and one who did not.

In sum, using mortality information for participants in a nationally representative study in the U.S., we examine whether bereaved parents, even those who have survived for decades after the death of a child, have an increased vulnerability to early mortality than their age peers who do not have any deceased children. We analyze multi-step models to evaluate potential gender differences. In addition, we examine the potential effects of unobserved genetic characteristics on the mortality of bereaved parents by analyzing twin subsamples of MIDUS.

2. Method

2.1. Data and sample

We analyzed data from the MIDUS study, a longitudinal survey of a national probability sample of non-institutionalized, English-speaking adults who were age 25 to 74 during the initial survey in 1995–1996 (MIDUS 1, $n = 7108$) (Radler and Ryff, 2010). Respondents were surveyed again in 2004–2006 when they were aged 35 to 84 (MIDUS 2, $n = 4963$); the retention rate between MIDUS 1 and MIDUS 2 was 75% (adjusted for mortality) (Radler and Ryff, 2010). In addition, the sample was evaluated again in 2013–2014 (MIDUS 3) and mortality data were collected in 2017.

We began our analysis at MIDUS 2 because this phase was the first to include questions about child death. The analytic sample was drawn from two groups of MIDUS 2 respondents. The first group included parents who had experienced the death of a child prior to the MIDUS 2 survey ($n = 451$; 272 mothers and 179 fathers) and the comparison group included parents whose children were all alive at the time of MIDUS 2 ($n = 3757$; 1983 mothers and 1774 fathers). Parents whose child died after MIDUS 2 were excluded from the analytic sample.

Bereaved parents were significantly older than non-bereaved parents (62.1 vs. 55.0 years old on average for mothers and 64.2 vs. 55.3 years old on average for fathers). Because age, gender, and race are significant predictors of mortality, we created age-, gender- and race-matched comparison groups of non-bereaved parents at a 1:4 ratio based on the age, gender, and race distribution of bereaved parents (comparison groups $n = 1804$; 1088 mothers and 716 fathers). We used a 1:4 ratio rather than a 1:1 ratio for matching to maximize the power to detect group differences.

To examine potential familial genetic confounding of the impact of the death of a child on parental mortality, we analyzed a twin sample that is part of the MIDUS study. The twin sample at MIDUS 2 included 742 twin pairs (811 women and 673 men). We examined same-sex pairs only so that both twins would have the same life expectancy based on their age at MIDUS 2. We identified 323 pairs of twins −52 target twin pairs in which one twin experienced the death of a child and his/her co-twin had not experienced the death of any children (31 monozygotic [MZ] twin pairs and 21 dizygotic [DZ] twin pairs), and 271 comparison

twin pairs in which neither twin had experienced any child death (147 MZ pairs and 124 DZ pairs).

2.2. Measures

2.2.1. Death of a child

Parental bereavement status was measured in MIDUS 2 via a computer-assisted telephone interview (CATI) and a self-administered questionnaire. In the CATI, as part of the household roster module, a question asked whether the respondent had any children who were no longer living. In the questionnaire, a series of items asked whether the respondent had experienced certain life events, one of which was a child's death, at any time during their lives. Agreement of responses for items related to the experience of death of a child in the CATI and the questionnaire was 94.5% overall and comparable for mothers and fathers. We identified a respondent as experiencing child death if he or she answered the parental bereavement question affirmatively in either the CATI or the questionnaire. The matched comparison group was drawn from MIDUS 2 respondents who had at least one living child and did not answer either of the bereavement questions affirmatively.

2.2.2. Mortality of parents and early death

The mortality status of parents was identified by MIDUS mortality datasets containing the confirmed decedent status of all participants as of October 2017. This decedent information came from several sources, including a National Death Index (NDI) search conducted in 2016, survey fielding operations completed by the University of Wisconsin Survey Center, and ongoing longitudinal sample maintenance by the MIDUS Administrative Core. Early death of parents was defined as death before their expected lifespan at MIDUS 2; the life expectancy was determined by summing the respondent's age and the additional years of life expectancy given the person's age, gender, and race (White, Black, Other). Expected additional years of life was drawn from U.S. Life Table information for each survey year of MIDUS 2 (2004–2006). For example, in 2004, a 50-year-old white woman had a life expectancy of 82.6 years (50 [age in 2004] + 32.6 [expected additional years of life expectancy for a 50-year-old white female in 2004, according to the 2004 U.S. Life Table from the CDC]). If a person died at a younger age than their life expectancy, the death was considered an early death. If the death occurred after the individual's life expectancy, the death was considered an instance of mortality, but not an early death, and so was not counted as early death in these analyses.

