ORIGINAL ARTICLE

Time to Hospitalization for Suicide Attempt by the Timing of Parental Suicide During Offspring Early Development

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Context: Previous studies have suggested that children who experience parental suicide at earlier ages are at higher risk of future hospitalization for suicide attempt. However, how the trajectories of risk differ by offspring age at the time of parental suicide is currently unknown.

Objective: To study time at risk to suicide attempt hospitalization among offspring of suicide decedents as compared with offspring of unintentional injury decedents by their developmental period at the time of parental death.

Design: Population-based retrospective cohort study.

Setting: Sweden.

Participants: Twenty-six thousand ninety-six offspring who experienced parental suicide and 32 395 offspring of unintentional injury decedents prior to age 25 years between the years 1973 and 2003.

Main Outcome Measure: Parametric survival analysis was used to model the time to hospitalization for suicide attempt among offspring who lost a parent during early childhood (0-5 years old), later childhood (6-12 years old), adolescence (13-17 years old), and young adulthood (18-24 years old).

Results: The risk in offspring who lost a parent to suicide or an unintentional injury during childhood surpassed the other age groups' risk approximately 5 years after the origin and, for the youngest group, continued to rise over decades. Offspring who lost a parent during adolescence or young adulthood were at greatest risk within 1 to 2 years after parental death, and risk declined over time. Offspring who lost a parent to suicide in childhood and young adulthood had earlier onset of hospitalization for suicide attempt compared with offspring who lost a parent to an unintentional injury.

Conclusions: The hospitalization risk for suicide attempt in offspring who lost a parent during their childhood is different from those who lost a parent later in development. The results suggest critical windows for careful monitoring and intervention for suicide attempt risk, especially 1 to 2 years after parental death for the older age groups and over decades for childhood survivors of parental death.

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Suicide affects millions of individuals worldwide and leaves a devastating impact on family members left behind, herein referred to as *survivors*.[1] Paralleling research on understanding the processes leading to suicide, an increasing number of studies have examined the psychosocial impact of suicide on survivors.[2,3] However, research is still needed to assess the long-term impact and evaluate interventions for bereaved individuals.[4,5]

Among survivors of suicide, young offspring who survived parental suicide have received particular research attention because they lost a caregiver during a critical developmental period and may be more vulnerable to suicide attempt and suicide.[6-8] Several studies have shown that offspring who experience parental suicide prior to young adulthood are at increased risk for suicide and hospitalization for suicide attempt as compared with those who experience a parent's death by other means.[9-12] Other studies have noted higher anger and depressive symptoms among offspring who experienced parental suicide during childhood than offspring who lost a parent by other means.[13,14] However, some studies have suggested that offspring of suicide decedents are more similar than different from offspring of unintentional injury decedents.[15]

Our research group recently reported that among offspring who lost a parent to suicide before age 25 years, risk for psychi-

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atric hospitalization and suicide varied by the developmental period when the offspring experienced parental suicide, as compared with offspring of parents who were alive, and that offspring who lost a parent to suicide before age 13 years were at particularly high risk.[9] Furthermore, child and adolescent offspring who lost their mother to suicide had greater risk for hospitalization for suicide attempt than offspring who lost their mother to an unintentional injury.[11] Although these studies have helped identify subgroups of survivors of parental suicide at particularly high risk, they do not provide information regarding how risk varies over time and if there are critical windows during which to carefully monitor or intervene with young survivors of parental suicide. Such information has been called for to better understand the risks associated with experiencing parental suicide and would inform intervention efforts in the wake of parental suicide.[3]

Using a population-based longitudinal study from Sweden with 30 years of follow-up, we characterized the pattern (time and shape) of risk of hospitalization for suicide attempt among young offspring who experienced parental suicide before age 25 years and examined if the pattern of risk varied by the offspring's developmental period at the time of parental death. To examine if the trajectories of suicide risk were specific to offspring of suicide decedents or were more general to offspring who experienced sudden parental death, we also examined the trajectories of hospitalization for suicide attempt among offspring of unintentional injury decedents.

METHODS

We conducted a retrospective cohort study using multiple Swedish longitudinal national registries. Data were linked using the personal identification number assigned to all individuals either at birth or, for immigrants, on being granted permanent residency. The Cause of Death Register provided data for 71 595 offspring of parents who died by suicide (*International Classification of Diseases* [*ICD*] *Eighth/Ninth Revision* codes: E950-E959; *ICD-10* codes: X60-X84) during 1973 to 2003. Offspring who lost a parent to suicide and the surviving parents were identified from the Multi-Generation Register, which indicates parent-child relations for all people born or granted permanent residency in Sweden since 1932 (currently encompassing 13 million people). Of the 71 595 offspring of suicide decedents, 27 997 were younger than 25 years when their parent died. We excluded (1) 673 offspring who experienced the death of the coparent prior to the suicide of a parent, (2) an additional 230 individuals who had unreliable data on the psychiatric hospitalization status of the deceased or surviving parents (eg, a hospitalization record after the parent died), and (3) 998 offspring with hospitalizations for suicide attempt prior to parental suicide. The final sample comprised 26 096 offspring who experienced parental suicide prior to age 25 years.

