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Alcohol-related mortality following the loss of a child: a register-based follow-up study from Norway

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ABSTRACT

Objectives The death of one's child is one of the most stressful events a person can experience. Research has shown that bereaved parents have a higher mortality than non-bereaved parents. This increased mortality might partly be caused directly by long-term stress. However, changes in health behaviour such as an increase in alcohol consumption might also play a role. This study examines the association between losing a child and alcohol-related mortality. In addition to Cox regression models using data covering the entire Norwegian adult population, we employ sibling fixed-effect models in order to partly control for genes and childhood experiences that might be associated with both losing a child and alcohol-related mortality.

Design A follow-up study between 1986 and 2014 based on Norwegian register data.

Setting Norway.

Participants The entire Norwegian adult population.

Primary outcome measure Alcohol-related mortality.

Results An increased alcohol-related mortality was found among parents who had experienced the death of a child. The HR of alcohol-related mortality among those bereaved of a child was 1.59 (95% CI 1.48 to 1.71) compared with non-bereaved parents, for women 2.03 (95% CI 1.78 to 2.32) and for men 1.46 (95% CI 1.34 to 1.59). After including sibling fixed effects, the HR of alcohol-related mortality among parents who had lost a child was 1.30 (95% CI 1.03 to 1.64).

Conclusions This study provides evidence of an elevated alcohol-related mortality among parents who have lost a child compared with non-bereaved parents. Although strongly attenuated, there is still an association when adjusting for genetic predisposition for alcohol problems as well as childhood environment using sibling fixed-effect models.

Strengths and limitations of this study

- ► This study is based on high-quality register data covering the entire Norwegian adult population.
- ► This study employs sibling fixed-effects to partly control for genes and childhood characteristics.
- ► There might still be residual confounding from factors not shared by siblings.

INTRODUCTION

The death of a child is a devastating event with implications for parents' mental health,[1–4] sickness-absence[5 6] and labour market attachment.[6] During the last decades, there has been a growing body of evidence of an association between parental bereavement and mortality.[7–12] This study fills a gap in the literature by focusing on alcohol-attributable mortality subsequent to the loss of a child.

So far, there has been limited research into the link between bereavement and problematic alcohol consumption. Pilling and colleagues[13] found that bereaved men displayed more problematic patterns of drinking behaviour 2 years post bereavement. They found no significant difference between non-bereaved men and men bereaved for less than 2 years or more than 3 years, nor between bereaved and non-bereaved women. That study did, however, only include participants who had lost a parent or a partner, and the vast majority (86%) had lost a parent. Although sad and stressful, this form of bereavement is more expected and part of the natural life cycle than losing a child.

A few studies have considered the relationship between widowhood and alcohol consumption. These studies have generally found higher levels of problematic alcohol consumption and elevated levels of alcohol-related mortality among widows and widowers.[14 15] In one study, 30% of widows reported drinking alcohol to deal with the grief.[14]

Only a small number of studies have considered alcohol consumption following the death of a child. A study concentrating on stillbirths, neonatal deaths and sudden infant death syndrome found that mothers who had experienced a stillbirth or lost an infant had a higher frequency of heavy drinking than non-bereaved mothers 2 months after the loss.[16] Two Danish register-based studies, using inpatient or outpatient treatment for a substance

abuse disorder as the outcome, found that bereaved parents had a higher risk of being admitted to treatment for substance abuse problems, especially shortly after the loss of an underage child.[2 3] These studies did, however, not distinguish between treatment for alcohol problems and drug abuse.

The number of alcohol-related deaths can be perceived as one indicator of alcohol problems in general among the bereaved and therefore useful in a wider context. For the purpose of studying also non-lethal alcohol-related problems, an alternative is surveys with questions regarding alcohol use. However, it might be difficult to get a sufficient number of parents who have lost a child to participate. In addition, there might be underreporting of current drinking, and reporting on alcohol use prior to the loss might be at risk of recall bias. Focusing instead on treatment for alcohol use disorder also has its drawbacks. Only a minority of those with alcohol use disorder are likely to seek treatment.[17–19] There might also be a selection in who seeks help. For example, earlier research has found that among those with an alcohol use disorder, women are less likely than men to seek treatment.[20] Stigma is one of the most common reasons cited for not seeking treatment for alcohol use disorder[21] and a study found that married parents reported the highest level of stigma attached to seeking substance abuse treatment.[22] Alcohol-related mortality might be less affected by selection than treatment for alcohol problems.

