Published in final edited form as:

Pediatrics. 2010 November ; 126(5): e1026–e1032. doi:10.1542/peds.2010-0974.

Maternal versus Paternal Suicide and Offspring Risk of Hospitalization for Psychiatric Disorders and Suicide Attempt

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Abstract

Objective—We examined whether the risk for psychiatric morbidity requiring inpatient care was higher in offspring who experienced parental suicide compared to offspring who experienced parental fatal accidents, and if the association varied by the deceased parent's gender.

Subjects and Methods—Children and adolescents (age 0-17 years) who experienced maternal (n=5,600) or paternal suicide (n=17,847) during 1973-2003 in Sweden were identified using national, longitudinal population-based registries. Cox regression modeling was used to compare psychiatric hospitalization risks among offspring of suicide decedents with propensity-matched offspring of accident decedents.

Results—Offspring of maternal suicide decedents had increased risk of hospitalization for suicide attempt after controlling for psychiatric hospitalization in decedents and surviving parents, compared to offspring of maternal accidental decedents. Offspring of paternal suicide decedents had similar risk of hospitalization for suicide attempt compared to offspring of accident decedents but had increased risk of hospitalization for depressive and anxiety disorders. The magnitude of risks for offspring hospitalization for suicide attempt was greater for those who experienced maternal versus paternal suicide, as compared to their respective controls (interaction $p=0.05$) [AHR (95%CI) = 1.80 (1.19-2.74) in offspring of maternal decedents vs. 1.14 (0.96-1.35) in offspring of paternal decedents].

Conclusions—Maternal suicide is associated with increased risk of hospitalization for suicide attempt in offspring, beyond the risk associated with maternal accidental death. However, paternal suicide is not associated with hospitalization for suicide attempt. Future studies should examine factors that might differ between offspring who experience maternal versus paternal suicide, including genetic or early environmental determinants.

Keywords

suicide; attempted; mental disorders; parent-child relations; death; parents; mothers; fathers

INTRODUCTION

Children and adolescents who experience parental suicide are assumed to be at increased risk for suicidal behaviors and psychiatric problems, as compared to children who experience other types of parental death.¹⁻⁶ Recent population-based studies suggested that young survivors of parental suicide are at increased risk of psychiatric hospitalization and suicide, as compared to young people with alive parents.⁷⁻¹⁰ Wilcox and colleagues further found that the developmental period of the offspring at the time of parental death and the mode of parental death modified risk for suicide and specific psychiatric outcomes among offspring.¹¹

Many of these studies directly compared offspring of suicide decedents with offspring of parents who were alive, which has not provided a clear distinction of risk over and beyond the stress and disruption associated with sudden parental death. Direct comparison with offspring of decedents from other modes of death could provide a more powerful approach to examine familial vulnerability to suicidal behavior.^{12, 13}

Additionally, whether losing a mother versus a father to suicide is associated with greater vulnerability to psychiatric disorders in general or to specific disorders has not been tested in a methodologically rigorous way. Studies in Denmark suggested that the risks for bipolar disorder are greater in offspring who experienced maternal suicide.^{7, 8} A similar trend was observed in an examination of offspring suicide risk.¹⁰ Studies that have examined the association of childhood parental death (from any cause) on offspring depression also suggested a stronger association with maternal death;¹⁴⁻¹⁶ however, the evidence remains equivocal.^{17, 18} Taken together, this evidence may suggest a generally increased risk for psychiatric disorders in offspring who lost a mother to suicide. However, no study to date has formally examined if parent gender modifies the association between parental suicide and hospitalization for a broad range of psychiatric outcomes among offspring.