Using the same data source, 236 400 offspring of parents who died of unintentional injuries (*ICD-8/9* codes: E800-E929; *ICD-10* codes: V01-X59) were identified during 1973 to 2003, of whom 34 327 experienced the death of a parent prior to age 25 years. After applying the same exclusion criteria, the final sample of offspring of unintentional injury decedents was 32 395.

This study was approved by the institutional review boards of the Karolinska Institutet and The Johns Hopkins School of Medicine. Although consent was not obtained, the data remained anonymous and incur minimal risk of identification.

OUTCOME VARIABLE

Hospitalization for confirmed or suspected suicide attempt (*ICD-8/9* codes: E950-E959 and E980-E989; *ICD 10* codes: X60-X84 and Y10-Y34) was the outcome of interest and was obtained from the National Inpatient Registry. The National Inpatient Registry records *ICD* discharge diagnoses for all individuals admitted to any general or psychiatric hospital in Sweden for assessment or treatment. We examined the date of first hospitalization for suicide attempt after the origin, which excluded offspring who attempted suicide prior to parental death. The origin was defined as the date when a parent died by suicide or unintentional injury or the date when the offspring turned 10 years old, if parental death occurred prior to this date. These dates were obtained by linking the Cause of Death Register and the Multi-Generation Register. The offspring age of 10 years was selected as an origin for offspring who lost a parent before age 10 years because it is rare for children younger than 10 years to carry out a suicide attempt requiring hospitalization, and a recent study used this age as a starting point to examine age at first suicide attempt.[16] Individuals were censored if they died prior to December 31, 2003, or at the end of this study period.

EXPOSURE VARIABLE AND COVARIATES

Offspring were stratified into groups based on the timing of parental death: early childhood (0-5 years old), later childhood (6-12 years old), adolescence (13-17 years old), and young adulthood (18-24 years old). A similar categorization was used in a previous study.[9]

In addition to the outcome and age of offspring when the parent died, we identified the following 11 covariates from the Swedish national registries: birth year and birth country of both parents and offspring (Sweden vs non-Sweden), deceased parent's history of psychiatric hospitalization, surviving parent's psychiatric hospitalization prior to parental death, sex of offspring and parents, and deceased parent's age at the time of parental death.

STATISTICAL ANALYSES

First, we examined the cumulative hazard of hospitalization for suicide attempt using nonparametric Nelson-Aalen cumulative hazard curves, which are graphically depicted in **Figure 1**. We then conducted stratified parametric survival analysis to examine the time to hospitalization for suicide attempt among the 4 developmental periods during which the offspring experienced parental death. Parametric survival analysis was preferred over semiparametric Cox regression because this technique allows for modeling the time and shape of hospitalization for suicide attempt at each developmental period without constraining the shape to be similar across periods (ie, without imposing proportional hazards). Parametric survival analysis assumes that hospitalization for suicide attempt follows a certain hazard shape. Since we did not find any prior literature reporting the shape of such hazard among offspring survivors, we compared models across several distributions (Weibull, loglogistic, gamma, and lognormal) using the Akaike Information Criteria[17] and Bayesian Information Criterion fit indices.[18] The lognormal distribution yielded the lowest Akaike Information Criteria and Bayesian Information Criterion for the majority of developmental periods and was thus selected for further analysis.

The lognormal distribution models the log of time to hospitalization for suicide attempt and assumes an increase followed by a decrease in hazard over time. The lognormal model estimates 2 parameters of interest: (1) a location parameter, β, captures time to event and is the log median survival time, and

