Number of siblings and psychotropic medication purchases surrounding parental death in adulthood: a population-wide cohort study in Finland

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ABSTRACT

Background Parental death has well-established adverse effects on the mental health of children and adolescents, but evidence on adults is scarce. Also, the role of siblings has not been assessed before, even though siblings might be an important source of support during parental death.

Methods We conducted a national cohort study to examine psychotropic medication purchases (antidepressants, anxiolytics, hypnotics and sedatives) before and after parental death and assessed differences by sibship size and sex of the offspring. We estimated annual probabilities of psychotropic medication purchases for 6 years surrounding parental death and compared men and women experiencing parental death from 2006 to 2016 at ages 35–55 years to a synthetic control group not experiencing parental deaths.

Results We showed increased psychotropic medication purchases in the year before and after parental death. These associations were strongest for those with no or fewer siblings and among women. For example, after mother's death, we observed an increase of 6.8 (95% CI 5.8 to 7.8) percentage points (pp) in psychotropic medication prevalence for women with no siblings in contrast to women whose mother did not die. For women with 1, 2 or 3 siblings, the respective differences were 6.1 (95% CI 5.5 to 6.8), 4.7 (95% CI 4.0 to 5.4) and 3.9 (95% CI 3.0 to 4.8) pp increases. The associations were also stronger after maternal than paternal death.

Conclusions The findings may indicate that the burden of parental death is less substantial when several siblings are present. The more pronounced association among women may reflect gendered differences in treatment-seeking.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Parental death has well-established adverse effects on the mental health of children and adolescents, but evidence on adults is scarce, although most people face the deaths of their parents in middle or older age.

⇒ Also, the role of siblings—who face the death of their parent simultaneously—has previously received no attention in the bereavement literature, even though siblings might be an important source of support during parental death.

WHAT THIS STUDY ADDS

⇒ The study provides an initial insight on how siblings are associated with mental well-being in the event of parental death and finds evidence that having more siblings is, on average, associated with fewer psychotropic medication purchases in the event of maternal death. The results were more robust with women.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ As families have become smaller, facing parental death might be increasingly difficult on average.

⇒ Although our results show the potential mental well-being relevance of sibship networks before and after parental death, more studies on the topic are needed.

INTRODUCTION

Parental death is a stressful life event that can decrease mental and physical well-being.[1 2] While numerous studies indicate adverse mental health consequences of experiencing parental death in childhood or adolescence,[3–8] studies on the mental health of adult offspring are scarce, even though most persons in high-income countries face the deaths of their parents in middle or older age.[9–13]

The few studies that focus on the mental health of adults facing parental death have found negative outcomes right after parental death, with increases in prescribed psychotropic medication purchases,[9] depressive symptoms[14] and experienced psychological distress.[13 15] The risks of suicides and alcohol-related mortality have also been observed to increase following parental death in Finland.[11] While parental death in adulthood has been mostly associated with short-term disruption to mental health, prolonged negative mental health impacts have also been observed, especially with an unexpected death of the parent.[10 15] In contrast, caregiver burden and anticipatory grief relating to chronic illness or frailty of a parent might affect offspring mental health already in the parents' last years of life.[16]

Numerous factors may influence the bereavement process and its mental health consequences,[2] yet, to what extent the mental health impact of parental death may depend on having siblings is still poorly understood. Siblings face the death of their parent

simultaneously and may offer each other social and emotional support. Moreover, they can potentially also share practical and financial responsibilities during the time before and after parental death. However, to our knowledge, there have been no prior attempts to assess whether and how having siblings is associated with mental health in the event of parental death. Additionally, how the number of siblings might affect bereavement is an increasingly relevant question, as families have become smaller,[17] indicating that the burden of both parental loss and the end-of-life care falls on fewer shoulders.

To investigate whether sibship size is associated with changes in psychotropic medication purchases before and after the death of a parent, we use data from the Finnish population registers. We compare adults experiencing parental death in mid-life, at ages 35–55 years, to a control group not experiencing parental death. We use parental deaths occurring during 2006–2016 and follow the offspring up to 3 years before and after the event of the death. We assess maternal and paternal deaths separately among men and women since a mother's death has been observed to be more detrimental to health than a father's death and the associations may depend on offspring gender.[10 15 18] We expect a larger number of siblings to be associated with smaller increases in psychotropic medication purchases around parental death, possibly due to shared burden and support given by the siblings.

