

## **Parental death due to natural death causes during childhood abbreviates the time to a diagnosis of a psychiatric disorder in the offspring: A follow-up study**

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**ABSTRACT**

Parental death before adulthood has been shown to increase offspring's risk of poor health and adverse social consequences. In a sample of 422 subjects with parental death (334 (79.1%) due to natural causes), and 6,172 matched controls, those with parental death were given a diagnosis of a psychiatric disorder up to 28 years of age earlier than their controls (10-year survival proportions: 88.6% vs. 93.1%,  $p=0.001$ ). Our findings indicate that psychosocial support must be provided as early as when a parent falls ill, especially with those illnesses that are the most common causes of death in the population.

**Keywords:** parental death, parental illness, offspring, prevention, psychosocial support system

## INTRODUCTION

The research indicates that 4–5% of children face the death of a parent before they reach adulthood (Hjern & Manhica, 2013). Tragic personal loss is a remarkable phenomenon influencing a significant part of the population in societies. Thus, possible consequences following a parent's death also affect a great number of individuals, especially family members, spouses and children.

A parent's death during their offspring's childhood and its consequences to their offspring's later life have been quite widely studied from various perspectives. For example, increased adverse social consequences like entering into foster care (Franzen & Vinnerljung, 2006) and displaying increasingly delinquent behavior (Draper & Hancock, 2011) have been reported. Poor health outcomes such as cardiovascular risk factors in the offspring (Schooling et al., 2011), even increased rates of dementia in later life and increased mortality (Kennedy et al., 2014; Norton, Østbye, Smith, Munger, & Tschanz, 2009; Phillips & Carver, 2015; Ravona-Springer, Beerli, & Goldbourt, 2012; Smith, Hanson, Norton, Hollingshaus, & Mineau, 2014) have been found. Especially parents' deaths due to external (unnatural) causes like accidents and suicides have been found to be associated with lower grades, school failure and increasing difficulties with work-related plans in comparison with those without parental death (Berg, Rostila, & Hjern, 2016; Brent, Melhem, Masten, Porta, & Payne, 2012). Having above mentioned impact on an individual level, it is evident that psychiatric problems may also exist in the offspring.

Parental death has been recognized as an adverse childhood experience (Felitti et al., 1998). Similarly to parental mental health problems or low family income (Shelleby et al., 2014), parent's death has been found to be a risk factor for negative psychological consequences in

offspring (Stikkelbroek, Bodden, Reitz, Vollebergh, & van Baar, 2016). Especially the offspring who have experienced parent's death due to suicide or accidents during their childhood have been shown to be at increased risk for depression (Appel et al., 2016; Berg et al., 2016; Bylund-Grenklo, Fürst, Nyberg, Steineck, & Kreicbergs, 2016; Jacobs & Bovasso, 2009). Association with parent's death and offsprings' serious mental health disorders such as psychosis and bipolar disorder in later life (Clarke, Tanskanen, Huttunen, & Cannon, 2013; Tsuchiya, Agerbo, & Mortensen, 2005) as well as offspring's risk for suicide and self-inflicted injuries (Hollingshaus & Smith, 2015; Jeon et al., 2014; Rostila, Berg, Arat, Vinnerljung, & Hjern, 2016) have been found.

Acknowledging the association between parent's death and offspring's psychological adversities provides possibilities to plan preventive actions for this particular population of the offspring. In order to prevent adverse consequences, preventive actions should take place before the problems occur. Hence, more population level information is needed on effects of parent's death to offspring's psychiatric disorders and especially on timing of their occurrence. We hypothesized that a parent's death would abbreviate the time to a diagnosis and increase the proportion of a psychiatric disorder of the offspring. Additionally, we aimed to study effects of the most common causes of death in respect with the hypothesized association. In the latter, we hypothesized that especially effect of parental death caused by neoplasms and suicides would abbreviate the time to a diagnosis and increase the proportion of a psychiatric disorder of the offspring.

