Death of Parent in Early Life, Remarriage, and Later-Life Suicide Risk

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In 2010, suicide was the 11th leading cause of death in the United States [1], and one of the leading causes of death in the world, particularly for young and middle-aged adults [2]. Thus, prevention of suicide could seriously reduce the burden of mortality. In this paper, we use the Utah Population Database (UPDB), a well-regarded trove of genealogical and health data, to examine how experiencing the death of a parent in early life can affect the risk for suicide in later life. Understanding this link could hopefully help to prevent suicides and deleterious associated ramifications of suicides. This link may also give some indication of how certain cohort effects, such as being born during wartime, may affect lifetime mortality profiles, as parental death may increase greatly during wartime. As remarriage is increasingly prevalent, we also consider how remarriage may affect this risk.

BACKGROUND

A few large population-based studies have examined the effects of early-life parent death on suicide risk. Agerbo et al. [3] compared all 496 suicides from the population of Denmark aged 10-21 years between 1981 and 1997 with 24,800 sex and age matched controls. They showed that experiencing death of a mother in early life increased risk for suicide. Gravseth et al. [4] followed the population of Norway born from 1967 to 1976 until 2004. Of the population of 610,359 that still lived in Norway at their 19th birthday, they identified 1,406 suicides. Findings showed that there was a slightly higher risk of suicide in adulthood for those whose mothers were either dead or widowed before the child reached age 19. Also, a history of mother's marital instability was correlated with increased suicide risk, though they did not model remarriage. Using Swedish register data from 1969 to 2004, Wilcox et al. [5] studied over 4 million parent-offspring pairs. After matching by sex and birthyear of parent and offspring, they found the risk

of suicide increased among offspring whose parents died of suicide, but not among offspring whose parents died of other causes. However, they did not test the effects of remarriage.

While these studies have generally found that severe loss in early life, including death of a parent, can increase risk of suicide in later life, they have not been able to test the effects of remarriage. Furthermore, we have not been able to identify any large studies using a population in the United States.

This study aims to build upon the previous studies by examine effects of early parental death on offspring suicide risk in a specific United States population—Utah—over a period of above 100 years. It also examines the effects of parental remarriage following such early-life death upon later-life suicide risk, and how that effect may depend upon sex of parent and offspring. We also examine the effects of religion and socioeconomic status.

METHOD

Data and Sample

Data came from the Utah Population Database (UPDB), an excellent genealogical source of population-based demographic and health data for the state of Utah. We considered triads—child, mother and father—though the suicide risk was measured for the offspring. We examine all individual offspring (for simplicity referred to hereafter as "egos") born between 1892 and 1998 who lived to at least 12 years of age; for whom we had reliable data on the linkage between ego, mother and father; and for whom neither ego, father nor mother were polygamous. The final sample consisted of N=823,717; 420,154 Male, 403,563 Female.

Variables

Suicide (Dependent Variable)

The UPDB data relevant to suicide for this study were obtained from the Utah Department of Health in two forms. First, for deaths occurring since 1957, ICD codes were directly provided: ICD6 (1957), ICD7 (1958-1967), ICD8 (1968-1978), ICD9 (1979-1998), and ICD10 (1999-2010). Previous to 1957, data were provided as death certificates. The literal causes of death written on the death certificates were then directly classified into ICD10 codes. Additionally, where possible the "manner of death" indicated on the certificate was coded.

Suicides were identified by an indication of ICD codes—E963, E970-E979 (ICD 6 & 7); E950-E959 (ICD 8 & 9); X60-X84, Y87.0, U03 (ICD 10)—or a manner of death clearly indicative of suicide. The union of these measures was considered a case of suicide. Separate analyses showed that the numbers of suicides in UPDB identified using this method follow published Vital Statistics very closely; and the risk of suicide peaked for men above age 75, and for women in their 40's near the end of childbearing age, consistent with prior research [1]. The first year with recorded suicides was 1904.