METHODS

Study participants

The study is based on administrative data on all persons living in Finland from 1987 to 2019. We focus on parental loss in mid-life when the offspring are likely to have gained independence from their parents and lead active working and family lives of their own. At these ages, parental loss becomes more common but is not yet ubiquitous. Therefore, we restricted the observation to individuals aged 35–55 years during 2006 to 2016.

We identified the dates of death for the biological parents from the Cause of Death Register maintained by Statistics Finland. We excluded individuals who could not be linked to their parent, had their respective parent die either before age 35 or before the start of follow-up in 2006, or individuals who died or moved abroad before their respective parent died, meaning 811 912 persons (40.1%) for father's death analyses and 420 503 persons (20.8%) for mother's death analyses. Individuals who did not experience parental death during the study period 2006 to 2016 formed a synthetic control group and were assigned randomised faux dates of parental death, which ranged between 1 Jan 2006 and 31 December 2016.

For ease of comparison, the observed population was restricted to adults with zero to three siblings, meaning that 202 494 persons (11.6%) were excluded from the mother's death analyses and 124 567 persons (9.6%) were excluded from the father's death analyses. The final sample consisted of 1 368 619 individuals observed for mother's death and 1 041 981 for father's death, among whom 12.5% experienced maternal death and 22.6% paternal death. A flow chart of the analysis population is presented in online supplemental appendix 1.

Psychotropic medication purchases and sibling characteristics

We assessed psychotropic medication use 3 years before and after parental death based on the Finnish Prescription Medication Register that contains data from all retail pharmacies and is maintained by the Social Insurance Institution. We used the Anatomical Therapeutic Chemical Classification System codes to identify purchases of antidepressants (N06A), anxiolytics (N05B) and hypnotics and sedatives (N05C) that are commonly prescribed for symptoms of psychological distress, depression and anxiety, or psychosomatic reactions such as sleep disturbance, which death or impending death of a parent can trigger.[2] All included psychotropic medications require a prescription from a physician.

Our main predictor, number of siblings, is based on full biological siblings alive and residing in Finland at the time of the actual or faux parental death, categorised as 0, 1, 2 and 3 siblings. Information on siblings, their sex and birth order (1, 2, 3, 4) was obtained from the longitudinal population files of Statistics Finland.

Statistical analyses

We modelled trajectories of any annual purchase (0,1) of psychotropic medication before and after the actual or faux date of parental death by including time relative to the event into a linear probability model as a categorical variable (years −3/–2/−1/0/1/2 with year zero starting from parental death). Differences in medication purchases by sibship size were modelled by interacting time with sibship size. The medication prevalence differences are calculated for each time point and each sibship category between the case and control groups to consider the potentially differing time trends and baseline levels between sibship size groups. General estimation equations with unstructured correlation matrices were used to account for repeated measures. We present our results as differences in the average annual predicted prevalence of psychotropic medication purchases by sibship size between those who experienced parental death and the synthetic control group.

We used dummies for the year of medication purchase to control for increasing medication purchases over time. All analyses were performed separately for mother's and father's deaths. We also ran a stratified analysis by offspring sex.

Sensitivity analyses

We performed additional analyses in shorter 6-month intervals in the year before and after parental death, and analysed psychotropic medication subtypes (antidepressants, anxiolytics, and hypnotics and sedatives) separately to assess potentially different patterns of changes.

We also compared birth order within sibships to see whether the youngest or oldest children's medication purchases might react differently to parental death. Such differences might rise from patterns of expectations, parental attachment or care-burden by birth order.[19] Furthermore, we assessed potential differences in trajectories by supposed abruptness of parental death by focusing on three types of causes of death: external causes of death (International Classification of Diseases (ICD) 10-codes: V01-X44, X46-Y89, U129), cancer (ICD 10-codes: C01-C97), and dementia (ICD 10-codes: F01, F03, G30, R54). We also separately assessed parents who were the first or the last biological parent to die.