2.2.3. Cause of parents' death

We use the definition of underlying cause of death by the World Health Organization that was defined as "(a) the disease or injury which initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence that produced the fatal injury" (World Health Organization, 1977). Causes of death of deceased parents were obtained via NDI plus search.

2.2.4. Covariates

Several variables that prior research has found to be associated with mortality were included in the analyses as control variables, including age (in years), gender, race (White vs. others), education (in years), household income (in dollars, log transformed), and marital status (currently married vs. unmarried [divorced, widowed, never married]). Prior studies have observed a greater risk of mortality among those who are older, who are part of a minority racial/ethnic group and who have less education and lower incomes than their counterparts (e.g., Stringhini et al., 2017). Because the death of a child has been linked to marital instability in some bereaved parents (e.g., Albuquerque et al., 2016), and this instability has adverse health impacts, the marital status of parents was also controlled in the analyses. Parents who were unmarried for different reasons (divorced, widowed, or never been married) did not differ in health outcomes, and thus were combined into one category. As a control for parents' baseline health before they had children, parents' physical health at age 16, which was retrospectively assessed at MIDUS 1, was also included in all analyses. Specifically, respondents were asked: "Now, think about when you were 16 years old. Was your physical health at that time … poor (1), fair (2), good (3), very good (4), or excellent (5)?" The circumstance of the death of a child (e.g., cause of death, timing) has been linked to outcomes of bereaved parents (e.g., Floyd et al., 2013). Due to limited information in MIDUS (i.e., cause of child death is not available, and about 33% of bereaved parents were missing information on the timing of death of a child), circumstances of child death is not analyzed in the current study.

2.3. Analysis plan

Bereaved and non-bereaved parents were compared with respect to their risk of early death over a period of 14 years (i.e., between 2004 and 2006 [MIDUS 2] and 2017 [the most recent time mortality data were updated]) using Cox proportional hazard models, with controls for age, gender, race, education, household income, marital status, and health at age 16. To examine possible gender differences in the association between parental bereavement and mortality (e.g., Li et al., 2003; Rostila et al., 2012), we tested the Gender × Death of a child interaction in Cox models. The proportion of respondents with missing data ranged from 0% to 22% for the analytic variables (ranging from no missing data on age to a maximum of 22% for income). The multiple imputation procedure in Stata was used for estimating values for missing data. The analytic results with missing values and those with imputed values did not differ substantially, thus, the latter are presented here (Manly and Wells, 2015).

In a follow-up analysis using the twin sample in MIDUS, bereaved parents and their non-bereaved co-twins, as well as the comparison group of two non-bereaved co-twins, were compared with respect to concordance in their risk of early death. If the two parents in a twin pair had the same occurrence of early death (i.e., both had early deaths or both did not have early death), the early death status of the specific twin pair was defined as concordant. If only one parent in a twin pair had early death and his/her co-twin did not have early death, then the early death status of the twin pair was defined as discordant.

3. Results

3.1. Early death in bereaved parents

Table 1 presents descriptive statistics for parents who had experienced the death of a child and the age-, gender-, and race-matched comparison parents who had not experienced the death of a child.

Table 1
Descriptive Statistics: Bereaved Parents vs. Non-bereaved Parents at MIDUS 2 (2004–2006).