Since the early paper by Li *et al*,[7] there has been growing evidence of an elevated all-cause mortality among bereaved parents compared with non-bereaved parents. In these studies, mainly from the Nordic countries,[5 7 8 12 23–32] Israel[11 33–35] and the USA,[9 36 37] the most consistent finding is a heightened mortality among mothers subsequent to the loss of a child.[5 7 8 10 36 37] Valdimarsdóttir *et al*[12] compared Icelandic cohorts born from 1800 to 1880 where 61.1% of parents lost at least one child to cohorts born from 1931 to 1996 where 5.2% lost a child and found elevated mortality among bereaved mothers across most cohorts. Among fathers, there was only an elevated mortality post bereavement in the youngest cohorts. Most other studies examining fathers separately have found no or weak associations.[7 33 37]

A heightened maternal mortality following the death of an infant has been found across studies.[5 10–12 29] On the other hand, the evidence for an excess mortality following the death of a child between the ages of 1 and 18 is more mixed.[7 8 11 12] Most studies have found a heightened mortality following the death of an adult offspring.[8 11 12 23] Rostila *et al*[8] found a lowered mortality in the first 3 years subsequent to the death of an adult offspring, but a heightened mortality after 8 years of follow-up. There is some evidence to suggest that mothers have a more elevated mortality following the death of an infant or very young child, whereas men's mortality is more strongly associated with the death of an adult offspring.[11 12]

Li *et al*[7] found maternal mortality to be particularly high subsequent to the external cause of death of a child, whereas parental mortality following the loss of a child due to a natural cause of death was elevated only in the long term.

The death of a child has been linked to parental suicide[23 30] and external cause mortality in general.[7] There is some evidence, although not unambiguous, that cancer incidence and cancer survival are associated with the loss of a child.[11 25 26 31 32 35] An association with death from cardiovascular diseases is found in some[5 11] but not all studies.[24 27]

Earlier studies argued that there might be a number of pathways from bereavement to mortality.[7 8 11] Depression and grief may lead to suicides and possibly accidents. Stress might adversely affect health directly. Furthermore, bereavement might induce changes in health behaviour such as poorer diet, less exercise and an increase in smoking and alcohol consumption.

One problem facing research into the relationship between the loss of a child and parental mortality is that there is likely to be selection in who loses a child, which might confound the relationship between bereavement and mortality. It might be that those who lose a child have poorer health or more adverse health behaviours already prior to the loss.

Alcohol can be used in an attempt to alleviate stress, reduce tension and cope with mental distress following negative life events.[38 39] However, parents who lose a child might have a higher level of alcohol consumption already prior to the loss. There are a number of reasons why parents with high alcohol consumption might be more at risk of losing a child. Both drinking during pregnancy and while having an infant are associated with increased risk of infant mortality.[40–42] Parental drinking during childhood is also associated with higher adult mortality in the offspring.[43–45] The link between parental drinking and offspring's alcohol-related mortality is particularly strong,[44] probably stemming from transmission of alcohol problems, either through shared genes[46 47] or environment.[48] Children growing up in households with high alcohol consumption often also tend to be subject to other adverse experiences,[45] which especially when taken together, predict premature mortality.[49] Moreover, high levels of parental drinking during childhood are associated with a number of offspring health problems that are also linked to premature mortality such as behaviour problems,[50 51] attention deficit hyperactivity disorder[52 53] and mental illness.[45 54] Finally, there might be clustering[55] and intergenerational transmission[56] of detrimental health behaviours that when combined are strong predictors of premature death.[57]

One way to try to disentangle the effects of parental bereavement on alcohol use from alcohol consumption prior to the loss is to employ a sibling fixed-effect design. Siblings share, on average, 50% of their genetic material and such models will therefore partly control for the hereditability of alcohol use. Furthermore, these models control for shared early life family environment factors that might influence alcohol use later in life, such

as parental drinking,[58] low parental education,[59] parental divorce[60] and parental death.[46] In order to come closer to causality, we therefore exploit the fact that using Norwegian register data, we are able to link different generations, and thereby identify siblings, which enables us to employ a within-family design.

The elevated all-cause mortality among bereaved parents who have been found in population samples have recently been confirmed in studies employing a sibling comparison design[12] as well as a twin study.[9]

This study aims to add to the existing literature by analysing the link between parental bereavement and alcohol-related mortality using (1) Cox regression and controlling for adult sociodemographic characteristics such as education, marital status and number of children, (2) models that take into account the age of the child at the time of death and the cause of death and (3) sibling fixed-effect models that control not only for observed characteristics but also for unobserved childhood characteristics and part of the genetic makeup.