Early life Death of Parents, and Remarriage (Key Independent Variables)

We considered an ego to have experienced the death of mother or father, separately, during early life if said mother or father was known deceased previous to the ego reaching age twelve.

To consider the effects of remarriage, we formed a separate five-category variable:

- Both parents lived past ego achieving age 12 (i.e. no early parental death)
- Father died in early life, and mother did not remarry prior to ego achieving age 12 years.
- Father died in early life, and mother remarried prior to ego achieving age 12 years.
- Mother died in early life, and father did not remarry prior to ego achieving age 12 years.
- Mother died in early life, and father remarried prior to ego achieving age 12 years.

Other Covariates

- Sex (Male / Female)
- Ego's Year of birth (continuously measured)
- Religion: whether the ego was baptized as a member of the Church of Jesus Christ of Latter-day Saints (LDS or Mormon).
- Socioeconomic status (SES), measured with the Nam Powers Score. This is a historical measure of SES on a scale from 1 – 99 (low to high). Data came from father's usual occupation as recorded on the Utah death certificate. We code it here as a six-category variable: including four quartiles (1-25, 26-50, 51-75, 76-99), farming (a score of 40), and unknown.

Analytic Strategy

Cox Hazard Models were used to model time to ego suicide after having achieved age 12, and estimate the hazard ratios. Censoring occurred when an ego died from a cause other than suicide, or left Utah before death, thereby precluding them from receiving a Utah death certificate. Non-proportional trends, where the variables are interacted with time, were also modeled, and the Breslow method for handling ties was implemented. We present six models, to be discussed in the results section.

While each ego was linked to a mother and father, there were 258,108 unique mothers, and 255,546 unique fathers. This is because several of the egos were siblings that shared parents. To account for possible interdependence among egos, all models calculated adjusted standard errors by clustering about the mother. Analyses were performed using Stata 10.1 MP.

RESULTS

[Table 1 about here]

For reference, brief descriptive counts are displayed in Table 1. We identified 5,360 suicides (1,095 female, 4,265 male) in the sample.

[Table 2 about here]

Model 1 considers how experiencing early-life death of each parent affects risk for later-life suicide, controlling for sex and birthyear. It shows that experiencing death of father in early life increases risk of later-life suicide, as does experiencing early death of mother. Consistent with known trends, males in this sample are at much higher risk for suicide than females (about three-fold). Risk of suicide increased with historical time as measured by birthyear.

Models 2 and 3 consider the same relationships, but separately by sex. The increased risk for suicide due to death of parent in early life depends on sex of parent and child. Specifically, the child's risk increases more if the parent lost in early life is the same sex as the child. This is evidenced by the hazard ratios associated with death to parent of opposite sex becoming statistically insignificant. This appears to be particularly true for females, where experiencing early death of mother increased the risk for suicide about three-fold. It also appears that the effect of early parental death may dissipate over time, as evidenced by the hazard ratios less than 1.00 for non-proportional effects of early parent death.

[Table 3 about here]

Table 3 repeats the analyses separately by sex, but considers the effects of remarriage. Four models are presented. Model 4a and 5a examine the effects of parent death and remarriage combinations for males and females, respectively. Models 4b and 5b add in controls for whether the ego was baptized, and SES measured as measured by the Nam Powers Score. Non-proportional effects are controlled for, but not presented for the sake of simplicity.

Model 4a shows that for males, losing father in early life increases the risk for suicide, and that risk increases even more if the father remarries. Model 4b shows that religion, as measured by LDS baptism, is protective suicide. And, higher SES is also protective against suicide. Once baptism and SES were controlled for, the hazard ratios for parental death and remarriage became insignificant.