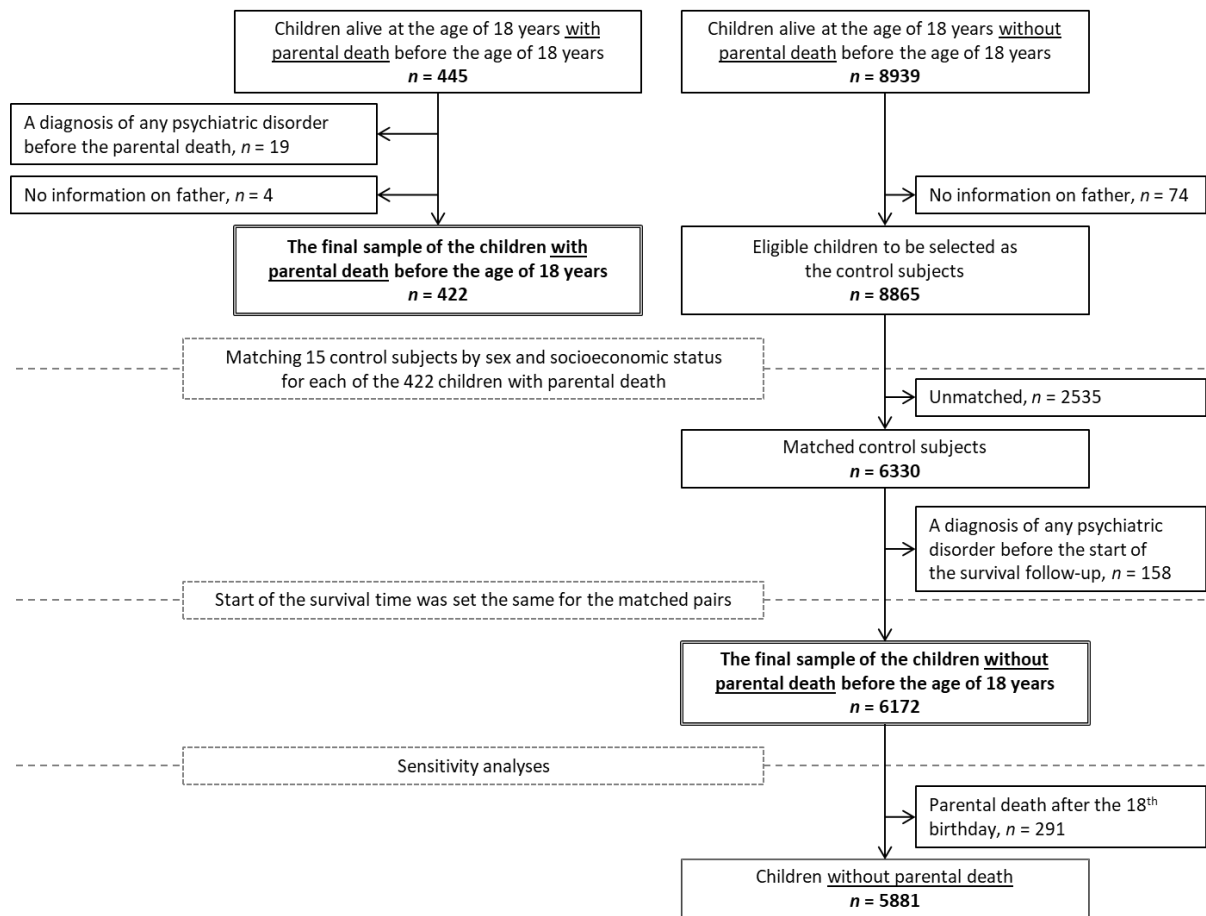
## **METHODS**

### **The Northern Finland Birth Cohort 1986**

The Northern Finland Birth Cohort 1986 (NFBC1986) is based upon pregnant women and their live born children (N=9,432) born in the northern Finland with an expected date of birth between the 1<sup>st</sup> of July 1985 and the 30<sup>th</sup> of June 1986 (Järvelin, Hartikainen-Sorri, & Rantakallio, 1993). The data have been collected on various occasions through postal questionnaires and clinical examinations, and the data have been combined with various register data and hospital records. Overall ethical permissions for the NFBC studies have been obtained from The Ethics Committee of the Northern Ostrobothnia Hospital District (EETTMK 94/11, 17<sup>th</sup> September 2012) and signed informed consents have been received from all participants.

### **Sample**

The sample of this study was selected from the cohort members alive at the age of 18 years (n=9,384). Altogether 445 (4.7%) had experienced parental death before their 18<sup>th</sup> birthday. The sample collection is presented in Figure 1. We excluded those who had a psychiatric diagnosis before the parental death (n=19). We then selected the cohort members for whom we had data on both parents, and among them, we randomly selected 15 control subjects, matched by gender and socioeconomic status at birth, for each of the 422 cohort members with parental death, resulting in 6,330 control subjects. In survival analyses, we excluded the control subjects who had a psychiatric diagnosis before the beginning of survival follow-up. The final sample sizes were therefore 422 and 6,172. In sensitivity analyses, we excluded the control subjects with parental death after their 18<sup>th</sup> birthday.



**Figure 1.** Selection of the study sample.

## Register data

In this study, we used national register data. They have been combined individually for all the cohort members using a personal identity code, which is allocated to all Finnish citizens.

### ***Data on parental death***

We collected information on time and cause of parental death from the Cause of Death Register from Statistics Finland. We used the time of death to select the cohort members with parental death until their 18<sup>th</sup> birthday. We classified the causes of death according to ICD-10 using the cause of death for primary tabulation. Categories from infections to congenital malformations, deformations and chromosomal abnormalities (A – Q) were classified as natural and categories concerning external causes and suicide (S – Y) to unnatural causes of death. If both parents had died, we used the time and cause of death of the parent who died earlier.