METHODS

Data

The study is based on data from a number of Norwegian administrative registers. We include all adults living in Norway on 1 January 1986 or later. The study population was then followed until time of death, emigration or until 31 December 2014, whichever came first.

In the Norwegian Central Population Register, which includes every person resident in Norway for some time after 1960, each person is given a unique person identification number. This number enables individual record linkages between the different registers as well as linking parents to their children. Through connecting parents and offspring, we are also able to link siblings. In our sibling sample, we include only full biological siblings. We are only able to link those born after 1964 or living in the parental home in 1970 to their parents and therefore siblings.

Years of birth and dates of emigration were included from the Central Population Register along with information about marital status at the beginning of each year and number of children. Highest level of education was added from the National Education Database. The Cause of Death Register provided information about the date and the cause of death in accordance with the International Classification of Diseases (ICD), using the ninth revision[61] from 1986 to 1995 and the 10th revision[62] from 1996 to 2014.

Alcohol-related deaths were defined as ICD 9: 255.0, 265.2, 291, 292.2, 303, 3050, 357.5, 359.4, 425.5, 535.3, 571.0–571.3, 790.3, 980.0. 980.1, 980.9 and E860. ICD 10: F10, E24.4, E52, G31.2, G62.1, G72.1, I42.6, K29.2, R78.0, K70, K86.0, T51.1, T51.9, X45, X65 and Y15. We also include deaths where alcohol was a contributing cause of death, either alcohol-related disorders (F10), alcohol intoxication (T51 and Y91) or alcohol in the blood (R78.0 and Y90). These are deaths directly attributable to alcohol, either suicide and accidents that took place while under the influence of alcohol or long-term consequences of harmful alcohol use. The Norwegian Cause of Death Register is generally regarded as having a high quality,[63 64] with a coverage of 98% of deaths.[65] However, there is likely to be underreporting of alcohol-related causes of death.[66] Furthermore, coding changes might disrupt time trends in specific causes of death.[67 68]

For deaths among offspring, we distinguish between deaths due to external causes of death—suicide, accidents and homicides (ICD9: E800–E999 and ICD10: V01–Y89) and natural causes of death (all other codes). Norway has a low infant mortality rate and an average child mortality rate compared with other OECD (Organisation for Economic Co-operation and Development) countries.[69]

Model

Cox proportional hazard regression models were used to analyse whether losing a child is associated with alcohol-related mortality. The death of a child is a time-varying feature, which means that when a child dies, the parent changes status from non-bereaved to bereaved.

We control for characteristics on which bereaved and non-bereaved parents have been shown to differ and who are also associated with alcohol-related mortality; marital status,[9 15 33 70 71] education[9 33 36 72 73] and number of children.[36 74 75] Marital status is included as a time-varying variable consisting of the categories never married, married, divorced and widowed. Education is included as a time-varying variable and distinguishes those with compulsory education, high school, a university degree and missing education. Calendar year and age are included as time-varying control variables in all models.

In the first model, we compare the alcohol-related mortality of those who have lost a child to non-bereaved parents. We show results for both sexes combined, as well as for mothers and fathers separately, since earlier research has found that losing a child affects mothers and fathers differently.[1 7 8] In the second model, we divided the parents who have lost a child into two groups distinguished by the cause of death of the offspring—external causes of death and natural causes of death. Third, we run models stratified by the age of the child at time of death. In the final model, we compare groups of siblings where at least one sibling has lost a child. In these models, each childhood family is allowed to have a different baseline hazard function.[76] In this analysis singletons, those who only have half-siblings and those whose mother or father is not registered are dropped from the sample. Only siblings who are discordant for both losing a child and alcohol-related death contribute to the estimates. Unfortunately, due to the lack of statistical power, we were not able to do this analysis separately for mothers and fathers.