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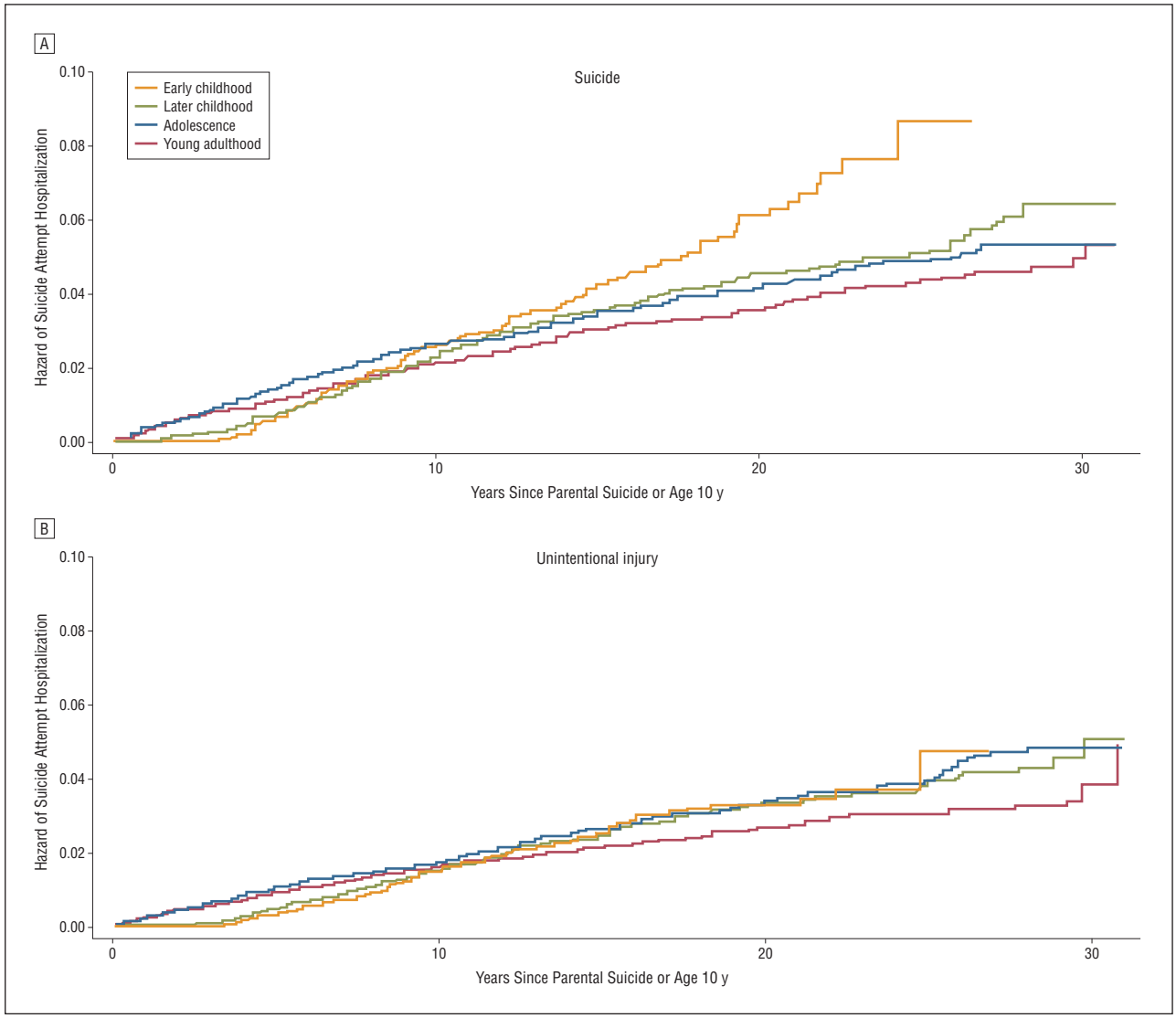

Figure 1. Nonparametric Nelson-Aalen cumulative hazard of hospitalization for suicide attempt among offspring who lost a parent to suicide or unintentional injury, stratified by developmental period when the offspring experienced parental suicide.

(2) a scale (dispersion) parameter, σ, informs the hazard shape.[19-21] Lower β denotes earlier time to hospitalization for suicide attempt because the median survival time will be smaller; larger σ indicates that the peak of the hazard shape will be closer to the origin.

We also examined if the 2 parameters, location and scale, were statistically different between offspring who experienced parental death in the 3 younger developmental periods as compared with those who experienced parental death during young adulthood (reference group). The models were adjusted for psychiatric hospitalizations in the deceased parent as well as the surviving parent prior to the index parent's death. We conducted parametric survival analysis similarly among offspring of unintentional injury decedents and chose the lognormal distribution to characterize the trajectory shapes using the same criteria. A model that included type of parental death was estimated to test whether the location and/or scale parameters were statistically different between offspring of unintentional injury and suicide decedents within each developmental period.

To gauge whether the differential risks were more due to the environmental impact of losing a parent to suicide early in the offspring's development, a subanalysis using a shared frailty model was conducted among siblings who experienced parental suicide at different developmental periods. The shared frailty model incorporates unobserved shared heterogeneity (ie, the correlation induced by sharing the same parent) in hazard estimation. This approach is similar to multilevel modeling as applied to correlated survival data.[22] The Weibull distribution that assumes a monotonic increase or decrease in hazard was preferred over the lognormal distribution for the sibling analysis. The selection was based on lower Akaike Information Criteria and better concordance with results from a piecewise exponential model that allows for a more flexible hazard.[21] Weibull models can be presented in hazard and accelerated time failure metrics.

We examined the differences in time and shape between daughters and sons at each developmental period among offspring of suicide decedents by using stratified lognormal models. A model was estimated to test whether the location and scale parameters were statistically different between daughters and sons within each developmental period. Model fit was assessed using the Cox-Snell goodness-of-fit test. Analyses used robust standard errors to account for the dependence between observations due to clustering of siblings within families (77% of the observations were siblings). All analyses were conducted using Stata version 10.[23]

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Table 1. Characteristics of Offspring, Suicide Decedents, and Surviving Parents by the Developmental Period of Offspring at the Time Parental Suicide Occurred, Identified From Swedish Population-Based Registries, 1973 to 2003