We attempted to improve on these limitations by conducting a retrospective cohort study using over 30 years of population-based Swedish registry data. We examined whether offspring who experienced parental suicide during childhood or adolescence were at increased risk for hospitalizations for psychiatric outcomes, as compared to offspring who experienced parental death from accidents (to control for similar suddenness of death). Additionally, we used propensity score matching to select comparison offspring who lost a parent in an accident but were otherwise as similar as possible to those who lost a parent to suicide. This procedure ensured that the offspring being compared were similar on important background characteristics such as parental psychiatric hospitalization prior to death. First, we hypothesized that offspring of suicide decedents, regardless of parent gender, would have increased risk of hospitalization for the psychiatric disorders under investigation, as compared to offspring of accident decedents. Second, we hypothesized that the association between parental suicide and offspring's risk of hospitalization for psychiatric disorders would be greater in offspring who lost a mother than in offspring who lost a father.

METHODS

Data Source

We conducted a retrospective cohort study using multiple Swedish, longitudinal national registries. Data were linked using the personal identification number (PIN), assigned to all individuals either at birth or, for immigrants, upon being granted permanent residency. Offspring who lost a parent to suicide or a fatal accident and the surviving parent 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). We obtained the causes of death and psychiatric inpatient records for deceased parents, surviving parents and offspring from 1973 to 2003. The National Inpatient Registry records International Classification of Diseases (ICD) discharge diagnoses for all individuals admitted to any general or psychiatric hospital in Sweden for assessment or treatment. In addition to the outcomes of interest, we identified the following twelve covariates from the Swedish national registries: birth year and birth country of offspring and both parents, deceased parent's history of psychiatric hospitalization, surviving parent's psychiatric hospitalization prior to parental death, offspring and deceased parent's gender, and offspring and deceased parent's age at the time of parental death. Deceased and surviving parents' history of psychiatric hospitalization was chosen as a covariate indicating whether a parent had been hospitalized for any of the psychiatric outcomes under investigation.

Offspring Outcome: Hospitalizations for Psychiatric Disorder or Suicide Attempt

Offspring outcomes were obtained from general or psychiatric hospitalization records held by the National Inpatient Registry. We examined the following seven outcomes: confirmed or suspected suicide attempt (ICD 8/9: E950-E959; E980-E989; ICD 10: X60-X84; Y10-Y34), depressive disorder (ICD 8: 296, 300.4; ICD 9: 296, 300E, 311; ICD 10: F30-39), anxiety disorder (ICD 8/9: 300; ICD 10: F40-F48), non-organic psychotic disorder (ICD 8/9: 291, 295-299; ICD 10: F20-F29, x5 in F10-F19), personality disorder (ICD 8/9: 301; ICD10: F60-F62), alcohol abuse and/or dependence (alcohol use disorder) (ICD 8: 303; ICD9: 303, 305A; ICD 10: F10 except x.5) and drug abuse and/or dependence (drug use disorder) (ICD 8: 304; ICD9: 304, 305X; ICD 10: F11-F19 except x.5).

Study Population

The Cause of Death Register provided data for 33,505 parents who died from suicide (ICD 8/9: E950-E959; ICD 10: X60-X84) and 105,386 parents who died from accidents (ICD 8/9: E800-E929; ICD10: V01-X59) during 1973-2003. Of these individuals, 14,299 suicide decedents and 12,080 accident decedents had 24,319 and 20,006 child or adolescent offspring (younger than 18 years of age), respectively, when they died. The data excluded adopted offspring. We also excluded: 1) 701 offspring who experienced the death of the other parent prior to the death of the index parent from suicide or accident, 2) 6 with miscoded data (i.e., psychiatric hospitalization of the parent was recorded after the parent died), 3) 342 parents with psychiatric hospitalization prior to 1973 when the register started, and 4) 484 individuals with missing data in at least one covariate described above. This resulted in 23,447 offspring of suicide decedents and 19,345 offspring of accident decedents who were available for propensity score matching.