Model 5a shows that for females, losing the father in early life increases the risk for suicide. However, for those whose fathers did not remarry, the value did not achieve traditional measures of statistical significance. But, having a father remarry after mother's death increased the risk considerably. In model 5b, baptism was protective against suicide, but the pattern for SES is harder to see than for males. For females in the second-highest SES category (Nam Powers Score of 51-75), the hazard for suicide was 2.4 times the hazard for those in the highest SES category. But the difference in risk for those in the lower SES categories was not statistically significant. Finally, even when controlling for baptism and SES, the increase in hazard for females whose mothers died early and fathers remarried was still statistically significant, with a hazard 3.6 times that of females whose parents both survived.

DISCUSSION

Our findings suggest that losing a parent to death in early life increases the risk of suicide in adulthood. This effect appears to dissipate over time. This trend is particularly true when the parent lost to death is the same sex as the child. And, the risk is even greater if the surviving parent remarries. In particular, when a female loses a mother to death in early life and the father remarries, that female is at greatly increased risk.

However, we have not yet been able to disentangle whether the increased risk due to parental remarriage is artifactual—parents who die in younger ages have more time to remarry,

so our remarriage variable may be capturing parents who died when the child was very young during a sensitive stage of development. This has yet to be tested. Being religious, as measured by LDS baptism, was protective against suicide. And, higher SES was protective, particularly for males. These two factors may account for some of the additional suicide risk introduced by early parent death. However, it is possible we have "overcontrolled" for SES in this analysis. In other words, it is quite possible that SES increases the risk for early parental death, which in turn increases the risk for suicide. These pathways have yet to be more finely delineated.

PLANNED ADDITIONS

We currently plan to make the following additions to this preliminary analysis.

1. For simplicity, we have only considered remarriage up to age 12. However, remarriage of parent may occur later in age and still affect ego's risk level. We plan to find a way to incorporate remarriage after age 12 as a time-varying covariate.
2. Add additional variables to test other family associations. For example, birth order and number of siblings.
3. Improve upon the model specification by modeling shared frailty around mother, rather than only clustering. This will enable us to control for shared time-invariant predictors of siblings, enabling more stringent testing. Such attempts have thus far proven intractable in Stata. We may need to consider other software such as R.
4. Try to increase the sample size further. We have only considered those born after 1892, because they reached age 12 in 1904. However, we have the necessary data for an additional several hundred thousand egos born previous to 1892. We can therefore likely increase the sample size further, including an additional 300 suicides, if we alter the

model to include these additional egos. This will require limiting their exposure times to certain age ranges.

5. While we have considered non-proportional effects of the key independent variables, we will try to model this in a more meaningful way. For example, how does the risk of losing a parent in early life affect the risk of suicide at age 20 compared to age 45 or 70?
6. Attempt to disentangle effects of the ego's exact age at parental death and remarriage, as mentioned in the Discussion section.

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TABLES

Table 1 - Brief Descriptive Counts of Covariates

Variable	Females	Males	Total
N	403,563	420,154	823,717
Suicide	1,095	4,265	5,360
Mother died early	10,067	9,591	19,658
Father not Remarried	6,258	5,974	12,232
Father Remarried	3,809	3,617	7,426
Father died early	15,086	15,266	30,352
Mother not Remarried	12,599	12,753	25,352
Mother Remarried	2,487	2,513	5,000
Baptized LDS	194,774	195,527	390,301
Nam Powers Score			
2-25 (Low)	7,275	11,817	19,092
26-50	15,738	27,467	43,205
51-75	9,392	37,665	47,057
76-99(High)	11,959	28,265	40,224
Farming (Score 40)	425	15,207	15,632
Unknown	358,774	299,733	658,507

Table 2 - Cox Hazard Models modeling hazard for suicide on early-life parental death for (1) Entire Sample, (2) Male Sample, (3) Female Sample