### ***Data on diagnoses of psychiatric disorders***

Information on diagnoses of psychiatric disorders of the cohort members and their parents are based on the following registers: The Care Register for Health Care (inpatient treatments until 2013), Finnish outpatient registers from the National Institute for Health and Welfare (specialised care 1998-2013, primary care 2011-2013), the register of reimbursable medicines (until 2005) hosted by the Social Insurance Institution, and the register of disability pensions (until 2013) hosted by the Finnish Centre for Pensions. We used the time of the first diagnosis of any psychiatric disorder of a cohort member until the age of about 28 years to define the outcome status (any psychiatric diagnosis vs. no psychiatric diagnosis). The psychiatric diagnoses were categorized according to ICD-9 or ICD-10 as follows: any psychosis (ICD-9: 2950-2959, 2961E, 2962E, 2963E, 2964E, 2967, 297, 2988, 2989; ICD-10: F20-F25, F28, F29, F302, F312, F315, F323, F333), any non-psychotic mood disorder (ICD-9: 2962-2964A-D, 2962-2964F-G, 2968, 2969, 3004; ICD-10: F300-F301, F303-F311, F313-F314, F315-F319, F320-F322, F324-F339. F341, F3810, F340S, F342-F3809, F3811-F39), anxiety disorder (ICD-9: 3000-3003, 3006-3009; ICD-10: F40-F44), any substance use disorder (ICD-9: 291,

292, 303-305; ICD-10: F100-F129, F131-F160, F163-F170, F173-F180, F183-F190, F193-F199), and other psychiatric disorders (any codes from ICD-9: 290-316 and ICD-10: F00-F69, F80-F99, except for the ones belonging to the other categories). We also used the diagnosis of any psychiatric disorder of the parents until cohort members' 18<sup>th</sup> birthday as a confounding factor.

### **Other data**

We used gender and socioeconomic status at birth, obtained from the NFBC1986 pregnancy and antenatal data, to match the sample. We categorized the socioeconomic status into three classes based on the occupational status of the parents: the first class included entrepreneurs and clerical workers; the second class was made up of skilled workers and farmers; and the third class consisted of all other occupational statuses combined, including those with missing data on the occupational status. Finally, we used cohort member's own opinion about his or her family's financial situation (very good, fairly good, and some or many financial problems), obtained from the NFBC1986 15/16 -year follow-up study, as a confounding factor.

### **Statistical methods**

Frequency distributions and means with standard deviation are presented to describe the data. We calculated proportions of the cohort members with parental death separately for different categories of the cause of death. We calculated survival time from the parental death until the time of the first diagnosis of any psychiatric disorder of the cohort member until the end of 2013 or for a maximum of 25 years of follow-up. In order to conduct the survival analyses, the beginning of the survival time of those with parental death was set as the beginning of the survival time of their control subjects. We first used Kaplan-Meier analysis to compare the



survival time of those with parental death and those without. We then conducted two models to calculate the hazard ratios for the diagnosis of any psychiatric disorder during the survival follow-up using Cox regression: in the first model, parental death was adjusted for the parental psychiatric disorder and gender, and in the second model, parental death was adjusted for the parental psychiatric disorder, gender and cohort member's own opinion about his or her family's financial situation at 16 years of age. As sensitivity analyses, we conducted the same analyses excluding the control subjects with parental death after their 18<sup>th</sup> birthday. We considered P-values less than 0.05 to be statistically significant.

## **RESULTS**

### **Description of the data**

Altogether 445 (4.7%) cohort members experienced parental death before the age of 18 years. Of them, 130 (29.2%) were born in high, 184 (41.3%) in middle and 131 (29.4%) in low socioeconomic classes. The corresponding figures for the final sample are presented in Table 1. Ninety-one (21.6%) of those with parental death were diagnosed with a psychiatric diagnosis after the parental death during the maximum of 25 years of follow-up until the age of about 28 years, compared with 970 (15.7%) of the control subjects.

### **Causes of parental death**

There were 334 (79.1%) deaths due to natural causes and 84 (19.9%) deaths due to unnatural ones (Table 2). The most common natural causes were neoplasms; endocrine, nutritional and metabolic diseases; and diseases of the circulatory systems. Five (1.2%) deaths were caused by mental disorders, which were all alcohol abuse-related. Within unnatural causes of death, 42 were caused by suicide or intentional self-harm and 37 by accidents. Five deaths were caused by assault or murder.