Selection of Offspring for Propensity Score Matched Analysis

Propensity score matching was conducted to select offspring of accident decedents with covariates similar to the offspring of suicide decedents.^{19, 20} Introduced by Rosenbaum and Rubin, this method models the probability of being assigned to the exposed group (having a

parent who died by suicide) for each individual using a set of covariates. This probability, referred to as the propensity score, is then used to match each unexposed or comparison individual (offspring who lost a parent in an accident) to an exposed individual (offspring of suicide decedents).²⁰ This matching matches the exposed and unexposed groups on the full set of covariates included in the propensity score model, but without requiring each pair to match on each variable, thus facilitating matching. This matching technique is especially useful since those who lost a parent to suicide might differ vastly from those who lost a parent in an accident on several important observed covariates such as psychiatric hospitalization of the deceased parent. According to psychological autopsy studies, the vast majority of individuals who die from suicide (90% or more) are known to have an underlying mental disorder,²¹ while it is assumed that individuals who die in an accident have lower rates of psychiatric disorders (yet higher than the general population).²² When such large imbalances in covariates exist, regression adjustments may result in extrapolation and no longer be reliable.^{23, 24} It is also standard practice to adjust for sociodemographic variables that may differ between the exposed and unexposed (comparison) groups. We selected covariates previously shown to be related to parental suicide, such as birth year, parent gender, and parental psychiatric hospitalization, as well as those that have been associated with the psychiatric hospitalization outcomes under investigation, such as immigrant status, offspring gender and age of offspring when the parent died. We also included age of the parent at death in an attempt to account for potential differences between individuals who die from suicide at a young age from those who die later in life as suggested from psychological autopsy studies.²⁵

Nearest neighbor propensity score matching was implemented using the MatchIt package in the R statistical program.^{26, 27} Propensity score matching was conducted using the twelve covariates described above, with offspring exactly matched on the deceased parent's gender. Offspring of accident decedents could be matched to multiple offspring of suicide decedents and were only retained in the sample if they indicated a high degree of similarity, as evidenced by similar propensity scores. The balance of the covariates achieved through the matching process was assessed using cross-tabulations and t-tests (Table 1). The final sample consisted of 23,447 offspring of suicide decedents matched to 14,993 offspring of accident decedents.

Statistical Analysis

Cross-tabulations and t-tests were performed to compare covariate similarity across the matched groups. Seven Cox regression analyses were then conducted to model the incidence of psychiatric outcomes. The baseline time point was defined as the date (month, day, and year) when a parent died. Offspring could be hospitalized multiple times for different disorders. Cox regressions modeled the time to first hospitalization for each psychiatric disorder for which they received inpatient care after parental death and excluded offspring who were hospitalized for a particular disorder before their parent's death. Individuals were censored if they died prior to the end of data collection or at the end of the study on December 31, 2003. The proportional-hazards assumption for deceased parents' psychiatric hospitalization was violated for offspring hospitalization for suicide attempt and spouse's psychiatric hospitalization for drug use disorder. The violation suggested that offspring of parents with past psychiatric hospitalizations had a different risk trajectory than offspring of deceased parents without past psychiatric hospitalizations. For these two outcomes, we stratified for these covariates to allow the model to have a unique baseline hazard with respect to these covariates.^{28, 29}

Since deceased and surviving parents' past psychiatric hospitalizations were thought to be important predictors of offspring psychiatric outcomes, these two covariates were further adjusted for in subsequent analyses. Such regression adjustment for covariates used in the

propensity score matching helps to remove residual confounding of observed covariates²⁷ and is referred to as “doubly robust.”³⁰ All analyses used a weight to account for the fact that offspring of accident decedents could be selected as a comparison subject multiple times and robust standard errors to account for the dependence between observations due to clustering of siblings within families (69% of the observations were siblings). Interaction terms were included in the models to examine if parent gender modified the relationship between parent suicide and offspring hospitalization risk for psychiatric outcomes. Analyses were performed using Stata version 10.³¹

RESULTS

Forty-three percent of suicide decedents and 11% of accident decedents had at least one biological child between 0 and 17 years of age. The characteristics of deceased parents, surviving parents and surviving offspring of suicide decedents, unmatched and propensity-matched comparison samples are shown in Table 1. Propensity score matching resulted in fairly comparable characteristics between the offspring of suicide and accident decedents. Most notably, after matching, the proportion of offspring with parental psychiatric hospitalization prior to parental death was more comparable between offspring of suicide and accident decedents (63% vs. 63% in the maternal group and 46% vs. 46% in the paternal group). In the unmatched data, the psychiatric hospitalizations of maternal and paternal accident decedents were 18% and 25%, respectively.