Variable	Bereaved Parents (n = 451)	Non-Bereaved Parents (n = 1804)	
	M (SD), %	*M (SD), %*	
Age (years)	62.9 (11.4)	62.1 (11.5)	*ns*
Gender (% Mother)	60.3	60.3	*ns*
Race *(%* White)	86.0	87.0	*ns*
Education (years)	13.4 (2.8)	14.1 (2.6)	***
Household income ($1000)	53.9 (51.3)	62.4 (56.6)	**
Marital status *(%* Married)	66.7	72.8	**
Health at age 16 (1–5)	4.4 (0.9)	4.5 (0.8)	*
Early Death *(%* by 2017)	24.2	17.3	***

Note. Early death = parental death earlier than life expectancy.
***$p \leq .001$; **$p \leq .01$; *$p \leq .05$. ns = non-significant.

Table 2
Cox proportional hazard models predicting early death of bereaved parents vs. matched non-bereaved comparison parents.

Variable	*HR* (95% *CI*)
Age (years)	1.10 (1.08–1.11)***
Gender (1 = Mother)	0.68 (0.56–0.84)***
Race (1 = White)	0.88 (0.65–1.20)
Education (years)	0.98 (0.93–1.00)
Household income (logged)	1.01 (0.95–1.07)
Marital status (1 = Married)	0.80 (0.64–0.99)*
Health at age 16 (1–5)	1.03 (0.92–1.15)
Death of a child (1 = Bereaved)	1.32 (1.06–1.65)*

Note. *HR* = Hazard Ratio, CI = Confidence Interval. Early death = parental death earlier than life expectancy.
***$p \leq .001$; **$p \leq .01$; *$p \leq .05$.

Bereaved parents had lower education levels and lower household income than their peers who had not experienced the death of a child. In addition, bereaved parents were less likely to be currently married and had poorer health at age 16 than non-bereaved parents.

Table 2 presents the results of Cox proportional hazard analysis predicting the risks of early death among bereaved and non-bereaved parents over time, adjusting for parents' sociodemographic characteristics (age, gender, race, education, income, and marital status) and baseline health before the child's birth (health at age 16). The results showed that older age, being a father, and being unmarried were significant predictors of early mortality. In addition, net of these sociodemographic factors, parents who experienced the death of a child had a 32% higher risk of early death over the study period than their peers who did not have any deceased children. We also tested the interaction of death of a child and parental gender and found it was not statistically significant, suggesting that the impact of child death on the risk of early parental death did not differ significantly between bereaved mothers and fathers (HR = 1.23, 95% CI = 0.80–1.92). Thus, the following analyses were based on the gender-combined sample. We also tested interactions of parents' sociodemographic characteristics (including race) by parental bereavement status and did not find any significant interaction effects (results not shown).

Fig. 1 illustrates the marginal survival probabilities for the separate groups of bereaved and non-bereaved parents. The figure indicates that the probabilities diverge for the groups with advancing age. Specifically, among parents age 39 or younger at MIDUS 2, the probability of surviving at least as long as their life expectancy during the study period (approximately 14 years) approached 100% for both the bereaved and the non-bereaved parents. On the high end of the age range, among parents age 79 at MIDUS 2, the probability of surviving at least as long as their life expectancy during the study period was approximately 40% for bereaved parents but over 50% for non-bereaved parents.

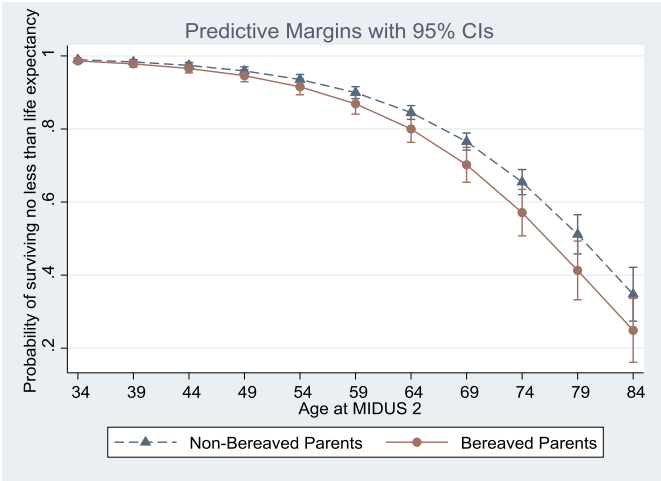

Fig. 1. Marginal probability of surviving no less than life expectancy: Bereaved vs. non-bereaved parents (models adjust for age, gender, race, education, household income, marital status, and health at age 16).