**Table 1.** Description of the final data.

	Parental death	
	Yes n = 422	No n = 6,172
Sex, n (%)		
Female	207 (49.1)	3,038 (49.2)
Male	215 (50.9)	3,134 (50.8)
Occupational status of parents at the time of birth, n (%)		
Entrepreneurs and clerical workers	124 (29.4)	1,830 (29.7)
Skilled workers and farmers	179 (42.4)	2,612 (42.3)
All other occupational statuses combined	119 (28.2)	1,730 (28.0)
Diagnosis <sup>1</sup> of any psychiatric disorder of a parent, n (%)	142 (33.6)	959 (15.5)
Age at parental death (years), mean (SD)	10.2 (5.1)	n.a.
0-6 years, n (%)	129 (30.6)	
7-12 years, n (%)	146 (34.6)	
13-18 years, n (%)	147 (34.8)	
Diagnosis of any psychiatric disorder, n (%)	91 (21.6)	970 (15.7)
Any psychosis <sup>2</sup>	5 (5.5)	50 (5.2)
Any mood disorder <sup>2</sup>	30 (33.0)	280 (28.9)
Anxiety disorder <sup>2</sup>	24 (26.4)	277 (28.6)
Any substance use disorder <sup>2</sup>	6 (9.9)	114 (11.8)
Other psychiatric disorder <sup>2</sup>	23 (25.3)	249 (25.7)
Age <sup>2</sup> at the first diagnosis of any psychiatric disorder (years), mean (SD)	20.0 (5.0)	21.0 (5.1)
Any psychosis <sup>2</sup>	21.8 (4.0)	20.4 (4.3)
Any mood disorder <sup>2</sup>	21.1 (4.1)	22.2 (4.0)
Anxiety disorder <sup>2</sup>	22.0 (3.8)	22.6 (4.0)
Any substance use disorder <sup>2</sup>	21.5 (4.4)	20.8 (4.1)
Other psychiatric disorder <sup>2</sup>	16.6 (5.8)	18.7 (6.6)

<sup>1</sup> Diagnosis before child's 18<sup>th</sup> birthday.

<sup>2</sup> Calculated within those with a diagnosis of a psychiatric disorder during the follow-up.

**Table 2.** Causes of parental deaths.

Cause of death	ICD-10 classification	n (%)
Natural		334 (79.1)
Neoplasms	C00-D49	85 (20.1)
Endocrine, nutritional and metabolic diseases	E00-E89	108 (25.6)
Diseases of the circulatory system	I00-I99	107 (25.4)
Diseases of the digestive system	K00-K95	16 (3.8)
Mental, behavioral and neurodevelopmental disorders	F01-F99	5 (1.2)
Others		13 (3.9)
Unnatural		84 (19.9)
Suicide or intentional self-harm	X60-X84	42 (10.0)
Accidents	V00-X59, Y10-Y34	37 (8.8)
Assault, murder	X85-Y09	5 (1.2)
Unspecified	--	4 (0.9)
Total		422 (100.0)

### Time to onset of a psychiatric disorder

The cohort members with parental death were diagnosed with a psychiatric disorder earlier than their control subjects (survival proportions from the Kaplan-Meier analyses at 10 years: 88.6% vs. 93.1%, and in the end of the follow up: 68.7% vs. 76.2%,  $p=0.001$ ; Table 3). Those with *natural* causes of parental death were diagnosed with a psychiatric disorder earlier than their control subjects (survival proportions at 10 years: 88.3% vs. 93.8%,  $p<0.001$ ; Figure 2a) whereas those with *unnatural* causes of parental death did not differ from their control subjects (survival proportions at 10 years: 89.2% vs. 90.6%,  $p=0.284$ ; Figure 2b).

**Table 3.** Survival analyses to a diagnosis of a psychiatric disorder during a maximum of 25 years of follow-up in cohort members with a parental death before the age of 18 years and their control subjects.

	n/N		Kaplan-Meier analysis				Cox regression <sup>1</sup>		
			10-year survival proportion		Survival proportion in the end of the follow-up		P <sup>2</sup>	HR (95% CI)	P <sup>3</sup>
	Yes	No	Yes	No	Yes	No			
Parental death:									
All causes	91/422	970/6172	88.6	93.1	68.7	76.2	0.001	1.31 <sup>4</sup> (1.06-1.63)	0.014
Natural	75/334	784/4889	88.3	93.8	69.3	76.8	0.001	1.38 <sup>4</sup> (1.09-1.75)	0.008
Neoplasms	19/85	191/1246	87.1	94.0	65.3	73.6	0.061	1.61 <sup>4</sup> (1.01-2.59)	0.047
Endocrine, nutritional and metabolic diseases	27/108	278/1598	88.9	95.6	72.4	78.7	0.025	1.43 <sup>4</sup> (0.96-2.13)	0.080
Diseases of the circulatory system	20/107	255/1558	90.6	91.5	77.1	76.4	0.463	1.07 <sup>5</sup> (0.68-1.69)	0.775
Unnatural	16/84	179/1225	89.2	90.6	73.4	76.5	0.284	1.08 <sup>4</sup> (0.64-1.83)	0.767
Suicides	10/42	81/612	85.6	90.8	64.6	78.9	0.052	1.73 <sup>6</sup> (0.89-3.41)	0.114
Accidents	6/37	83/541	91.9	90.9	78.6	78.9	0.922	0.89 <sup>5</sup> (0.38-2.06)	0.783