Table 2 shows the risk of hospitalization for psychiatric disorders and suicide attempt among offspring of suicide decedents, as compared to offspring of accident decedents, and stratified by the gender of the deceased parent. Maternal suicide significantly increased the risk of hospitalization for suicide attempt in the offspring, as compared to the propensity-score matched offspring of accident decedents. Offspring of paternal, but not maternal, suicide decedents had increased risk of hospitalization for depressive and anxiety disorders. Neither maternal nor paternal suicide increased risk of hospitalization for offspring psychotic, personality, alcohol use and drug use disorders, as compared to maternal and paternal accidental death. For hospitalization for suicide attempt, the difference in risk between offspring of suicide and accident decedents was slightly higher for the maternal than the paternal group [interaction p-value=0.05]. Offspring of mothers who died from suicide had close to two times increased risk of hospitalization for suicide attempt, as compared to offspring of mothers who died in accidents [AHR = 1.80, 95% CI: 1.19-2.74]. This relative risk was lower and non-significant in offspring of paternal suicide decedents [AHR = 1.14, 95% CI: 0.96-1.35].

DISCUSSION

This retrospective cohort study using Swedish longitudinal, total population registries found that the offspring of suicide decedents who were children or adolescents at the time of parental death were at increased risk of hospitalization for multiple psychiatric outcomes. We also found that the difference in risk of hospitalization for suicide attempt between maternal suicide and accident decedents was higher than for those who lost a father.

Although a study suggested that offspring of suicide decedents were more similar than different from offspring of accident decedents,³² our study suggests that their cumulative risks may be different. The increased risk in offspring of suicide decedents may be attributed to genetic or environmental familial factors that affect both risk for parental suicide and offspring psychiatric outcomes, such as family functioning prior to death, parent-child relationship and parental mental illness not accounted for by parental psychiatric hospitalization.^{2, 33-36} A family member's death by suicide may also impact the remaining

family differently than death by other means, as they may experience more anger, blame and shame.^{6, 37} Additionally, a recent study suggested that complicated grief may be higher in individuals who were affected by suicide,³⁸ and such grief has been associated with suicidal ideation among bereaved subjects.³⁹ This study provides further impetus to examine why offspring of suicide decedents are at increased risk of hospitalization for psychiatric outcomes.

We also found that the relative risk of maternal suicide on offspring hospitalization for suicide attempts was larger than the relative risk observed for paternal suicide. The association remained even though we directly compared offspring of suicide decedents with offspring of accident decedents. This finding was congruent with a previous Danish study that suggested a stronger association with offspring suicide in those who lost a mother to suicide.¹⁰ Interestingly, we did not find this trend with hospitalization for psychiatric disorders, including depressive disorder. The difference in the findings between hospitalization for suicide attempt and psychiatric disorders supports possible influences of unmeasured risk factors independent of psychiatric hospitalization in families previously affected by suicide.¹³ Oftentimes, a stronger risk associated with maternal loss than paternal loss is attributed to the loss of a primary caregiver, who is usually the mother.¹⁶ If environmental factors related to the sudden loss of a mother as compared to a father play a major role, we would expect parent gender to moderate the relation between parent suicide and offspring risk for hospitalization from a broad range of psychiatric disorders.