3.2. Bereavement and likelihood of early death in twin pairs

Table 3 presents the descriptive statistics for twin pairs in MIDUS 2. In the target twin pairs, both MZ and DZ twins who had experienced the death of a child and their co-twins who did not have any deceased children did not differ in education, household income, or marital status. Similarly, sociodemographic characteristics did not differ between twin parents if neither had experienced the death of a child.

Fig. 2 illustrates the concordance rates within twin pairs for the occurrence or nonoccurrence of early mortality. If early mortality is influenced by a life event, in this case the death of a child, then twin pairs for whom only one twin experienced a child death should show lower concordance for early mortality than twin pairs for whom neither experienced the death of a child. Consistent with this expectation, the occurrence and nonoccurrence of early mortality was significantly more concordant in comparison twin pairs (i.e., in which neither twin had experienced the death of a child) than in the target twin pairs (i.e., in which one of the twins had experienced the death of a child). Specifically, comparison twin pairs were highly concordant for early deaths (87.8% of pairs were concordant). In contrast, the target twin pairs were less concordant for early mortality (71.2% of pairs were concordant) ($t = -4.42$, $p \leq .001$).

3.3. Cause of death for parents

Table 4 displays the leading causes of death in the U.S. for the members of the bereaved and non-bereaved parent groups who experienced early deaths. The table also lists the prevalence rates in the U.S. population, specifically among those who were 65 or older in 2015, as a reference. In 2015, among the decedents who were 65 or older at the time of death, 26% died of heart diseases and 21% died of cancer. Bereaved parents in the MIDUS sample experienced relatively higher rates of early deaths from diseases of the heart (30%) than non-bereaved parents (25%). In contrast, the non-bereaved parents were relatively more likely than the bereaved parents to experience early deaths from cancer (27% and 19%, respectively).

4. Discussion

The current study examined whether the death of a child might have long-term impacts on the mortality of their parents. The results show significantly greater early mortality among bereaved parents than controls, including in mid-to late-life, likely decades after the death of their children. These patterns are consistent with past research showing long-term negative effects on health and well-being (Bratt et al., 2017; Floyd et al., 2013; Rogers et al., 2008; Song et al., 2010; Youngblut et al., 2013). Specifically, we found that parents who had experienced the death of a child had a 32% greater early mortality risk than non-bereaved parents (see Table 2). Studies of the health outcomes associated with bereavement have consistently found significant associations between bereavement experiences and the risk of physical and mental health problems as well as mortality, not only during the acute phase but also over a prolonged period after the death (e.g., Stroebe et al., 2007). Empirical evidence regarding how the death of a child affects the health of bereaved parents is limited relative to research on other types of bereavement (e.g., the death of a spouse or parent). The current study filled this gap in the literature, revealing that the death of a child has long-term adverse impacts on bereaved parents' health and mortality.

The findings from the twin analysis provide preliminary evidence

Table 3
Parental bereavement status and early death in twin parents at MIDUS 2 (2004–2005): Target twin pairs (MZ, DZ) vs. comparison twin pairs.

Variable	Target twin parent pairs: MZ		Target twin parent pairs: DZ		Comparison twin parent pairs[a]	
	Bereaved parents (n = 31)	Non-bereaved parents (n = 31)	Bereaved parents (n = 21)	Non-bereaved parents (n = 21)	Non-bereaved parents A (n = 271)	Non-bereaved parents B (n = 271)
	M (*SD*), %	*M* (*SD*), %	*M* (*SD*), %	*M* (*SD*), %	*M* (*SD*), %	*M* (*SD*), %
Age (years)	60.4 (11.0)		60.8 (12.6)		53.5 (11.2)	
Gender (%, Mothers)	54.8		71.4		52.8	
Education (years)	13.3 (2.8)	13.4 (2.0)	14.1 (2.4)	14.3 (2.1)	14.3 (2.5)	14.2 (2.4)
Household income ($1000)	82.2 (65.8)	56.7 (56.5)	58.4 (32.9)	60.1 (34.7)	77.6 (60.1)	72.3 (57.7)
Marital status (%, Married)	74.2	77.4	61.9	71.4	85.4	84.3
Early Death (%, by 2017)	25.8	12.9	23.8	9.5	7.8	7.9