Weighting the study population

Persons experiencing parental death might differ from the synthetic control group of those with a living parent. To respond to this bias, we used inverse probability treatment weights.[20] First, we predicted the probability of parental death with a logistic regression model with all the individual characteristics as the independent variables. Second, weights were calculated as the inverse of this probability. Essentially, we gave more weight to people in the control group who

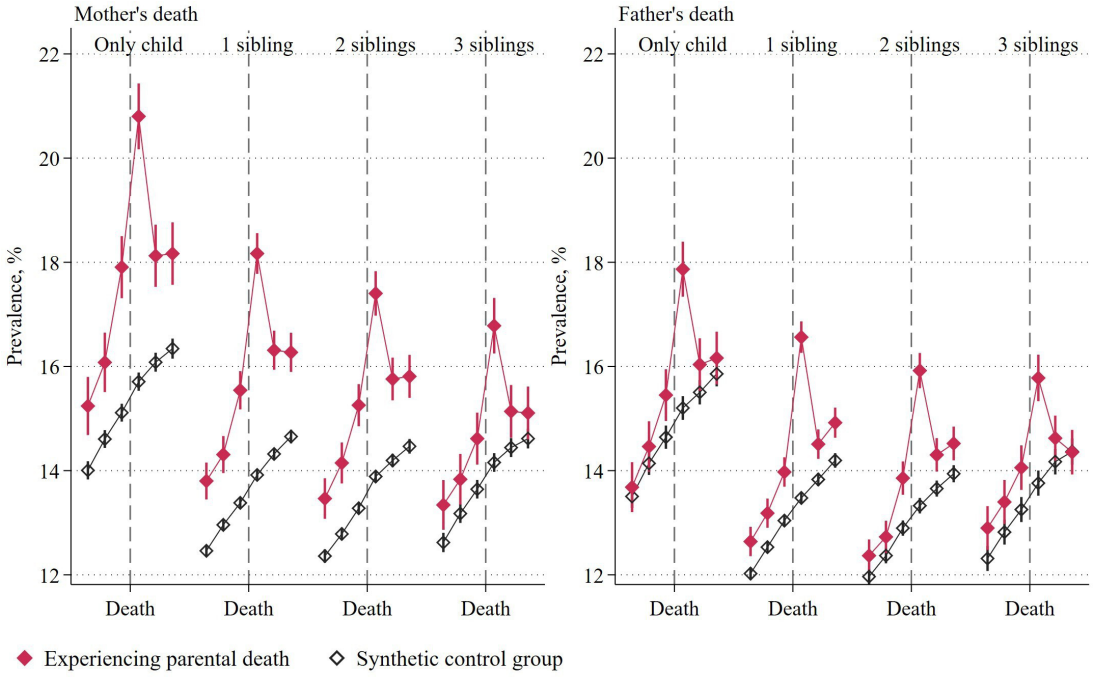

Figure 1 Predicted prevalence of offspring psychotropic medication purchases during 6 years surrounding parental death by sibship size (0 to 3 siblings). Dashed vertical line indicates time of parental death. Father's and mother's death modelled separately. Models with 95% CI. n=1 368 619 with mother's death and 1 041 981 with father's death analyses.

were similar to people experiencing parental death to decrease problems related to the uneven distribution of confounders among the exposed and unexposed groups.[20] Extreme weights were truncated to the 99th percentile.

We weighted the population using sociodemographic information obtained from Statistics Finland. Potential confounding variables that are likely to be associated with the baseline prevalence of psychotropic medication use and treatment-seeking behaviour include age, age squared and educational attainment (basic, secondary or tertiary education) of the child at the time of parental death or at the time of the faux date. We also included parental marital/cohabitation status (1,0), and whether the deceased parent was the last biological parent alive (1,0); both could measure differences in the availability of support. Single and separated persons have been noted to show a more intense grief response after parental death;[12] therefore, we included offspring marital/cohabitation status (1,0). Finally, we included the geographical area of residence (n=19) to account for potential regional differences in medication purchases. Lastly, we included birth cohort dummies for both parent and child.

The covariate balance between the persons experiencing parental death and the synthetic control groups by sibship size is presented in online supplemental appendix 2. Overall, the synthetic control group is more educated, younger, more likely to have a partner and the other parent still alive than the persons experiencing maternal or paternal death. This is likely due to selection by both offspring and parental age. Also, having fewer siblings is correlated with younger age.

