Does parental death affect fertility? A register-based study of the effect of parental death on childbearing in Sweden

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This study examines the link between parents' mortality and their offspring fertility by studying the long- and short term effect of parental death during the reproductive age on fertility. The long term effect of parental death is measured as permanent childlessness while the short-term outcome changed propensity to have children directly after loses a parent. The study shows that both male and female have significantly higher fertility directly after a parental death. This is most likely a recovery after having had lower fertility rate prior to the parent's death. Despite this high recovery, individuals who experienced a parental death never fully recovers and remains at a higher probability of end up in permanent childlessness. This relationship is especially true for male offspring who experience the loss of one or both parents during the reproductive age. The most likely explanation for why men who experience a parent's death are more likely to end up in permanent childlessness is that the male recovery period after the loss of a parent is both weaker in magnitude and shorter in time compared to women who experience the same event. The study includes indicators for anticipated deaths (Cancer) and unpredictable deaths (accidents) to see if predictable or unpredictable loss of parents affects offspring fertility differently.

Introduction

Death of a parent and its immediate aftermath have been shown to be a traumatic life event that increases stress levels in offspring and raises their vulnerability to psychological and physical disease [1-4]. In particular, parental death during childhood and outcomes in offspring adult life has been studied [5-13]. Another type of death that has received much research attention is the death of spouse. Especially the effect on the surviving spouse mortality subsequent to the death of a partner has been frequently studied [14-15]. However, one of the most common deaths experienced by adults is the death of a parent [16]. The effect of parental death during adulthood has received surprisingly little research attention considering how relative common such events are. Previous research has shown that people linked through social ties are affecting each other's health. A person may be affected by the illness or death of a person to whom he or she is socially connected [17]. For most people, even in adulthood the relationship between parent and child is one of high emotional closeness [18]. With this in mind, it is somewhat surprising that the potential effects of parental death during children adult life have not received more attention.
In this paper the previously not studied intergenerational link between two of demography most central concept mortality and fertility is analyzed. The purpose of this study is to investigate if parental death during adulthood influences the offspring fertility and propensity of permanent childlessness. There are no previous large-data investigation on the relationship between parental death during adulthood and offspring fertility. One reason why no previous studies have been done is that this kind of study requires a large multigenerational data. The Swedish multigenerational registers provide a unique opportunity to study this. The aim of the study is to investigate the link between mortality and offspring fertility by focusing on both the shorter-term and long-term effect. The shorter-term effect of mortality on offspring fertility is investigated by studying offspring fertility during the first five years following the death of a parent. The long-term effect of mortality on offspring fertility is investigated by analyzing the propensity of permanent childless depending on parental deaths. The study also separates between parental deaths due to cancer or accidents.

Why should parents' death affect the offspring's fertility?

Since a possible link between parental death and offspring fertility has not previously been studied, there is little theory to explain a possible relationship. What is sometimes referred to as the social

isolation perspective on the relationship between social support and fertility, state that individuals who have fewer and weaker social ties will compensate this lack of social support by creating new social ties, partly by having children [19-21]. The loss of a parent should in most cases mean a significant reduction in social support and it is therefore possible that a parental death could lead to increased fertility among the offspring's as they compensates for the reduction in social support by creating their own families.

Another possible explanation for how parental death may affect children's fertility can be found in the stress and disorientation perspective that states that fewer social ties will lead to lower fertility. Individuals that feels that the world around them are stressful, norm-less and chaotic will not be as likely to take the decision to bring a child into the world as individuals who feels that the world around them are well established and peaceful [22]. Individuals who experience a parental death should be more likely to perceive their lives as stressful and therefore be less likely to enter parenthood. The stress and disorientation might also be applied to the period before the parental death. Depending on the cause of death also the time prior to the parental death might be a stressful time in which the offsprings desire to bring a child into the world decreases.

It has been suspected and in some cases demonstrated that stress can negatively affect reproductive function. However, evidence supporting that human fertility decreases during periods of stress is neither overwhelming nor unchallenged [23].Some research has found that both male and female fertility decreases due to increased levels of stress hormones during periods of stress. Other researchers explains decreased fertility during periods of stress with under-nutrition or nutrition disorders which is associated with stress [24].

Although the period immediately prior to a parental death is likely to be stressful for most people it is not necessarily equally stressful for men and women. Previous research has shown that women are much more likely to participate in the care giving of elderly parents [25]. It is therefore possible that women are more affected by the stressful period before a parental death.

Another reason for why men and women might experience a parental death differently is that men and women respond differently to maternal and paternal deaths. Previous research has shown that men's mental health is more likely to be negatively affected by a paternal death then by a maternal death. On the other hand, women's mental health is more likely to be affected negatively if she experience a maternal death [26]. Since most people who experience the loss of a parent during

their reproductive age, experience a paternal death it is perhaps possible to see that men's fertility is affected more negatively.