	No. (%)				
	Early Childhood (Ages 0-5 y) (n = 3534)	Later Childhood (Ages 6-12 y) (n = 7147)	Adolescence (Ages 13-17 y) (n = 6401)	Young Adulthood (Ages 18-24 y) (n = 9014)	*P* Value
Offspring					
Country of birth, Sweden	3489 (99)	6953 (97)	6159 (96)	8722 (97)	.001
Offspring female	1674 (47)	3474 (49)	3110 (49)	4333 (48)	.60
Year of birth, mean (SD)	1981 (7.1)	1976 (8.9)	1971 (8.8)	1965 (8.7)	.001
Any psychiatric hospitalization prior to parental death	1 (0.03)	12 (0.2)	65 (1.0)	195 (2.2)	.001
Deceased parent					
Country of birth, Sweden	2984 (85)	6142 (86)	5563 (87)	7980 (89)	.001
Year of birth, mean (SD)	1951 (9.0)	1947 (10.6)	1942 (10.9)	1936 (11.1)	.001
Any psychiatric hospitalization	1548 (44)	3392 (47)	3075 (48)	4268 (47)	.001
Age of parent at death, y, mean (SD)	33.1 (6.7)	38.8 (6.9)	44.3 (6.5)	49.8 (6.6)	.001
Parent mother	741 (21)	1702 (24)	1617 (25)	2556 (28)	.001
Surviving parent					
Country of birth, Sweden	3045 (87)	6190 (87)	5529 (87)	7819 (88)	.21
Year of birth, mean (SD)	1953 (8.7)	1949 (10.2)	1943 (10.5)	1938 (10.7)	.001
Any psychiatric hospitalization prior to spouse death	280 (8)	509 (7)	450 (7)	630 (7)	.30

RESULTS

Among the 26 096 offspring who experienced parental suicide prior to age 25 years, 3534 (13%) occurred during 0 to 5 years of age (early childhood), 7147 (27%) occurred during 6 to 12 years of age (later childhood), 6401 (25%) during 13 to 17 years of age (adolescence), and 9014 (35%) during ages 18 to 24 years (young adulthood). **Table 1** describes the characteristics of the offspring of suicide decedents and their parents (deceased and surviving). Psychiatric hospitalization rates of the deceased parent ranged anywhere between 44% and 48% across all age groups. Parental psychiatric hospitalizations were least frequent among the group of offspring who lost their parent to suicide during their early childhood. Any psychiatric hospitalization of the surviving parent prior to the death of their spouse ranged from 7% to 8%. Among 32 395 offspring who experienced parental fatal unintentional injury prior to age 25 years, 4058 (13%) occurred during early childhood, 7444 (23%) during later childhood, 7241 (22%) during adolescence, and 13 652 (42%) during young adulthood. The characteristics of the offspring of unintentional injury decedents, as well as their parents, are provided in the eTable (http://www.jamapysch.com).

Table 2 reports the parameter estimates that characterize time to hospitalization for suicide attempt for each age group, as well as by whether the offspring lost a parent to suicide or a fatal unintentional injury. The models adjusted for psychiatric hospitalization of both parents (deceased and the spouse) prior to parental death. Figure 1 shows the nonparametric cumulative hazard of hospitalization for suicide attempt. **Figure 2** graphically depicts the hazard shape of hospitalization for suicide attempt predicted from the model parameters. Table 2 (left portion) and Figure 2A suggest that the shape of suicide attempt hospitalization hazard is different among offspring who experienced parental suicide during different developmental periods. Although the absolute hazard is relatively small, offspring who experienced parental suicide during early childhood surpassed all other offspring's hazards approximately 5 years after the origin, and their hazard continued to rise until it leveled off 2 decades later. Similarly, those who lost a parent to suicide during later childhood had increased hazard of hospitalization for suicide attempt relative to those who lost a parent during young adulthood, although the hazard did not increase after approximately 5 years after parental death. The hazard of hospitalization for suicide attempt for offspring who experienced parental suicide during adolescence or young adulthood was highest in the first 2 years after parental suicide but then decreased over time. No significant differences were noted in either time or shape parameters between offspring who experienced parental suicide during young adulthood vs adolescence (Table 2 left portion).

A similar analysis was conducted to examine trajectories of hospitalization for suicide attempt among offspring of unintentional injury decedents (Figure 2B) and compare that group with the suicide decedents (Table 2). This analysis indicated that the shape parameter was not significantly different between the suicide and unintentional injury groups. Therefore, we ran a more parsimonious model that fixed the shape to be the same between the suicide and unintentional injury groups and only allowed the time parameter to vary. This model suggested that offspring who lost a parent to suicide in early childhood, later childhood, and young adulthood had significantly earlier onset of hospitalization for suicide attempt than offspring who lost a parent to an unintentional injury during the same developmental periods ($P = .001$, $P = .02$, and $P = .04$, respectively) (Table 2).