The findings should be interpreted in light of some limitations, the most prominent being the registers' inclusion only of psychiatric disorders severe enough to require hospitalization. Although this limitation may affect the absolute rates of offspring psychiatric morbidity, the relative risks for offspring of suicide decedents, as compared to offspring of accident decedents, are less likely to be affected. Additionally, we did not have detailed information on psychiatric hospitalizations of the parents; therefore, we could not control for hospitalization for specific disorders or for parental suicide attempts. We also focused on biological offspring who were not adopted. Future adoption studies that compare biological versus adopted offspring would be helpful to delineate genetic and environmental influences on parental suicide. Generalizability may be limited to the Western world, since the Swedish population is primarily Caucasian with relatively high socioeconomic status and universal access to health care. Although propensity score matching ensured comparable controls for the cases on measured sociodemographic covariates, unmeasured differences such as genetic or environmental familial confounding may still have been present.⁴⁰ Additionally, we did not include some offspring of accident decedents when propensity score matching was implemented. This may have decreased the study power, but it has been suggested that having more similar controls, despite the reduced sample size, may actually increase study power.⁴¹ It is also important to note that null findings of hospitalization for certain psychiatric disorders do not necessarily imply that parental suicide is not associated with hospitalization of these disorders, but that the risk of being hospitalized for these disorders was not statistically different between offspring of suicide and accident decedents.

Despite these limitations, the population-based data allowed us to conduct a study not feasible in the United States and many other countries. Propensity score matching accounted for measured confounders, resulting in the selection of comparable offspring of suicide and accident decedents, especially on important covariates such as prior psychiatric hospitalization of the parent. The direct comparison with offspring whose parent died in an accident also provided a more clear description of cumulative risks associated with parental suicide, beyond the risks generally associated with sudden parental death. The large sample enabled us to compare the offspring psychiatric hospitalization risks associated with maternal versus paternal suicide, previously difficult to study because maternal suicide is

less common than paternal suicide.⁴² Finally, parental psychiatric morbidity and offspring outcomes were not affected by recall or self-report biases since longitudinal clinical inpatient diagnoses were used across the study population.

CONCLUSION

The identification of high-risk individuals is especially important to inform the development of guidelines for care and appropriate interventions for young survivors of parental death. This study provided further evidence that the cumulative risk of hospitalization for some psychiatric disorders is higher in offspring of suicide decedents, as compared to offspring of accident decedents. Offspring of maternal suicide decedents are at particularly increased risk of hospitalization for suicide attempt. However, offspring of paternal suicide decedents had similar risk of hospitalization for suicide attempt, as compared to offspring of paternal accident death. Future studies should examine factors that might differ between offspring who experience maternal versus paternal suicide, including genetic or early environmental determinants.

Acknowledgments

The authors wish to acknowledge National Institute of Drug Abuse for a training support of S. Janet Kuramoto (1F31DA0263182), NARSAD for a Young Investigator Award to Holly C. Wilcox and the Swedish Research Council – Medicine for support of the study and a senior researcher position to Niklas Långström.

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Abbreviations

AHR	adjusted hazards ratio
CI	confidence interval

Table 1
Characteristics of Suicide Decedents and Unmatched and Propensity-score Matched Offspring of Accident Decedents Identified from Swedish Population-based Registries, 1973–2003¹.