[a] Non-bereaved parent A vs. B in each twin pair was randomly assigned. MZ = Monozygotic, DZ = Dizygotic.

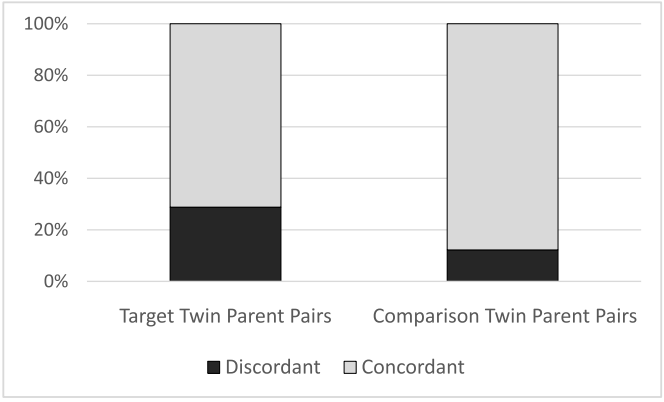

Fig. 2. Early death status in target twin parent pairs vs. comparison twin parent pairs: Concordant vs. discordant.

examining possible confounding of genetic predisposition or vulnerability in the examination of health outcomes in bereaved parents after the death of a child. Such findings also indicate that there was greater concordance of early death among twin pairs neither of whom experienced child death, whereas there was greater discordance in early death among twin pairs where one experienced child death but the co-twin did not (see Fig. 2). Given that twins share a substantial proportion of genetic predisposition/vulnerability (e.g., 100% in MZ twins and 50% in DZ twins), the greater discordance of early death between bereaved and non-bereaved co-twins provides evidence that the death of a child had a detrimental health impact net of genetic predisposition or vulnerability. To the best of our knowledge, this is the first study to use twin data to examine possible genetic confounding in the impacts of the death of a child on bereaved parents' health and mortality risks. Future studies with larger twin samples are needed to validate the current preliminary finding, which is based on a relatively small number of twin pairs (52 target twin pairs and 271 comparison twin pairs).

The finding of no significant difference in elevated mortality risk between bereaved mothers and fathers is contrary to our hypothesis. Prior studies that found greater risks for mothers than fathers (e.g., Cohen-Mansfield et al., 2013; Li et al., 2003; Rostila et al., 2012) were conducted in countries with different rates and causes for children's deaths, and different health care systems for surviving parents than our U.S. sample, which might account for our discrepant findings. We also focused on the occurrence of early mortality, dying before average life expectancy, which might present a different picture than mortality irrespective of timing. In addition, we could evaluate mortality only for parents who had survived until MIDUS 2, and gender differences might have been more pronounced in parents who died soon after a child's death. All of these factors deserve attention in future research in order to better understand the experiences of bereaved mothers and fathers.

The data on the cause of parent death show relatively high rates of death due to heart disease, which implicates chronic stress as a possible mechanism for parent mortality. Prior research has found that chronic stresses in adulthood impact the development or progression of cardiovascular disease in individuals via acute stress response and pathophysiological changes over time (e.g., Aalbaek et al., 2017; Carey et al., 2014; Kvimaki and Steptoe, 2018). In addition, European guidelines for cardiovascular disease prevention include stress as a significant risk factor, especially for individuals who are already at high risk for the disease (Kvimaki and Steptoe, 2018). Accordingly, the high rates of death due to heart disease in the current sample of bereaved parents suggest that the chronic stress associated with parental bereavement across midlife and early old age might be an important contributor to

Table 4
Cause of early death: Bereaved vs. non-bereaved parents.