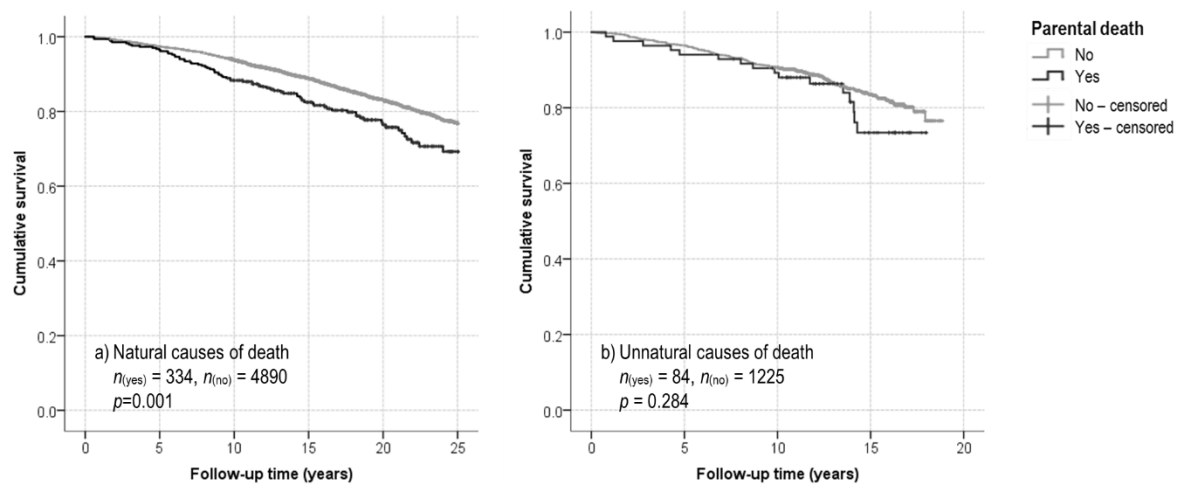
n/N = number of events / number of subjects in the corresponding analyses.

<sup>1</sup> No parental death due to corresponding cause of death as a reference group.

<sup>2</sup> Significance from the log-rank test. <sup>3</sup> Significance from the Cox regression, adjusted for the parental psychiatric disorder and gender.

<sup>4</sup> Parental psychiatric disorder and gender significant (HR>1) in the model. <sup>5</sup> Parental psychiatric disorder significant (HR>1) in the model.

<sup>6</sup> Gender significant (HR>1) in the model.