RESULTS

Figure 1 shows the predicted prevalence of medication purchases before and after parental death by sibship size. In general, with a smaller sibship size, there was a higher probability of medication purchases, and with the group experiencing parental death, there were increases in medication purchases in the year before death and a clear peak in the following year. The annual prevalence ranged between 12–21%, increasing over time in all groups, but the starkest increases in psychotropic medication prevalence were observable with mother's death and with those with fewer siblings. There were level differences in medication purchases by sibship size, as the baseline prevalence is higher for the only children, as compared with the other sibship sizes. For easier comparison, figure 2 shows the percentage point (pp) differences in medication prevalence between those experiencing parental death and the synthetic control group by sibship size.

For mother's death, there was a gradient between psychotropic medication and sibship size; having fewer siblings showed a stronger peak in psychotropic medication purchases during the year following maternal death as compared with the synthetic control groups (figure 2).

In the year following mother's death, being the only child was associated with a 5.1 (95% CI 4.4 to 5.7) pp medication prevalence difference between the case and control in contrast to a 4.3 (95% CI 3.9 to 4.7) pp prevalence difference of having one sibling, 3.5 (95% CI 3.1 to 4.0) pp difference with two siblings or 2.6 (95% CI 2.0 to 3.2) pp difference with three siblings.

The differences by sibship size were already visible during the year before mother's death: 2.8 (95% CI 2.2 to 3.4) pp for only children, 2.2 (95% CI 1.8 to 2.5) pp for persons with one sibling, 2.0 (95% CI 1.6 to 2.4) pp with two siblings, and 1.0 (95% CI 0.4 to 1.5) pp with three siblings. The differences by sibship size mostly attenuated after the first year after mother's death.

For father's death, the increase in medication purchases only occurred in the year following death. The increase was overall smaller than for mother's death and similar regardless of sibship size.

Figure 3 shows the medication prevalence differences separately for women (see predicted baseline levels in online supplemental appendix 3). For paternal death, there were no sibship size differences in psychotropic medication purchases at any