Participant and public involvement

The public or interest groups were involved neither in the design nor in the choice of outcome measure in this

Table 1 Descriptive statistics

	The whole population (N=5 633 387)			The sibling sample (N=2 598 002)		
	Prevalence (%)	Exposure time	Number of deaths	Prevalence (%)	Exposure time	Number of deaths
Total		103 160 700	16 380		55 008 291	5331
Not bereaved	98	101 097 486	15 564	99	54 458 208	5128
Bereaved	2	2 063 214	816	1	550 083	203
Education						
Compulsory education	51	52 606 639	11 912	41	22 553 399	3798
High school	24	24 307 663	2575	31	17 052 570	960
University degree	22	23 189 978	1439	27	14 852 239	494
Missing	3	3 056 420	454	1	550 083	79
Marital status						
Married	41	42 295 887	6504	52	28 604 311	2666
Never married	45	46 422 315	2997	39	21 453 233	649
Divorced	8	9 284 463	5441	8	4 400 663	1859
Widowed	6	6 189 642	1458	1	550 083	160
Sex						
Men	49	50 548 743	12 844	52	28 604 311	4320
Women	51	52 611 957	3536	48	26 403 980	1011

study. There are no plans to involve the public or interest groups in choosing a dissemination strategy.

RESULTS

The exposure time and number of deaths by sex, bereavement status, education and marital status, in the population, as well as in the sibling sample are shown in table 1. Among the bereaved, there were 816 alcohol-related deaths during 2 063 214 years of follow-up, while there were 15 564 alcohol-related deaths during 101 097 486 years of follow-up among the non-bereaved (table 1). In the sibling sample, there were 203 alcohol-related deaths during 550 083 years of follow-up, while there were 5128 alcohol-related deaths during 54 458 208 years of follow-up among the non-bereaved.

In the general population, there were more than three times as many alcohol-attributable deaths among men (12 852) than among women (3537). However, the sex difference was much smaller among those who had lost a child, where only about two times the number of men (560) compared with women (256) died of alcohol-related causes.

Table 2 shows results from analyses examining the association between having lost a child and alcohol-related mortality. When analysing men and women together, the HR for alcohol-related mortality for bereaved parents versus non-bereaved parents was 1.59 (95% CI 1.48 to 1.71) after adjusting for sex, year, age, education, marital status and number of children. When running the analyses stratified by sex, the HR for bereaved mothers was 2.03 (95% CI 1.78 to 2.32) and for bereaved fathers 1.46 (95% CI 1.34 to 1.59).

Table 3 shows results from analyses stratified by the cause of death of the child as well as by the age of the child at the time of death. Alcohol-related mortality is higher among bereaved than non-bereaved parents regardless of whether the cause of death was external or natural. The alcohol-related mortality is, however,higher following the death of a child due to external causes (HR 1.79, 95% CI 1.61 to 1.99) than following the loss of a child due to natural causes (HR 1.47, 95% CI 1.34 to 1.61). In the analyses stratified by gender, we find this difference between loss due to external and natural causes only among fathers. There is an elevated alcohol-related mortality subsequent to the loss of a child whether the child was an infant (HR 1.55, 95% CI 1.30 to 1.86), aged 1–18 (HR 1.54, 95% CI 1.32 to 1.80) or an adult offspring (HR 1.61, 95% CI 1.47 to 1.76). There is an elevated mortality among both fathers and mothers who have lost an offspring regardless of the age of the offspring. Mothers who have lost an infant (HR 2.52, 95% CI 1.86 to 3.43) have a higher alcohol-related mortality then fathers who have lost an infant (HR 1.27, 95% CI 1.01 to 1.59). Likewise, mothers (HR 1.97, 95% CI 1.68 to 2.30) have a higher alcohol-related mortality than fathers (HR 1.52, 95% CI 1.36 to 1.69) subsequent to the loss of an adult offspring.

In the final analysis, presented in table 4, we include sibling fixed-effect in the model presented in table 1, with men and women analysed together. Controlling for childhood characteristics that are shared by siblings and part

Table 2 HRs (and 95% CIs) for the association between bereavement and alcohol-related mortality, parents who have lost a child compared with non-bereaved parents, Norway, 1986–2014