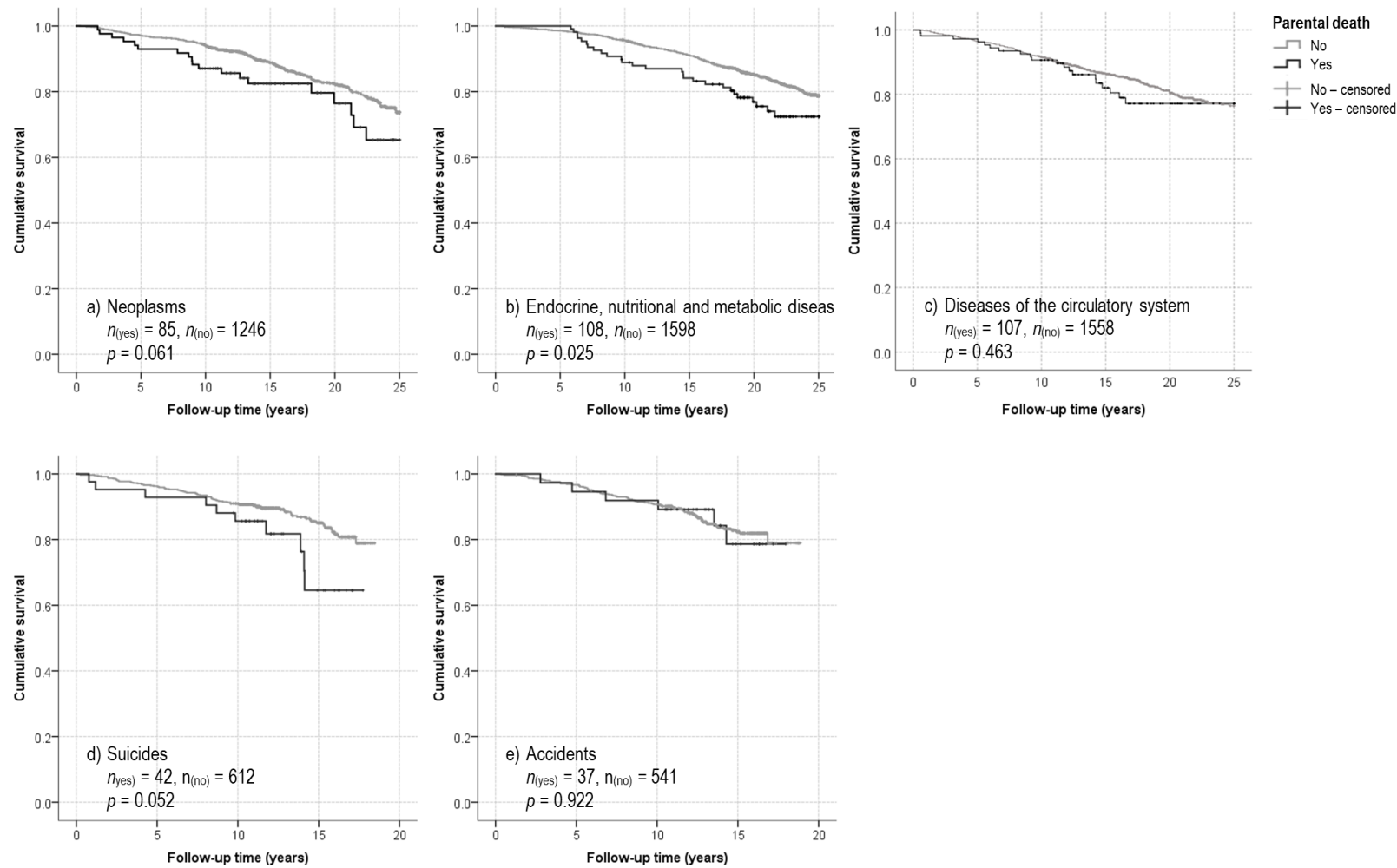


**Figure 2.** Time to a diagnosis of a psychiatric disorder of the cohort members with and without parental death caused by a) natural and b) unnatural cause.

### *Natural and unnatural causes of death*

Within natural causes, those with parental death caused by *endocrine, nutritional and metabolic diseases* were diagnosed as a psychiatric disorder earlier than their control subjects (survival proportions from the Kaplan-Meier analyses at 10 years: 88.9% vs. 95.6%,  $p=0.025$ ; Figure 3a, Table 3). The survival proportions at 10 years were 87.1% vs. 94.0% ( $p=0.061$ ) for the *neoplasms* and 90.6% vs. 91.5% ( $p=0.463$ ) for the *diseases of the circulatory system* (Figures 3b and 3c, Table 3).

Within unnatural causes, those with parental death due to *suicide* or *an accident* did not differ from their control subjects. The survival proportions at 10 years were 85.6% vs. 90.8%,  $p=0.052$  for the *suicides*; and 91.9% vs. 90.9%,  $p=0.922$  for the *accidents* (Figures 3d and 3e, Table 3).



**Figure 3.** Time to a diagnosis of a psychiatric disorder of the cohort members with and without parental death caused by a) neoplasms, b) endocrine, nutritional and metabolic diseases, c) diseases of the circulatory system, d) suicide, and e) accident.

***Adjusting for parental psychiatric disorders, gender and cohort member's own opinion about his or her family's financial situation***

When adjusted for the parental psychiatric disorder and gender in the Cox regression model, the cohort members with parental death had higher risk for earlier diagnosis of a psychiatric disorder in comparison with their control subjects (hazard ratio (HR) =1.31,  $p=0.014$ ; Table 3). The risk was increased for those with *natural parental death causes* (HR=1.38,  $p=0.008$ ) and specifically for those with parental death caused by *neoplasms* (HR=1.61,  $p=0.047$ ). Those with parental death due to other causes did not differ from their control subjects (Table 3).

When cohort member's own opinion about his or her family's financial situation was included in the Cox regression model, the cohort members with parental death had higher risk for earlier diagnosis of a psychiatric disorder in comparison with their control subjects (HR = 1.52,  $p=0.001$ ; Table 4). The risk was increased for those with *natural parental death causes* (HR=1.53,  $p=0.003$ ), in which for those with parental death caused by *neoplasms* (HR=1.85,  $p=0.030$ ) and *endocrine, nutritional and metabolic diseases* (HR=1.81,  $p=0.011$ ). In these models, parent's psychiatric disorder and female gender had  $HR > 1$  ( $p<0.05$ ). In the models for all causes, natural causes, and *endocrine, nutritional and metabolic diseases* having financial problems in the family had  $HR > 1$  ( $p<0.05$ ). Within unnatural causes the risk was increased for those with parental death caused by *suicide* (HR=2.41,  $p=0.017$ ). Other confounding variables were not significant in the last model.

**Table 4.** Final model for time to a diagnosis of a psychiatric disorder during a maximum of 25 years of follow-up in cohort members with a parental death before the age of 18 years and their control subjects.