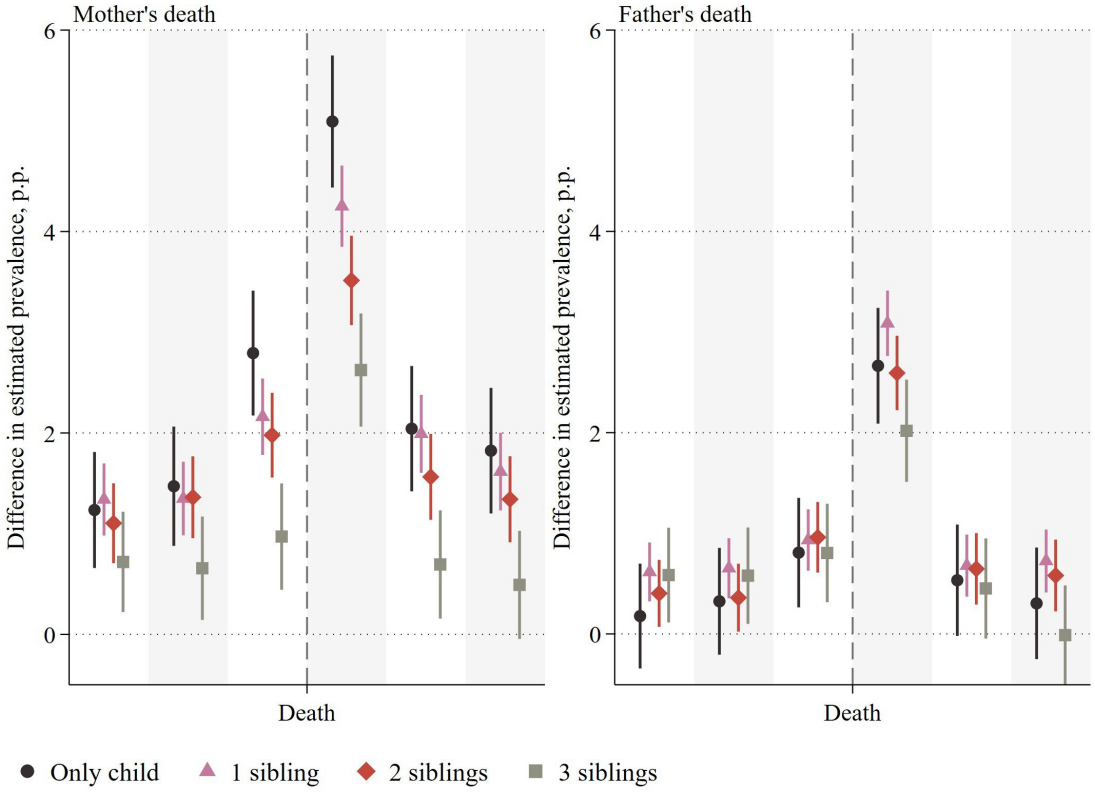

Figure 2 Percentage point (pp) differences on estimated psychotropic medication purchase prevalence during 6 years surrounding parental death. Comparison of individuals with 0 to 3 siblings experiencing parental death in relation to the synthetic control groups. Dashed vertical line indicates time of parental death. Models with 95% CI. n=1 368 619 with mother's death and 1 041 981 with father's death analyses.

point of the 6-year follow-up. Regarding mother's death, the increase in medication prevalence was larger for those with fewer siblings. The differences with sibship size started during the year before maternal death and they were starkest during the year starting from mother's death. After mother's death, being the only child was associated with a 6.8 (95% CI 5.8 to 7.8) pp difference to the synthetic control group of only children. Similarly, we observed a 6.1 (95% CI 5.5 to 6.8) pp increase among those with one sibling, 4.7 (95% CI 4.0 to 5.4) pp increase with two siblings or 3.9 (95% CI 3.0 to 4.8) pp increase with three siblings. However, these differences mostly attenuated in the second year following maternal death.

For men experiencing maternal or paternal death, the differences by sibship size were small in absolute terms and the confidence intervals were mostly overlapping (figure 4, see predicted baseline levels in online supplemental appendix 4).

Sensitivity analysis results

We performed analyses with shorter intervals of 6 months in the 2 years surrounding parental death to assess the timing of medication purchases in more detail (online supplemental appendices 5 and 6). The medication purchases peaked right after parental death, with similar sibship size differences as in our main results.

We assessed the different psychotropic medications in separate analyses (online supplemental appendices 7–10). Compared with antidepressants, purchases of anxiolytics, hypnotics and sedatives show a somewhat clearer peak around parental death. Overall, the sibship size gradient in each medication subtype looks similar.

Assessing birth order in the sensitivity analyses, the increases in medication purchases around maternal death were highly similar between earlier and later born offspring, and there were no birth order differences within the sibship size groups (online supplemental appendices 11 and 12).

We also performed separate analyses concerning the abruptness of parental death with the underlying cause of death being dementia (ICD 10-codes: F01, F03, G30, R54), cancer (ICD 10-codes: C01-C97) and external cause (ICD 10-codes: V01-X44, X46-Y89, U129) in each respective analysis (online supplemental appendices 13–15). For parental deaths due to dementia, the level of psychotropic medication purchases among offspring was elevated throughout the follow-up, without notable differences by sibship size. The most notable differences by sibship size were observed in maternal deaths due to cancer, where the medication purchases strongly increased in the year before mother's death, particularly among those with fewer siblings. When the parent died from external causes such as falls, other accidents or suicide, offspring's psychotropic medication purchases peaked in all sibship groups without clear evidence for differences given the wide confidence intervals for these rarer causes of deaths.

Finally, we considered whether the parent was the first or last parent to die (online supplemental appendices 16–18). In general, the order of the death seemed to matter little for the differences by sibship size, with only children whose mother died first being an exception to this. The results from this sensitivity analysis suggested that while there still was a clear sibling gradient with mother's death, it did not matter much whether the parent was the first or last one to die.