Cause of Parent Death		Maternal Death			Paternal Death			
Characteristic	From Suicide (N=5,600)	Unmatched From Accident (N=4,018)	χ^2 /t-test p-value	Matched From Accident (N=2,872)	χ^2 /t-test p-value	Unmatched From Accident (N=15,327)	Matched From Accident (N=12,121)	χ^2 /t-test p-value
Offspring								
Country of Birth (n (%))								
Sweden	5,422 (97)	3,884 (97)	<0.001	2,794 (98)	<0.001	14,850 (97)	11,773 (97)	0.003
Other Scandinavian	77 (1)	28 (1)		21 (1)		232 (1)	196 (2)	
Other Country	101 (2)	106 (2)		57 (1)		245 (2)	152 (1)	
Offspring Female (n (%))	2,695 (48)	1,942 (84)		1,390 (48)	0.93	7,465 (49)	5,913 (49)	0.76
Year of Birth (Mean (SD))	1976 (10.0)	1977 (9.3)	<0.001	1976 (9.4)	0.41	1977 (10.1)	1976 (10.0)	0.20
Age at Parental Death (Mean (SD))	10.2 (4.8)	10.1 (5.0)	0.55	10.4 (4.9)	0.15	9.7 (5.1)	9.9 (5.1)	0.05
Deceased Parent								
Country of Birth (n (%))								
Sweden	4,660 (83)	3,442 (86)	<0.001	2,499 (89)	<0.001	12,741 (83)	10,171 (85)	<0.001
Other Scandinavian	578 (10)	252 (6)		182 (6)		1,382 (9)	1,144 (10)	
Other Countries	362 (7)	324 (8)		191 (5)		1,204 (8)	806 (5)	
Year of Birth (Mean (SD))	1949 (10.8)	1949 (10.3)	0.02	1949 (10.4)	0.32	1945 (12.0)	1946 (11.7)	0.67
Any Psychiatric Hospitalization (n (%))	3,499 (63)	739 (18)	<0.001	727 (63)	0.98	3,773 (25)	3,526 (46)	0.98
Age of Parent at Death (Mean(SD))	37.4 (7.1)	38.3 (7.7)	<0.001	37.6 (7.7)	0.47	40.9 (9.2)	40.1 (8.4)	0.85
Surviving Parent								
Birth Country (n (%))								
Sweden	4,693 (84)	3,380 (84)	0.002	2,465 (88)	<0.001	12,848 (84)	10,251 (86)	<0.001
Other Scandinavian	424 (7)	241 (6)		169 (5)		1,487 (10)	1,219 (10)	
Other Country	483 (9)	397 (10)		238 (7)		992 (6)	651 (4)	
Year of Birth (Mean (SD))	1945 (11.4)	1946 (10.9)	0.007	1945 (11.2)	0.66	1949 (11.2)	1949 (11.1)	0.36
Any Psychiatric Hospitalization Prior to Death of Spouse (n (%))	607 (11)	341 (8)	<0.001	276 (14)	0.003	1,089 (7)	875 (8)	0.83

¹ Percentages were weighted to account for multiple matching of offspring of accident decedents to offspring of suicide decedents.

Table 2

Risk of Hospitalization for Suicide Attempt and Psychiatric Disorders in Offspring of Suicide Decedents Compared to Propensity-Matched Offspring of Accident Decedents Identified from Swedish Population-based Registries, 1973-2003^{1,2}.

Cause of Parent Death	Maternal Death			Paternal Death			Parent Gender × Cause of Death p-value
	From Suicide (N=5,600)	From Accident (N=2,872)	Adjusted Hazard Ratio ¹ (95%CI)	From Suicide (N=17,847)	From Accident (N=12,121)	Adjusted Hazard Ratio ¹ (95%CI)	
Offspring Outcome	n (%)	n (%)		n (%)	n (%)		
Suicide Attempt	233 (4)	50 (2)	1.80 (1.19-2.74)**	589 (3)	308 (3)	1.14 (0.96-1.35)	0.05
Depressive Disorder	185 (3)	40 (2)	1.61 (0.99-2.61)	388 (2)	172 (2)	1.29 (1.03-1.61)*	0.41
Psychotic Disorder	104 (2)	31 (2)	1.02 (0.55-1.92)	248 (1)	145 (1)	1.03 (0.81-1.31)	0.99
Anxiety Disorder	138 (3)	52 (3)	0.96 (0.61-1.50)	357 (2)	178 (2)	1.35 (1.09-1.66)**	0.18
Personality Disorder	78 (1)	19 (1)	1.55 (0.81-2.97)	175 (1)	93 (1)	1.03 (0.76-1.41)	0.27
Alcohol Use Disorder	166 (3)	65 (4)	0.77 (0.51-1.15)	457 (3)	286 (3)	0.88 (0.73-1.06)	0.53
Drug Use Disorder	162 (3)	46 (2)	1.27 (0.84-1.93)	355 (2)	231 (2)	0.84 (0.68-1.03)	0.07

Note:

¹ Hazard ratio adjusted for past psychiatric hospitalization of the deceased parent and surviving spouse.

² Percentages were weighted to account for multiple matching of offspring of accident decedents to offspring of suicide decedents.

* p<0.05;

** p<0.01