Subanalysis was conducted among siblings who experienced parental suicide during different developmental periods. There were 14 289 (55%) offspring who had at least 1 sibling in another developmental period when parental suicide occurred. Siblings who experienced parental suicide in early childhood had a statistically in-

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Table 2. Parameter Estimates and Standard Errors Obtained From the Lognormal Regression Models After Parental Death or Age 10 Years (for Those Who Experienced Parental Death Prior to Age 10 Years) After Adjusting for Psychiatric Hospitalization of Spouse and Parent Prior to Parental Death, Identified From Swedish Population-Based Registries, 1973 to 2003

	Offspring of Suicide Decedents				Offspring of Unintentional Injury Decedents				Suicide vs Unintentional Injury, *P* Value	
Age When Parent Died	No. of Attempts	IR	Parental Suicide (n = 26 096), β (SE)	Difference From Young Adults, *P* Value	No. of Attempts	IR	Parental Unintentional Injury (n = 32 395), β (SE)	Difference From Young Adults, *P* Value	Unconstrained Model[a]	Constrained Model[b]
Early childhood (0-5 y)	116	2.74	5.23 (0.17)	<.001	75	1.52	5.82 (0.23)	<.001	.06	.001
Later childhood (6-12 y)	248	2.16	6.42 (0.18)	<.001	180	1.54	6.70 (0.25)	<.001	.58	.02
Adolescence (13-17 y)	222	2.09	8.44 (0.34)	.63	195	1.70	8.39 (0.40)	.08	.69	.07
Young adulthood (18-24 y)	274	1.83	8.81 (0.36)	Reference	283	1.37	9.70 (0.41)	Reference	.35	.04
Age When Parent Died			**σ (SE)**	***P* Value**			**σ (SE)**	***P* Value**	***P* Value**	***P* Value**
Early childhood (0-5 y)			1.38 (0.08)	<.001			1.51 (0.10)	<.001	.37	NA
Later childhood (6-12 y)			1.91 (0.08)	<.001			1.89 (0.12)	<.001	.91	NA
Adolescence (13-17 y)			2.99 (0.17)	.93			2.81 (0.19)	.18	.38	NA
Young adulthood (18-24 y)			3.03 (0.17)	Reference			3.25 (0.19)	Reference	.66	NA

Abbreviations: IR, incident rate (per 1000 person-years); NA, not applicable; β, location parameter, which informs the median log survival time; σ, dispersion parameter, which informs the shape of the hazard.

[a] These *P* values report the comparison of offspring who lost a parent to suicide vs an unintentional injury for each parameter in the same age group.

[b] These *P* values report the comparison of offspring who lost a parent to suicide vs an unintentional injury for the location parameter in the same age group after the pattern (shape) is constrained to be the same.

creased risk for suicide attempt hospitalization over the course of the follow-up period (hazard ratio = 1.50; 95% CI, 1.09-2.07; β = 6.06; SE = 0.20; *P* value = .01), as compared with siblings who experienced parental suicide during young adulthood. No significant differences were noted between siblings who experienced parental suicide during later childhood or adolescence as compared with their young adult siblings.

We further examined if the time and shape of risk for hospitalization for suicide attempt differed between daughters and sons who experienced parental suicide during the same developmental period (**Table 3**) and the predicted hazards are graphically depicted in **Figure 3**. For offspring who experienced parental suicide during early childhood (Figure 3A) or adolescence (Figure 3C), daughters were at greater risk of hospitalization for suicide attempt than sons directly following parental suicide. This difference became minimal approximately 20 years after parental death for offspring who experienced parental suicide during early childhood and 10 years after parental death for those who experienced parental suicide during adolescence. In both developmental periods, the shape parameters were significantly different in daughters and sons, but the time parameters were not significantly different, suggesting that the shape of the hazard for suicide attempt hospitalization significantly differed between daughters and sons, but time to suicide attempt hospitalization was not earlier in daughters than sons. Time to hospitalization for suicide attempt did not significantly differ between daughters and sons who experienced parental suicide during later childhood or young adulthood (Figure 3D). The risk of suicide attempt hospitalization did not differ significantly between offspring who lost their mother to suicide as compared with offspring who lost their father (results not shown).

COMMENT

This study offers a novel approach to examine the time to hospitalization for suicide attempt among offspring who experienced parental suicide prior to age 25 years. We found that risk of hospitalization for suicide attempt in childhood survivors of parental suicide differed in duration and persistence from those who lost a parent later in their lives. The hospitalization risk for suicide attempt continued to rise for decades among offspring who experienced parental suicide during early childhood. The trajectory shapes were very similar for offspring of suicide and unintentional injury decedents, but overall, offspring of suicide decedents had earlier onset of hospitalization for suicide attempt than offspring who lost a parent to an unintentional injury. Siblings who lost a parent to suicide during early childhood had an increased long-term risk of hospitalization for suicide attempt as compared with their elder siblings who lost a parent during young adulthood, which is congruent with the hypothesis of a detrimental impact of parental suicide during early development.