DISCUSSION

While we observed an increase in the psychotropic medication purchases after the death of either parent, mother's death showed

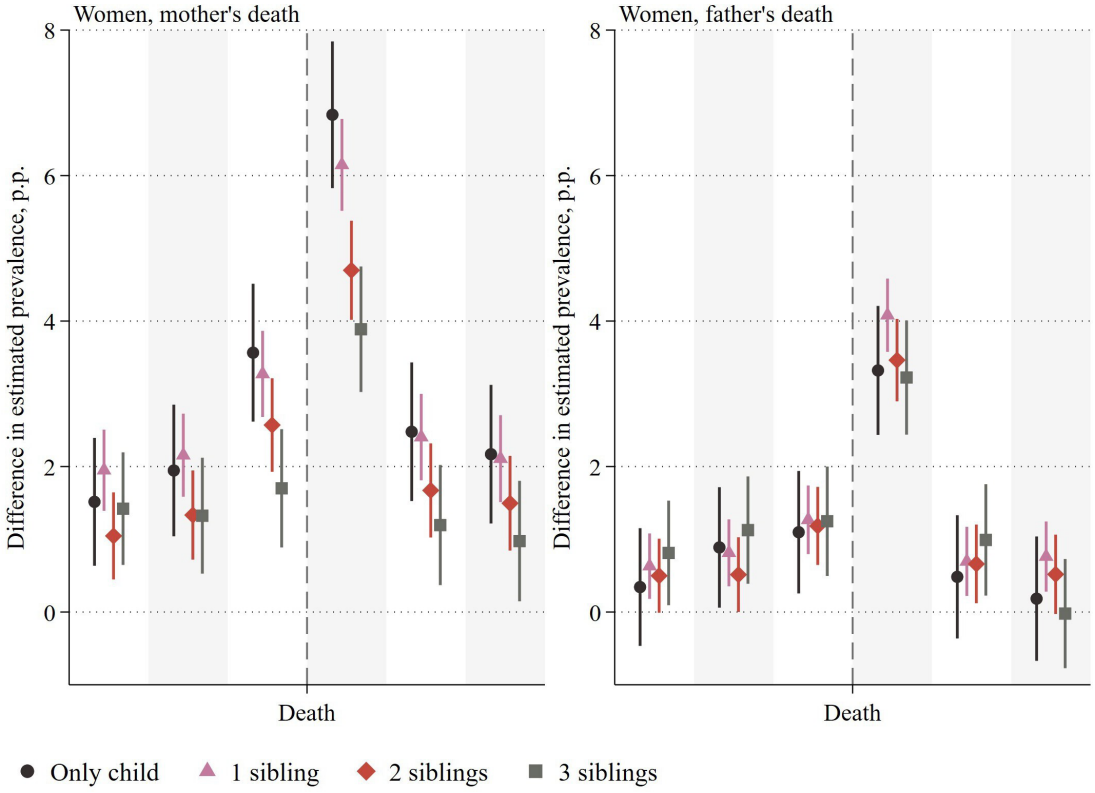

Figure 3 Percentage point (pp) differences on estimated psychotropic medication purchase prevalence of adult women during 6 years surrounding parental death. Comparison of sibling groups (0 to 3 siblings) experiencing parental death in relation to the synthetic control groups. Parent–child sex combinations modelled separately. A dashed vertical line indicates time of parental death. Models with 95% CI. n=669 181 with mother's death and 507 815 with father's death analyses.

larger increases in medication prevalence. We observed especially increased psychotropic medication purchase prevalence for women with fewer siblings, and in the event of maternal death. For maternal deaths, these differences by sibship size emerged already in the year preceding death. Overall, increases in psychotropic medication purchases were much more notable with women than men.

There might be several reasons behind these associations. First, siblings may support each other before and after parental death and share caretaking and other burdens. Also, parental attachment might be stronger in smaller families,[19] which in turn leads to a more intense mental health response when the parent dies. Conversely, some siblings in larger families may be more attached to their parent and participate in the caregiving more over the other siblings, which could show as decreased medication purchases in larger sibship groups on average.