Parental death:	n/N		Cox regression <sup>1</sup>	
	Yes	No	HR (95% CI)	P <sup>2</sup>
All causes	69/299	699/4784	1.52 <sup>3</sup> (1.18-1.95)	0.001 <sup>3</sup>
Natural	56/245	555/3764	1.53 <sup>3</sup> (1.16-2.02)	0.003 <sup>3</sup>
Neoplasms	14/61	133/978	1.85 <sup>4</sup> (1.06-3.20)	0.030 <sup>4</sup>
Endocrine, nutritional and metabolic diseases	21/75	195/1215	1.81 <sup>3</sup> (1.14-2.86)	0.011 <sup>3</sup>
Diseases of the circulatory system	15/87	182/1196	1.01 <sup>3</sup> (0.60-1.72)	0.962 <sup>3</sup>
Unnatural	13/54	141/977	1.51 <sup>4</sup> (0.84-2.69)	0.166 <sup>4</sup>
Suicides	9/31	67/488	2.41 (1.17-4.96)	0.017
Accidents	4/22	63/435	1.10 <sup>3</sup> (0.40-3.09)	0.850

n/N = number of events / number of subjects in the corresponding analyses.

<sup>1</sup> No parental death due to corresponding cause of death as a reference group.

<sup>2</sup> Significance from the Cox regression, adjusted for the parental psychiatric disease, gender and cohort member's own opinion about his or her family's financial situation at the age of 16 years.

<sup>3</sup> Parental psychiatric disorder, gender and cohort member's own opinion about his or her family's financial situation at the age of 16 years significant (HR>1) in the model.

<sup>4</sup> Parental psychiatric disorder and gender significant (HR>1) in the model.

### ***Sensitivity analyses***

When controls with a parental death after their 18<sup>th</sup> birthday (n=291) were excluded, the results remained largely unchanged. The difference in the time to a diagnosis of a psychiatric disorder between the cohort members with and without parental death became statistically significant for the comparisons of parental death caused by *neoplasms* and by *suicide* (survival proportions from the Kaplan-Meier analyses at 10 years for *neoplasms* 87.1% vs. 94.1%, p=0.045; and for *suicides* 88.4% vs. 91.0%, p=0.045). The results from the Cox regression analyses remained the same.

## **DISCUSSION**

### **Main findings**

Almost 5% of the population faced parent's death before adulthood. The majority (80%) of the parental deaths in our sample were due to natural, i.e., illness-related, causes of death and a minority (20%) due to unnatural death causes, i.e., suicides and accidents. Parental deaths due to natural causes, as well as suicides within unnatural causes, were associated with an increased number of psychiatric diagnoses of the affected offspring. Finally, the offspring with parental death due to natural causes, specifically due to neoplasms or endocrine, nutritional and metabolic diseases, not only neoplasms as hypothesized, or suicide were given a diagnosis of psychiatric disorder earlier than their peers without parental death.

### **Comparison with previous studies**

Our study confirmed that parental death is a common phenomenon in society. In line with previous studies (Hjern & Manhica, 2013), our study revealed that almost 5% of the population under 18 years of age encountered parental death. The cohort members with parental death had psychiatric diagnoses more frequently than their peers without parental death, which is concordant with earlier studies (Appel et al., 2016; Berg et al., 2016; Bylund-Grenklo et al., 2016; Jacobs & Bovasso, 2009). The findings indicate that parental death is a risk factor for psychiatric disorders.

Eighty percent of the parental deaths were caused by natural, i.e., illness-related, causes. Interestingly, natural causes of death were, by contrast to quite strong evidence from the previous literature (Appel et al., 2016; Berg et al., 2016; Bylund-Grenklo et al., 2016; Jacobs

& Bovasso, 2009; Nickerson, Bryant, Aderka, Hinton, & Hofmann, 2013), associated with elevated levels of psychiatric diagnoses in the offspring. Twenty percent of parental deaths were caused by suicides and accidents, which formed the category of unnatural causes of death. Parent's suicide is well known and generally accepted risk factor for offspring's mental health problems (Hollingshaus & Smith, 2015; Jeon et al., 2014; Rostila et al., 2016). In our study, unnatural death causes did not associate with the psychiatric diagnoses in the offspring as a whole, but suicides were separately associated with elevated levels of psychiatric diagnoses in the offspring.

One purpose for this study was to get more information of the most appropriate timing for psychosocial preventive actions after death of a parent aiming to reduce adverse consequences in the offspring. Prevention should naturally take place before the onset of a psychiatric illness in the offspring either systematically after parent's death or immediately when early signs are recognized. Our findings indicate that parental deaths due to natural illnesses were associated with offspring's earlier and more frequently set psychiatric diagnoses. These findings indicate a target for child-centered work in adult healthcare. Support should be provided, not only at the time of the parent's death, but also as early as the very beginning of a parent's life-threatening illness.