Several study limitations should be noted. This study focused on suicide attempt hospitalizations, which only captured a subset of individuals who attempted suicide, because many attempters do not come to medical attention. Misclassification of suicides as unintentional injuries is also possible because unintentional injuries could be hidden suicides. This study excluded offspring who had been hospitalized for suicide attempt prior to parental suicide, as well as those who experienced the death of their other parent prior to parental suicide, which may have made our results more conservative because these subgroups may be at particularly high risk for subse-

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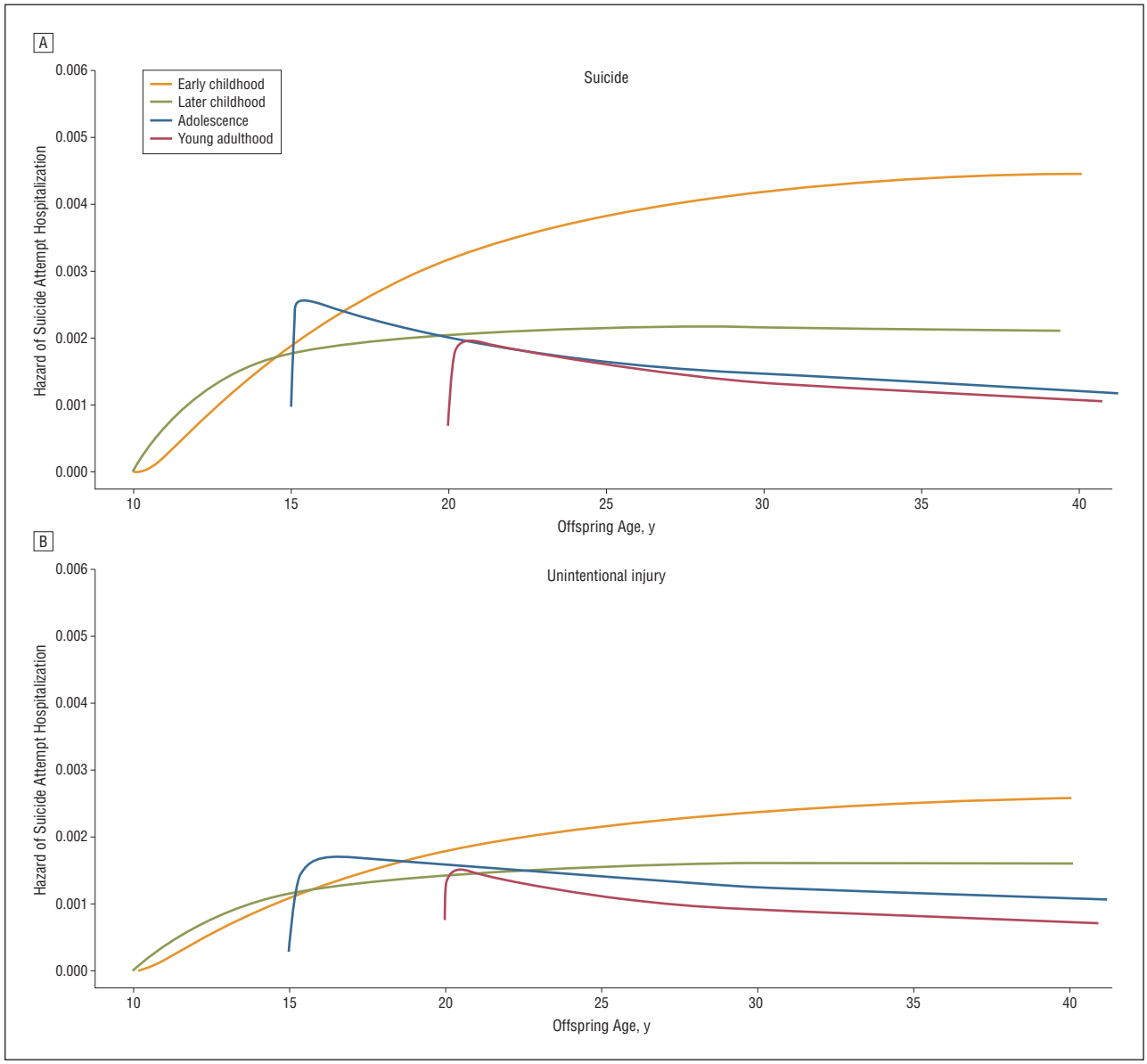

Figure 2. Predicted hazard of hospitalization for suicide attempt among offspring who lost a parent to suicide (A) or unintentional injury (B), stratified by developmental period when the offspring experienced parental death. For offspring who lost a parent during early childhood (before 5 years old), hazard was predicted from the later origin at age 10 years. Hazard was predicted for offspring who experienced parental suicide during later childhood at age 10 years, during adolescence at age 15 years, and during young adulthood at age 20 years.

quent suicide attempt. The trajectory may depend on the choice of hazard; however, the comparison of models using model diagnostics should have minimized model misspecification. Generalizability may be limited to the Western world, since the Swedish population is primarily white with relatively high socioeconomic status and universal access to health care. Suicide was relatively rare in this sample of offspring survivors and could not be examined separately as an outcome. Notwithstanding these limitations, this study offers several major strengths such as the use of the population-based Swedish registry, which identified more than 20 000 people who lost a parent to suicide before age 25 years, with close to 30 years of follow-up, and the ability to compare offspring of suicide and unintentional injury decedents. We also used parametric survival analysis that provided a robust approach to elucidate the risk pattern for suicide attempt hospitalizations. Hospitalization for suicide attempt was recorded by clinicians and was not biased by self-report. Finally, the within-sibling analyses are a particular strength, because they controlled for unmeasured familial confounders and corroborated the main results.