Methods

Data

The data were extracted from the Swedish population register, which covers the whole Swedish population and its vital events with very high accuracy. In this study, all Swedish-born individuals born between 1947 and 1962 and for which it is possible to identify both biological parents were included. Individuals who were adopted were excluded from analyzes. It has previously been established that there often exists under-registration of mortality among immigrants in official mortality statistics due to re-immigration at higher ages [27]. In order to obtain as high quality information as possible on parents mortality, only Swedish-born parents were included. In the Swedish population register 1 500 508 individual meets these criterions. Table 1 presents the characteristics of the study populations.

Since the child's social background may affect both the child's age at becoming a parent [28] and the probability of experience a loss of a parent during the reproductive age information [29] about the parents' social class [30] were included in the analysis. Information about parents' occupations have been taken from the Swedish population censuses and then been coded into EGP. The highest EGP of both parents has been used [31]. Individuals whose parents' occupation has not been possible to determine constitute a separate category in the analyzes.

Educational level of the child at the end of the reproductive age (age 45) was used as a measure of socioeconomic position. In the analyses, the Swedish educational schemes were reclassified into three categories corresponding to the International Standard Classification of Education (ISCED): lower secondary education or less (ISCED categories 0–2), upper secondary education (3–4) and post-secondary education (5–6). Individuals with unknown educational level were combined with the lowest level of education.

Information on parents mortality comes from the Swedish Cause of Death Register. ICD-7, ICD-8 and ICD-9 and ICD-10 were used create categories of "Accidents" and "Cancer" as causes of death. The causes of death "Cancer" and "Accidents" were included in the analyzes as interactions with the first parents death to study if fertility after a sudden death (accidents) differs from fertility

after a death that most likely occurred after a time of illness. Although the Swedish registry data are massive, not enough individuals experiencing the event of losing both parents during the reproductive age, to make separate analyzes on different causes of death for the second parental death.

Methods

First logistic regression was used to estimate the association between parental death and the likelihood of being childless at the end of the reproductive age. For women the dichotomous variable of permanent childlessness was measured at age 45 and for men the same variable was measured at age 50. The estimated odds ratios (OR) with 95% confidence interval (CI) were adjusted for parents class, oldest parents birth year, mothers age at first birth, index persons final educational level, birth year and number of siblings.

Second, event history analyses were used to study how parental deaths influence children's fertility immediately after a parent's death. The estimated relative risks (RR) with 95% confidence interval (CI) were adjusted for parent's class, oldest parent's birth year, mother's age at first birth, birth year, number of siblings and calendar year. The data were organized into longitudinal histories containing information on all first child births. Additional information on emigration and death were added to censor observations at appropriate points in time. The basic time variable was age of the index person. Cases were included regardless if they ever had a child or not. The age was given in six month periods since the respondent's fifteenth birthday. Respondents were followed from age fifteen to a first birth, or if no event had occurred, until time of a possible emigration, death, or age 45. The variable indicating parental deaths during the reproductive age were included as a time-varying variable which measures years since first or both parents' death. Both the logistic regressions and the event history analysis were done using separate models for men and women.

Results

85.4 % of all women in the study had become mothers by the age of 45 and 80.3 % of all men had become fathers by the age of 50. In the studied cohort 39.8 % of women experienced a parental death and 11.6 % experienced the death of both parents during the reproductive age. For men, 43.4

% experienced a parental death and 20.2 % experienced the death of both parents, during the reproductive age.

When analyzing the relation between the parental death and childlessness, both the death of one and two parents showed a significant impact on the propensity to be childless at the end of the reproductive age. The OR for childlessness among women who had experienced a parental death, compared to women who had not experienced any parental death, was 1.04 (95% CI: 1.02–1.05), adjusted for birth year, education, number of sibling, mothers age at first birth, oldest parents birth year and social background. The OR among women who had experienced parental death of both parents was 1.06 (95% CI: 1.03–1.08). The OR for childlessness among men who had experienced a parental death, compared to men who had not experienced any parental death, was 1.08 (95% CI: 1.06–1.09), adjusted for birth year, education, number of sibling, mothers age at first birth, oldest parents birth year and social background. For men who experienced the death of both parents, the OR was 1.14 (95% CI: 1.12-1.17) compared to men who did not experience any parental death. Thus, both men and women who experienced a parental death during the reproductive age are more likely to end up permanently childless than men and women who do not experience the event. The magnitude of the positive relationship between parental death and permanent childlessness is even higher if both parents die compared to only one parent dying. Furthermore, the positive relationship between parental death and childlessness is stronger for men than for women.

When analyzing the relation between the parental death and risk of first birth, both the death of one or two parents showed a significant impact on the risk of becoming a parent.