Prior findings about bereavement differences by offspring's sex corroborate our results of women being more affected by parental death. For example, in Germany, women who lost their mothers were recorded to experience deepest loss of life satisfaction,[10] and in the USA, women were observed to have a more intense grief response after parental death and more difficulty adjusting to the loss of a parent.[12] Furthermore, women have been identified as more likely to act as principal caregivers for their elderly parents.[21] In the context of this study, the clearer sibship size trajectories for women in the event of mother's death could reflect this unequal care-burden.[22 23]

Mother's death was associated with larger increases in psychotropic medication purchases for both men and women than father's death, and the sibship size differences on medication purchases observed with women were more notable with mother's death. Prior literature provides rather consistent views on maternal death being more detrimental to both mental and physical health of the offspring.[10 15 18] This could be due to mother–child relationships being categorised with more emotional and material support, more shared values and greater stability as compared with father–child relationships.[24 25] Also, children in general spend more time with their mothers while growing up,[26 27] and in the event of parental separation, mothers are the more likely custodians.[28] If generally there is a greater attachment to mothers, this attachment could further be emphasised by smaller sibship size as we observed larger medication prevalence differences by sibship size with mother's death. Finally, mothers tend to be frailer when they die,[29] which could mean accumulation of caregiving and anticipatory grief in smaller sibships.

Having fewer siblings—and thereby a potentially weaker social support system—appears a risk factor for psychotropic medication use when experiencing maternal death, likely signalling mental health consequences. Geriatric and hospice care clinicians could act pre-emptively on the mental health of bereaved adults, asking about potential support networks, with an emphasis on close relatives, already when the parents have become frail, and counsel and inform the offspring accordingly.

Limitations

While the population-level register data offers statistical power and alleviates potential selection biases, social networks or interactions between families, friends or loved ones are not included in the data of purely administrative nature. We also lack information on the qualitative characteristics of family relationships that are likely important determinants in these associations. While survey data have the potential to provide a remedy here,

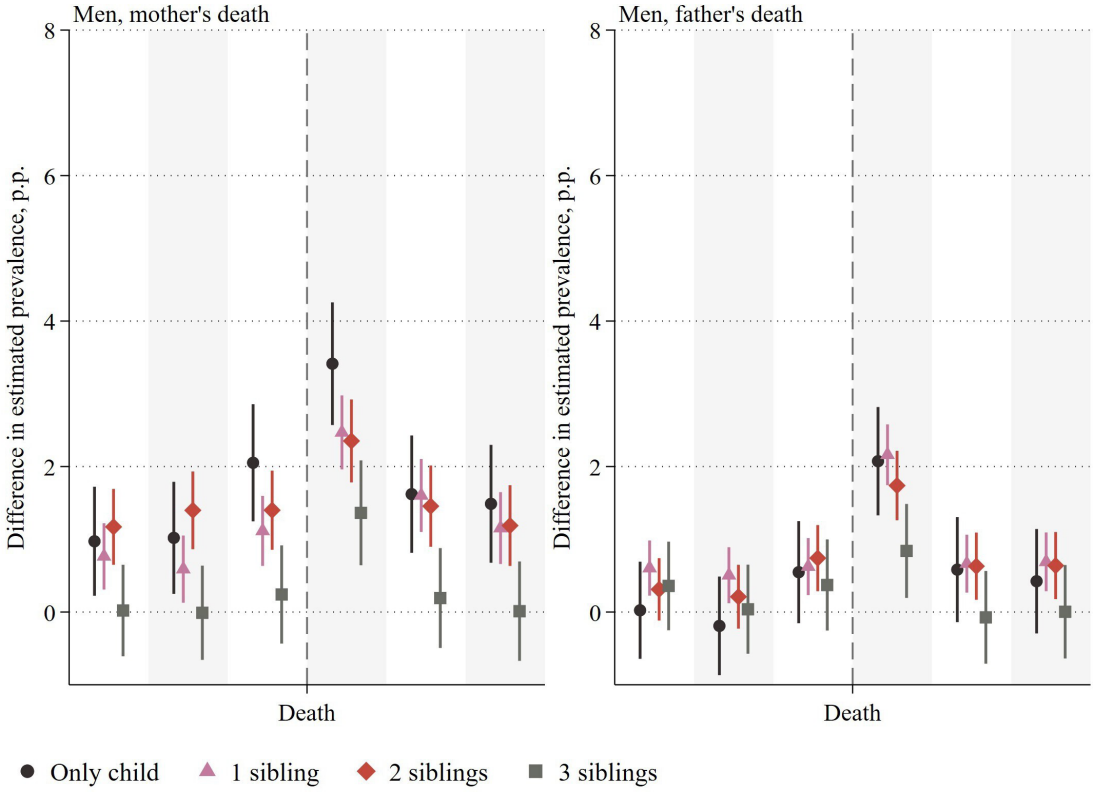

Figure 4 Percentage point (pp) differences on estimated psychotropic medication purchases of adult men during 6 years surrounding parental death. Comparison of sibling groups (0 to 3 siblings) experiencing parental death in relation to the synthetic control groups. Parent–child sex combinations modelled separately. A dashed vertical line indicates year starting from parental death. Models with 95% CI. n=699 438 with mother's death and 534 166 with father's death analyses.