		Model 1 (Entire Sample)			Model 2 (Males)			Model 3 (Females)		
		HR	p	95 % CI	HR	p	95 % CI	HR	p	95 % CI
Main Effects										
Father Died[a]		1.506	0.005	(1.13, 2.01)	1.644	0.002	(1.20, 2.25)	1.049	0.893	(0.52, 2.10)
Mother Died[a]		1.739	0.005	(1.18, 2.56)	1.471	0.088	(0.94, 2.29)	2.898	0.011	(1.28, 6.55)
Birthyear		1.025	0.000	(1.02, 1.03)	1.029	0.000	(1.03, 1.03)	1.009	0.021	(1.00, 1.02)
Male		2.994	0.000	(2.62, 3.42)	-	-	-	-	-	-
Non-Proportional Effects										
Father Died[a]		1.008	0.000	(1.00, 1.01)	0.993	0.080	(0.98, 1.00)	0.999	0.939	(0.98, 1.02)
Mother Died[a]		1.000	0.000	(1.00, 1.00)	0.992	0.161	(0.98, 1.00)	0.976	0.058	(0.95, 1.00)
Birthyear		0.994	0.112	(0.99, 1.00)	1.000	0.000	(1.00, 1.00)	1.000	0.071	(1.00, 1.00)
Male		0.989	0.026	(0.98, 1.00)	-	-	-	-	-	-

a – Indicated parent died previous to ego achieving age 12. Reference group is neither parent died.

Table 3 - Cox Hazard Models modeling hazard for suicide on early-life parental death and remarriage for (4) Males and (5) Females. Models 4b and 5b add covariates for religion (baptism) and SES.

		Model 4a (Males)			Model 4b (Males)			Model 5a (Females)			Model 5b (Females)		
		HR	p	95 % CI	HR	p	95 % CI	HR	p	95 % CI	HR	p	95 % CI
Main Effects													
Father died Mother not Remarried[a]		1.558	0.011	(1.11, 2.20)	1.213	0.278	(0.86, 1.72)	1.063	0.879	(0.49, 2.33)	0.961	0.921	(0.44, 2.10)
Father died Mother Remarried[a]		2.107	0.048	(1.01, 4.40)	1.628	0.200	(0.77, 3.43)	1.044	0.953	(0.25, 4.35)	1.034	0.963	(0.25, 4.32)
Mother died Father not Remarried[a]		1.734	0.056	(0.99, 3.04)	1.376	0.279	(0.77, 2.45)	2.488	0.079	(0.90, 6.87)	2.135	0.143	(0.77, 5.89)
Mother died Father Remarried[a]		1.201	0.611	(0.59, 2.43)	1.128	0.744	(0.55, 2.32)	3.623	0.049	(1.00, 13.06)	3.646	0.044	(1.03, 12.86)
Birthyear		1.029	0.000	(1.03, 1.03)	1.074	0.000	(1.07, 1.08)	1.009	0.020	(1.00, 1.02)	1.029	0.000	(1.01, 1.04)
Baptized		-	-	-	0.740	0.002	(0.61, 0.89)	-	-	-	0.693	0.042	(0.49, 0.99)
Nam Powers													
51-75[b]		-	-	-	1.562	0.000	(1.27, 1.92)	-	-	-	2.400	0.000	(1.53, 3.77)
26-50[b]		-	-	-	2.429	0.000	(1.97, 2.99)	-	-	-	1.273	0.320	(0.79, 2.05)
1-25 (Low)[b]		-	-	-	3.828	0.000	(2.98, 4.92)	-	-	-	1.854	0.053	(0.99, 3.46)
40 (Farming)[b]		-	-	-	1.870	0.000	(1.32, 2.66)	-	-	-	1.579	0.558	(0.34, 7.27)
Unknown[b]		-	-	-	0.066	0.000	(0.05, 0.09)	-	-	-	0.088	0.000	(0.05, 0.16)

a – Indicated parent died and surviving parent either had or had not remarried previous to ego achieving age 12. Reference group is neither parent died.
b – Reference group is Nam Powers score 76-100 (High SES).
Non-proportional effects controlled for, but not presented here.