	All		Men		Women	
	Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**	**Unadjusted**	**Adjusted**
Bereaved parent	2.04 (1.89 to 2.19)	1.59 (1.48 to 1.71)	2.08 (1.91 to 2.27)	1.46 (1.34 to 1.59)	2.39 (2.10 to 2.72)	2.03 (1.78 to 2.32)
Non-bereaved parent	1	1	1	1	1	1
Childless	1.60 (1.54 to 1.65)	1.11 (1.02 to 1.20)	1.46 (1.40 to 1.52)	1.09 (1.00 to 1.19)	1.23 (1.13 to 1.34)	1.16 (0.97 to 1.38)
Education						
Compulsory education		1.76 (1.68 to 1.84)		1.74 (1.66 to 1.83)		1.71 (1.53 to 1.91)
High school		1		1		1
University degree		0.63 (0.59 to 0.68)		0.63 (0.59 to 0.68)		0.60 (0.52 to 0.70)
Missing		1.58 (1.43 to 1.75)		1.52 (1.36 to 1.70)		1.73 (1.35 to 2.20)
Marital status						
Married		1		1		1
Never married		3.34 (3.09 to 3.61)		4.35 (3.98 to 4.75)		1.56 (1.32 to 1.84)
Divorced		9.98 (9.54 to 10.45)		12.44 (11.80 to 13.11)		4.95 (4.52 to 5.42)
Widowed		2.62 (2.45 to 2.80)		3.24 (2.99 to 3.52)		1.84 (1.64 to 2.06)
Number of children		0.90 (0.88 to 0.91)		0.92 (0.90 to 0.94)		0.81 (0.78 to 0.84)
Age		1.03 (1.03 to 1.03)		1.04 (1.03 to 1.04)		1.01 (1.01 to 1.01)
Year		0.90 (0.89 to 0.90)		0.90 (0.90 to 0.91)		0.87 (0.85 to 0.88)
Sex						
Men		1		–		–
Women		0.21 (0.20 to 0.22)		–		–

Table 3 HRs (and 95% CIs) for the association between bereavement and alcohol-related mortality compared with non-bereaved parents, stratified by the age and cause of death of the offspring, Norway, 1986–2014

	All	Men	Women
Cause of death of child			
Non-bereaved parent	1	1	1
Natural causes	1.47 (1.34 to 1.61)	1.33 (1.19 to 1.49)	1.93 (1.64 to 2.28)
External causes	1.79 (1.61 to 1.99)	1.66 (1.47 to 1.89)	2.22 (1.82 to 2.72)
Age of child (years)			
Non-bereaved parent	1	1	1
<1	1.55 (1.30 to 1.86)	1.27 (1.01 to 1.59)	2.52 (1.86 to 3.43)
1–18	1.54 (1.32 to 1.80)	1.43 (1.19 to 1.71)	1.91 (1.41 to 2.60)
>18	1.61 (1.47 to 1.76)	1.52 (1.36 to 1.69)	1.97 (1.68 to 2.30)

Controlling for sex, age, education, marital status and number of children.

of the genetic makeup, the HR was 1.30 (95% CI 1.03 to 1.64).

DISCUSSION

This follow-up study using high-quality register data covering the entire Norwegian population and spanning nearly 30 years shows that losing a child is associated with a substantially higher alcohol-related mortality for both men and women. The link is particularly strong for women, where bereaved mothers had a hazard of alcohol-related mortality two times that of non-bereaved mothers. There was an excess alcohol-related mortality among those who have lost a child regardless of whether the child was an infant, aged 1–18 or an adult offspring. The alcohol-related mortality was elevated among both parents who had lost a child due to external causes of death and to natural causes of death. Results from models including sibling fixed-effects confirm the results from the standard Cox model, that bereaved parents have a higher alcohol-related mortality than their non-bereaved siblings. The association between parental bereavement and alcohol-related mortality is, however, strongly attenuated by the inclusion of sibling fixed-effects in the model.

Table 4 HRs (and 95% CIs) for the association between bereavement and alcohol-related mortality, parents who have lost a child compared with their non-bereaved siblings, Norway, 1986–2014

	All
Bereaved parent	1.30 (1.03 to 1.64)
Non-bereaved parent	1
Childless	1.18 (0.99 to 1.40)
Education	
Compulsory education	1.84 (1.63 to 2.07)
High school	1
University degree	0.59 (0.50 to 0.71)
Missing	2.03 (1.39 to 2.97)
Marital status	
Married	1
Never married	5.39 (4.53 to 6.42)
Divorced	8.16 (7.12 to 9.36)
Widowed	5.59 (4.25 to 7.34)
Number of children	0.86 (0.81 to 0.91)
Age	1.08 (1.07 to 1.09)
Year	1.01 (0.97 to 1.06)
Sex	
Men	1
Women	0.29 (0.26 to 0.33)

Our results correspond with findings from the previous research that show that parents who have lost a child have higher levels of entry into substance abuse treatment than their non-bereaved counterparts.[2 3]

We focus on causes of deaths that are directly attributable to alcohol consumption such as accidents that took place while under the influence of alcohol and long-term consequences of heavy alcohol consumption such as liver cirrhosis. Alcohol plays a role in many accidental deaths,[77] suicides[78] and drug-related deaths[79] and is likely to be underreported as a contributing cause of death.[66] Furthermore, a number of diseases, such as many forms of cancer and heart disease, are partly attributable to alcohol consumption.[80] This means that the true number of deaths caused by alcohol is likely to be higher.