longitudinal survey data often lack sufficient follow-up time and linkage capacity with siblings living outside the household (which is the norm in Western countries in adulthood), suffer from attrition, particularly after adverse life events such as parental death, and offer less robust measures of health outcomes. Furthermore, to reduce complexity, we only considered biological full-siblings, even though step- and half-siblings may be a source of emotional and social support especially among the more recent cohorts.

The covariate balance of the synthetic control group differed from the persons experiencing parental death. We calculated the inverse probability weights by all the various sociodemographic covariates (excluding sibling information), but the two groups could still differ by some unobserved confounding factors. Overall, the weighting did increase similarity between the population experiencing parental death and the synthetic control group (see online supplemental appendix 19 for the results from the unweighted models). Furthermore, there are sample selection differences between maternal and parental deaths as fathers tend to die younger than mothers, and a great number of fathers have already died before their offspring turns 35 years old; this might have contributed to the observed medication differences between maternal and paternal deaths, as the children of earlier cohorts with larger families are more likely to have already lost their fathers. Additionally, the fathers or mothers dying younger might have more health and behavioural issues, so we could be excluding those offspring who have risk factors for psychotropic medication purchases.

Although using psychotropic medication purchases is an objective and standardised way of tracking individuals, the purchases partly reflect treatment seeking behaviour and thus our data do not cover all mental health symptoms relating to parental death. Men do not seek psychological help as much as women do,[30 31] and the observed sex differences might also reflect gendered treatment-seeking patterns instead of mental well-being differences. In Finland, adult men have been observed to experience the highest increases in mortality following parental death.[11] Also, a medication purchase is not the same as medication use or adherence to medication. However, self-reported use of psychotropic medication and the administrative prescription data have been shown to be highly concordant in Finland.[32] Finally, there might be unobserved confounders related to medication purchases by sibship size. For example, religious views could affect both family size and treatment-seeking patterns, and parental mental health problems might be associated with both smaller sibship size[33] and children's mental health problems.[34] This is true for other parental chronic health conditions as well, and is partly influenced by environmental and lifestyle factors.[35–37]

Finally, our results are based on Finland, a context characterised by an extensive public health and social care system. While we do believe that siblings can form an important social support network, which could be even more important in family-centric societies, our results should be externally validated in different contexts to see whether the associations observed in this study are generalisable outside a Nordic welfare state.

CONCLUSIONS

We showed increased psychotropic medication purchases in the year before and after maternal death. These associations were strongest for those with no or fewer siblings and among women. The findings suggest that the mental health burden of bereavement and impending parental death is less substantial

when several siblings are present. Both uneven care burden and gendered treatment-seeking behaviours may contribute to the observed sex and sibship differences.

Our results show the potential mental well-being relevance of sibship networks in coping before and after parental death. More research of sibling interactions before and after parental death is needed to unravel mechanisms driving these associations and to assess other health conditions. Considering the shrinking kinship networks in many ageing societies, children may face increasing strain as their parents near the end of their lives.

Contributors JL designed the study. PM acquired the data. JL ran the statistical analyses with support from JP and HR. JL wrote the initial draft of the manuscript with help from all authors. All authors contributed to the interpretation of the findings and revising the manuscript. All authors approved the final manuscript. JL is the guarantor.

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Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval The study has been approved by Statistics Finland Board of Statistical Ethics (TK-53-1490-18) and the Social and Health Data Authority Findata (THL/2180/14.02.00/2020).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data sharing not applicable as no datasets generated and/or analysed for this study. Due to data protection regulations of the national register-holders, we are unable to make any parts of the data available to third parties. Interested researchers may contact Statistics Finland. Contact by email: tutkijapalvelut@stat.fi.

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