Variable	Parents in analysis		U.S. Population: age 65 and over[a]
	Bereaved parents (n = 103)	Non-bereaved comparison parents (n = 294)	
	%[b]	%[b]	%[b]
Disease of heart	30.1	25.2	25.5
Malignant neoplasms	19.4	26.9	21.1
Chronic lower respiratory diseases	14.6	11.9	6.6
Cerebrovascular diseases	5.8	5.1	6.0
Alzheimer's disease	5.8	6.5	5.5
Accidents/Unintentional injuries	2.9	2.7	2.6
Diabetes mellitus	1.0	2.4	2.8

[a] Heron, M (2017). *Deaths: Leading causes for 2015*. National Vital Statistics Report, 66 (5). Hyattsville, MD: National Center for Health Statistics. [b] Percent in the total early deaths. Sum of percentages are less than 100% because only leading causes are presented, partly due to small number of cases in other categories of cause of deaths.

early mortality in bereaved parents. Contrary to heart disease, death due to cancer was not substantially higher in bereaved parents, consistent with previous studies (e.g., Levav et al., 2000).

Future studies should explore the mechanisms through which parents' bereavement experience increases the risk of early mortality, and should examine possible protective and risk factors at various levels (e.g., individual-level, family-level, and societal-level intervention programs and/or policies), even for parents who survive decades after their loss. Such research would provide a better understanding of the health outcomes of bereaved parents over the life course. The current findings suggest that heart disease was a more prevalent cause of early death among bereaved parents than among their non-bereaved peers. Replication of these exploratory analyses with a larger sample would clarify the validity of the current findings and provide opportunities to examine individual differences among subsamples based on factors such as the cause of the child's death and the parents' coping resources that have been shown to relate to stress and well-being (Floyd et al., 2013).

4.1. Limitations and strengths

Certain limitations of this study should be taken into consideration. Because we used secondary data from MIDUS, we could not examine the potential moderation effects of characteristics of child death, including cause of death. In addition, duration since death of a child was not included in the analysis because of the extent of missing data. Future studies that include the characteristics of the death of the child (e.g., cause of death and timing) would improve the understanding of the association between parental bereavement and mortality. In addition, because we identified the bereaved parents among MIDUS 2 participants, parents who experienced the death of a child and themselves died before the MIDUS 2 survey would be excluded from the current analyses. Thus, our estimates of the effects of child death on parents' early mortality are likely to underestimate the true effect. Finally, although we controlled race in all analyses, we were not able to address race effects due to small number of non-white respondents in the analytic sample and also the heterogeneity of this group (i.e., it was a blend of African American, Asian, etc.). Given the substantial racial differences in exposure to the death of a child and its implication for health disparities across racial groups (Umberson et al., 2017), future research with larger numbers of racial minority participants is warranted. Such research might probe the effects of the death of a child and consequent parental mortality risk as one possible mechanism of health disadvantages in racial minority groups, specifically in African Americans.

The present study has important strengths, including the use of data from a nationally representative sample of U.S. parents to examine the long-term impacts of the death of a child on parents' early mortality, for both mothers and fathers. Parents' mortality status was traced for 14 years after MIDUS 2, which allowed the examination of the long-term impact of parental bereavement on the risk of early death decades after the death of a child. Another unique contribution of the current study is the analysis of twin samples that include bereaved parents and their non-bereaved co-twins. This type of analysis examines the possible impact of genetic vulnerabilities that could be shared by a deceased child and their bereaved parents and thus affect health and mortality in both generations.

5. Conclusions

In conclusion, the present study suggests that the death of a child has lasting adverse impacts on the risk of early mortality in bereaved parents, net of their sociodemographic characteristics and genetic predisposition. As Rogers et al. (2008) noted, the effects of bereavement after the death of a child might be difficult to detect in daily role functioning (e.g., work, socializing), but they nevertheless take a toll in the form of long-term health consequences. Health professionals should be sensitized to potential lasting stress and health problems in bereaved parents and their higher risk of early mortality.

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