This study showed that offspring suicide attempt hospitalization trajectories differed by the developmental timing of parental death. The differences in the risk of hospitalization for suicide attempt may in part be due to different psychiatric profiles of parents who die by suicide at an early vs later age. Although we did not find that the parents with younger offspring had higher rates of psychiatric hospitalizations than parents of older offspring, previous studies have suggested that parents who died suddenly earlier in their offspring's lives were more

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Table 3. Sex Differences in the Parameter Estimates and Standard Errors Obtained From the Lognormal Regression Models After Parental Suicide or Age 10 Years (for Those Who Experienced Parental Suicide Prior to Age 10 Years), Identified From Swedish Population-Based Registries, 1973 to 2003

	β (SE)		
Age When Parent Died by Suicide	Daughters (n = 12 591)	Sons (n = 13 505)	Sex Differences, *P* Value[a]
Early childhood (0-5 y)	5.24 (0.21)	4.73 (0.22)	.14
Later childhood (6-12 y)	6.39 (0.22)	6.30 (0.29)	.91
Adolescence (13-17 y)	8.66 (0.45)	7.85 (0.49)	.31
Young adulthood (18-24 y)	9.02 (0.56)	8.63 (0.45)	.71

	σ (SE)		
	Daughters (n = 12 591)	Sons (n = 13 505)	Sex Differences, *P* Value[a]
Early childhood (0-5 y)	1.54 (0.10)	0.97 (0.10)	.001
Later childhood (6-12 y)	1.98 (0.11)	1.76 (0.14)	.26
Adolescence (13-17 y)	3.26 (0.22)	2.55 (0.23)	.05
Young adulthood (18-24 y)	3.01 (0.26)	3.04 (0.21)	.69

Abbreviations: β, location parameter, which informs the median log survival time; σ, dispersion parameter, which informs the shape of the hazard.
[a]These *P* values report the comparison of daughters vs sons for each parameter in the same age group.

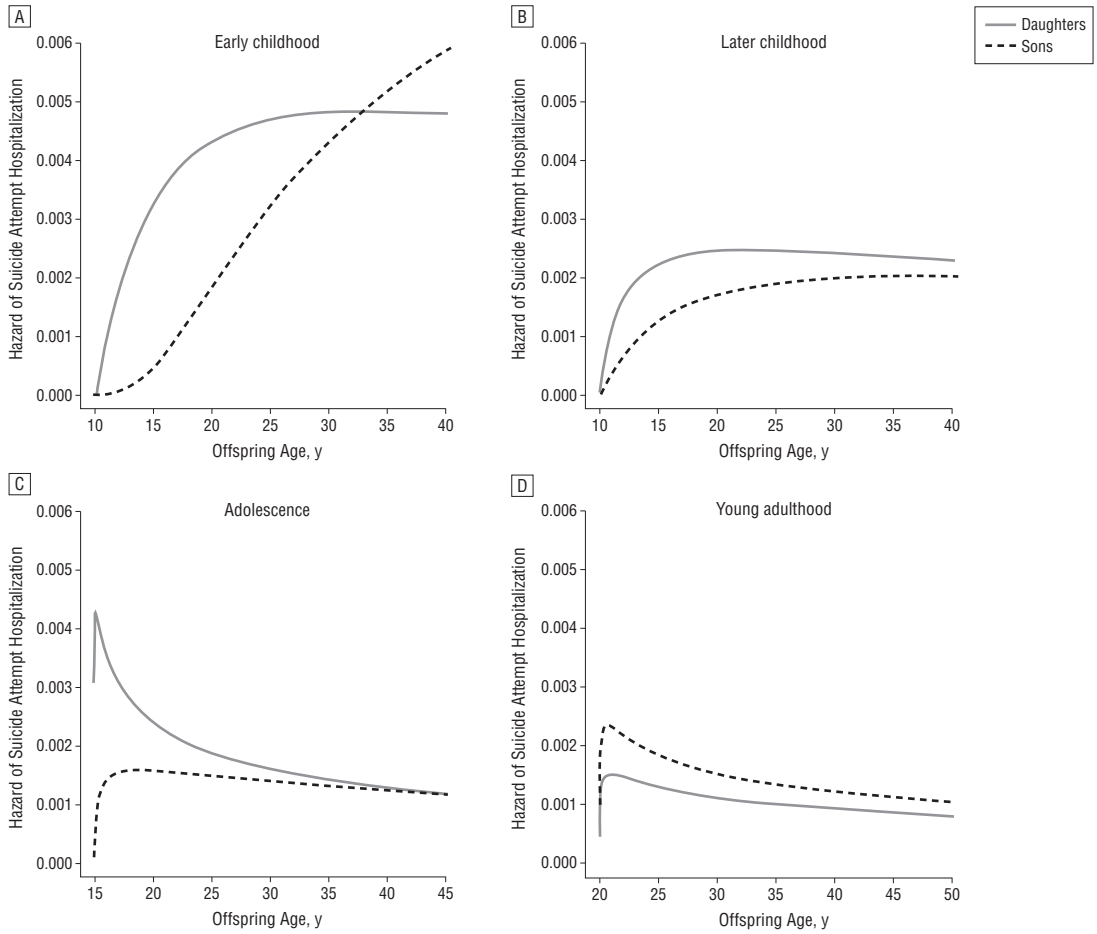

Figure 3. Predicted hazard of hospitalization for suicide attempt among offspring who lost a parent to suicide, stratified by offspring sex and developmental period when the offspring experienced parental suicide. For offspring who lost a parent during early childhood (before 5 years old), hazard was predicted from the later origin at age 10 years. Hazard was predicted for offspring who experienced parental suicide during later childhood at age 10 years, during adolescence at age 15 years, and during young adulthood at age 20 years.