Our results suggest that the excess mortality from alcohol-related causes following the death of a child is higher among mothers than among fathers. This is consistent with findings from earlier studies focusing on health consequences such as psychotropic medicine use[81] and all-cause mortality,[7 8] which have found more adverse outcomes of losing a child for mothers than for fathers. In line with our findings, Li *et al*[2] found that compared with their non-bereaved counterparts, bereaved mothers have higher levels of psychiatric hospitalisation for substance abuse than bereaved fathers.

Our findings show that among men, particularly those who have lost a child due to external causes of death have an elevated mortality from alcohol-related causes. Earlier research has found that parents who have been bereaved by violent causes of death have more adverse outcomes on measures such as being admitted to treatment for mental health problems,[3] sickness absence due to psychiatric problems[82] and higher levels of complicated grief.[83] As mental health problems[84] and complicated grief[85] are linked to alcohol misuse, this might help explain the higher levels of alcohol-attributable deaths in this group.

Strengths and limitations

The main strength of this study is that it is based on high-quality register data which means that there is little loss to follow-up and there are no problems caused by recall bias or non-response. Furthermore, having data covering the entire Norwegian population for multiple generations means that we can link siblings and apply a within-family design. Certain genetic predispositions and early life characteristics might be associated with both losing a child and alcohol-related mortality. For example, the heritability of alcohol use disorder has been estimated to be between 50% and 70%.[86] This study shows that even when taking childhood characteristics and the genetic heritage shared by siblings into account, bereaved parents have a heightened alcohol-related mortality.

However, despite the obvious strengths of the sibling fixed-effects design, the results from these models might still be confounded by childhood experiences that the siblings did not share or where the age at the time of the event matters. There might also be other factors not shared by siblings that affect both alcohol use and the risk of losing a child. Furthermore, except for monozygotic twins, siblings only share parts of their DNA—50% on average—which means that genetic predispositions for alcohol abuse could not be fully accounted for in the model. Finally, those who do not have full siblings are dropped from the analysis. Another limitation is that there might be underreporting of alcohol-related deaths[66] and cultural differences in coding of alcohol-related deaths across countries[87] might make comparisons difficult.

The findings from this study provide evidence that the heightened mortality among parents who have lost a child might be partly caused by changes in the health behaviour. This underpins the need for health and support services to monitor the alcohol use and other health behaviour among bereaved parents. In addition, early and customised help for bereaved parents might help prevent long-term changes in health behaviour. Earlier research has indicated that mothers may be particularly affected by the loss. For example, they have a higher excess mortality[7 8] and a higher use of psychotropic medication[1 81] following the death of a child. They may therefore need extra support from health and bereavement services. As it contradicts usual gender norms, support services should be especially aware that women might use alcohol as a coping mechanism following the loss of a child.

Unfortunately, due to the lack of statistical power, we were not able to include sibling fixed-effect in the models stratified by the sex of the parent, the cause of death or the age of the child at the time of death. This would be an interesting line of inquiry for future research. Another logical next step would be to quantify to what extent the heightened parental mortality following the loss of a child is caused by changes in health behaviour and to what extent it is directly attributable to the effects of stress on bodily functioning. Norway has strict alcohol policy with high taxes, a state monopoly on the sale of wine and spirits as well as other measures to restrict alcohol consumption.[88 89] The results from this study might not be directly transferable to settings with a different alcohol policy. Studies from countries with less strict alcohol policies would therefore be of interest.

Contributors SGC formulated the study design, carried out the data analyses and drafted the paper. AR, KS-L and LJH participated in the interpretation and discussion of the findings and critically revised the paper.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The Regional Committee for Medical and Health Research Ethics granted approval for the research project (REK 2014/1970). As the study used the existing registry data, no written or verbal consent to participate was required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The data used in this study are available from Statistics Norway and the Norwegian Institute of Public Health. In order to obtain and link the data ethical approval is needed. Transfer of these data outside Norway's borders is not allowed.

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