The women who experience a first parental death have a significantly higher risk of becoming directly after the parental death. All six month periods after the first parent's death means significantly higher risk of becoming a parent compared to baseline group not experienced a parent's death. During the first six months after the first parental death the RR is 1.10 (95% CI: 1.03–1.17). RR then increases for each successive six-month period up to the fourth six-month period when the elevated RR begins to fall back. Women who experience a first parental death due to cancer have a significantly higher risk of becoming a mother directly after the parental death, but do not differ significantly in relation to other categories of causes of death. Women who experience a first parents death as a result of an accident do not have a significantly higher risk of becoming a parent after directly after the parental death. Only three six-month periods after a

parent died in an accident is the RR significantly higher compared to women who have both parents still alive. Women who lose a parent, where the cause of death is accident, also has a later peak compared with other causes of parental deaths. While all other categories of causes of death (including cancer) experience the highest RR four six-month periods after the parental death, women whose parents died as a result of an accident experience the highest RR of 1.42 (95% CI: 1.23–1.64) thirty-six months after the parental death. For women who experience a first parental death, even after five years (ten periods of six months), has a higher RR of 1.07 (95% CI: 1:03 to 1:11) and throughout the reproductive age.

The impact of a second parental death is even stronger. The first six months after the second parent's death RR of having a first birth is 1.34 (95% CI: 1.05-1.70) compared with baseline. For women who experience a second parent's death remains RR was significantly higher in the first nine six-month periods after the other parent's death. Also, women who experience the death of both their parents, still five years after the death of the second parent, shows a higher RR of 1.24 (95% CI: 1:01 to 1:52) compared to the baseline of women with both parents still alive. As already pointed out, even with such a large data as in this case, it is not possible to study the second parental death divided into different categories of causes of death.

For men, the results are similar to those of women. However, the magnitude of the impact of parental death on men’s risk of becoming fathers is weaker. For men who experience a first parental death the RR is 1.07 (95% CI: 1:02 to 1:14) during the first six months after the parent's death. As for women who experience parental death, the relative risks continue to increase until the twenty-fourth month after the parent's death, and then gradually decline. Unlike women who experience a first parental death, men are not at significant higher risk of becoming a parent after 5 years, compared to the baseline of men with both parents still alive.

Men who experience a first parental death due to cancer has a higher risk of becoming fathers in the years after the death but do not differ significantly from other categories of causes of death of the deceased parent. However, men who experience a first parental death due to an accident have significantly different RRs compared to men who lose a parent as a result of any other categories of causes of death. As for women, men who experience a parental death as a result of an accident do not differ from the baseline during the two first six-month periods after the death of the first parent. However, one year after the parental death caused by an accident, the RR is 1.42 (95% CI: 1.22-1.65). The RR of becoming a father for men who lose a parent due to an accident continues to

be significantly higher than the baseline for another year (fourth and fifth six-month period after the first parent's death). Unlike women who experience a first parental death as a result of an accident, men only have significantly higher RR in the third, fourth, and fifth six-month period after the parent's death. Women who experience the same event have significantly higher RR throughout the reproductive age.

Men who experience a second parental death have, like women who experience this type of event, significantly higher RR directly after the second parent's death and throughout the studied ages. RR for men who experience a second parental death is 1.57 (95% CI: 1.28-1.92) during the first six-month period after the other parent's death and still 1.33 (95% CI: 1.12-1.57) after five years.

Discussion

The principal finding of the present study was that people who experience a parent's death have a significantly higher risk of becoming a parent directly after parent's death, and for some time to come. Despite these results, those who have experienced a parental death are significantly more likely of being permanently childless. The results may be seemingly contradictory to each other. Significantly higher risk of becoming a parent after parental death should be combined with the result that childlessness is more common among those who experienced a parental death. After controlling for both characteristic on the parental level (index person's social background, index person's mother's age at first birth and index person's oldest parent's birth year) and index person's level (birth year, education level and number of siblings) the only likely explanation for why individuals who experience a parents death have higher risk to remain permanently childless despite having a very high fertility immediately after the parent's death is that they probably have had a very low fertility before the parental death. The argumentation and recommendation in [32-33] on anticipatory analysis are followed and no separate measurements of first birth risks pre of the parental death have been estimated. It is only possible speculate why those who experience a parental death are at higher risk of ending up childless even though they have significantly higher risk of becoming a parent after the parent's death. The increased RR is already seen in the first six-month period after the first parental death, which indicates that the transition, probably from low, to high fertility occurs before or just before the parent dies. Those who experience a parental death due to an accident, showing no significant difference from the baseline immediately after the

parent dies. Only two years after the parental death due to an accident is the offsprings fertility pushed up. This can be seen as an indication that fertility among those who experience a parental death where the cause of death is accident, do not differ from the baseline before the parent's dies. At least people who suddenly lose a parent do not seem to have any different fertility before the parental death.

When looking at the difference between women and men, the results suggest that women recover better from a parental death than men. Women who experience parental death have a significantly higher fertility after but also throughout the reproductive age. However, men have more or less the same high fertility immediately after a parental death, but do not remain at any higher risk of becoming a parent after five years after the parent died. It makes sense to conclude that this is the reason why men experience parental death during the reproductive age are at higher risk of ending up in permanent childlessness than women who experience same event. These results and this interpretation is also consistent with previous research [34] which shows that men suffer more psychologically from losing a father than women do. The death of the mother affects women and men different and women are more likely to be negatively affected by the loss than men. Since most people who experience a parental death before the end of the reproductive ages experiencing the death of his or her father it makes sense that men are more affected by parents' mortality.

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