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likely to have severe mental illnesses.[24] Psychological autopsy studies have noted differences in the psychiatric profiles of individuals who died by suicide at younger ages,[25-27] suggesting that losing a parent during childhood may be a marker of higher familial and environmental vulnerability to suicidal behavior and/or psychiatric disorder.

Parental suicide may have different meanings and consequences to offspring at different developmental stages. Although adolescent and young adult survivors experienced parental suicide during the developmental periods in which the rate of suicide attempt is generally higher than those who are younger, survivors who lost a parent during early childhood had the highest cumulative risk for hospitalization for suicide attempt over the course of the 30-year follow-up. In bereavement studies that have examined the impact of parental death on offspring outcomes, the moderating effect of child's age at the time of death on psychosocial outcomes has been suggested, although empirical evidence is scarce and with conflicting results.[28] For adolescents and young adults, the loss of a parent could be a precipitating/proximal risk factor for suicide attempt hospitalization following parental death, especially because the risk for onset of psychiatric disorders and suicide attempt increases during these periods. However, among childhood survivors of parental suicide, loss of a parent may be a distal risk factor for suicide attempt in offspring, potentially because of the interaction of genetic, epigenetic, and environmental vulnerability. According to attachment theory, parental death can result in a permanent disruption of attachment.[29,30] The severed attachment by parental death has been suggested to have a long-term impact on the mental well-being of the child,[31] but this may also depend on the quality of attachment before the loss. The sibling analyses provide some evidence for an environmental impact of losing a parent very early in the course of development.

This study builds on the work of prior studies using the same data source that found that offspring of suicide decedents have increased hospitalization risk for suicide attempt compared with offspring of alive parents and unintentional injury decedents. The shape of risk for offspring of suicide decedents was not significantly different from offspring who experienced a parental fatal unintentional injury. The more parsimonious model, which only examined the difference in time, suggested that offspring of suicide decedents generally had an earlier onset of hospitalization for suicide attempt. Although the shape of risk was quantitatively similar between the 2 groups, this study cannot elucidate potential qualitative differences before and after parental death between these 2 groups. Two reviews have suggested that there are unique themes in the bereavement process that differ in suicide survivors.[32] A recent review noted that the bereavement process differs between offspring of suicide decedents and offspring survivors of other causes of parental death by family functioning before and after the loss; however, the review emphasized the need for more longitudinal studies that examine the bereavement process.[8]

This study also suggested that among those who lost a parent to suicide during early childhood or adolescence, daughters are more likely to be hospitalized for suicide attempt than sons; however, no sex differences were noted among offspring who lost a parent to suicide during later childhood. This study could not distinguish whether this sex difference was due to differences in the prevalence of psychiatric disorders such as depression between males and females at a younger age. Although sex differences may also be due to the higher likelihood of females to attempt suicide than males (males are, however, more likely to die by suicide),[33,34] future studies should examine this evidence more closely. Previous studies have suggested that offspring of maternal suicide decedents had higher risk for suicide attempt hospitalization than offspring of maternal fatal unintentional injury.[11] However, in the present analyses when offspring of maternal suicide decedents were directly compared with offspring of paternal suicide decedents, we did not find a significant difference in the hazard shape of hospitalization for suicide attempt. The finding suggests that although losing a mother to suicide and to an unintentional injury may be different, parental sex may not have a significant impact on the risk trajectory for hospitalization for suicide attempt in offspring survivors of parental suicide. This study was underpowered to double stratify by both the sex of the parent and offspring to examine whether female offspring who lost their mother to suicide or males who lost their father to suicide had differing risk trajectories.

This study further solidified evidence showing that child survivors of parental death are at increased risk for suicide attempt hospitalization for decades and that this risk trajectory differs from older offspring survivors of parental death. The study findings have implications for clinicians and parents to monitor risk for suicide attempt that may vary depending on when the child experienced parental death and by offspring sex. An emphasis may be placed on more immediate support for adolescent and young adult offspring who lost a parent. However, the cumulative risk in young offspring survivors suggests the importance of providing proactive long-term support. Although the relative risk for hospitalization for suicide attempt was higher among those who experienced parental death in childhood than older survivors, hospitalization for suicide attempt was a rare event. The pattern of risk was similar between offspring of suicide and unintentional injury decedents, although it generally occurred earlier in survivors of parental suicide. Future studies could examine if the pattern is similar for other outcomes such as the onset of major depression. Future studies should identify malleable factors that could protect and build resilience in young survivors of parental death such as the surviving parent's health and psychological well-being and support provided by grandparents and other extended family members.

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