Our study may indicate that the duration of illness and length of its' consequences before a parent's death could be one of the intervening factors behind adverse impact. Accidents, on the other hand, are generally sudden incidences that may lead to death. Thus, the duration of impact of illness before the parent's death is longer than with the lethal accidents. In our study, accidental parental deaths did not abbreviate the time to a psychiatric diagnosis in the offspring. Suicide is also a sudden incidence, but it is almost without exception preceded by mental health or substance abuse problems of a parent (Berg et al., 2016; Brent et al., 2012).

The duration of parental lethal illness may be weeks, months or often years before the death. In our study, e.g. parental endocrine illnesses as a cause of deaths had the strong effect on the psychiatric diagnoses of the offspring. These are often chronic illnesses and may have profound negative long-term impact on the everyday life of the families. In our study, we also found the cancer diagnosis-related parental deaths abbreviating the time to a diagnosis of a psychiatric illness in the offspring. Cancer may be very intense and the time with parental illness and its' treatments can be demanding. A parent's cancer affects family life dramatically. Everyday life, such as communication and relationships between family members, will be different (Rauch, Muriel, & Cassem, 2002). Losing a parent is reality for a large number of children of cancer patients (Niemelä et al., 2016b).

The duration of parental illness before the death is an obvious intervening factor for adverse psychological consequences for children. This time is important not only for treatment of patient but it also provides a possibility for healthcare professionals to reach families with preventive actions. The parents suffering from life-threatening illness with young children should be supported by offering psychoeducation on how parents can help their children to cope with their changed life circumstances (Niemelä et al., 2016a). Thus, children and their loved ones can adjust better under the demanding circumstances from the very beginning of the process of the illness, not only when one of their parents dies. The law in many Nordic countries require this kind of support for the families, but it is too rarely offered (Niemelä et al., 2016a).

### **Strengths and limitations**

The NFBC1986 is a large population-based cohort in which we had the opportunity to utilize individual data of the cohort members and their parents from various nationwide registers. The

Cause of Death Register, as well as other registers, has a high level of completeness and the quality has been found to be good (Gissler, Laursen, Ösby, Nordentoft, & Wahlbeck, 2013; Miettunen, Suvisaari, Haukka, & Isohanni, 2011). We had a long follow-up with information on the parental death occurring during the offspring's childhood but also during their early adulthood. As limitations, there were a limited number of deaths caused by some illness groups and we were not able to analyze them in detail and the follow-up time of individual cohort members differed depending on their age at the time of the parental death.

## **Conclusions**

This study showed that parental illness-related deaths are increasingly associated with children's psychiatric diagnoses and the diagnoses are given earlier to the offspring with parental death than the offspring without parental death. Therefore, the child-centred psychosocial support should also be provided to families at the time of a parent falling ill with a life-threatening illness, not only after parental death.

## **DATA AVAILABILITY STATEMENT**

Data are stored in secured servers at the University of Oulu maintained by the NFBC data management team together with IT Administration Services of the University of Oulu. The NFBC Project Center controls the data. The data can be used for teaching and academic research purposes and can be requested via the NFBC material request portal online (<http://www.oulu.fi/nfbc/node/47960>).

## REFERENCES

- Appel, C. W., Johansen C., Christensen J., Frederiksen K., Hjalgrim H., Dalton S. O., ..., Bidstrup P. E. (2016). Risk of use of antidepressants among children and young adults exposed to the death of a parent. *Epidemiology*, 27(4), 578–585.
- Berg L., Rostila M., & Hjern A. (2016). Parental death during childhood and depression in young adults - a national cohort study. *Journal of Child Psychology and Psychiatry*, 57(9), 1092–1098.
- Brent D. A., Melhem N. M., Masten A. S., Porta G., & Payne M. W. (2012). Longitudinal effects of parental bereavement on adolescent developmental competence. *Journal of Clinical Child & Adolescent Psychology*, 41(6), 778–791.
- Bylund-Grenklo T., Fürst C. J., Nyberg T., Steineck G., & Kreicbergs U. (2016). Unresolved grief and its consequences. A nationwide follow-up of teenage loss of a parent to cancer 6-9 years earlier. *Supportive Care in Cancer*, 24(7), 3095–3103.
- Clarke M. C., Tanskanen A., Huttunen M. O., & Cannon M. (2013). Sudden death of father or sibling in early childhood increases risk for psychotic disorder. *Schizophrenia Research*, 143(2–3), 363–366.
- Draper A., & Hancock M. (2011). Childhood parental bereavement: the risk of vulnerability to delinquency and factors that compromise resilience. *Mortality*, 16(4), 285–306.
- Felitti V. J., Anda R. F., Nordenberg D., Williamson D. F., Spitz A. M., Edwards V., ..., Marks J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, 14(4), 245–258.
- Franzen E., & Vinnerljung B. (2006). Foster children as young adults: Many motherless, fatherless or orphaned: A Swedish national cohort study. *Child & Family Social Work*, 11(3), 254–263.
- Gissler M., Laursen T. M., Ösby U., Nordentoft M., & Wahlbeck K. (2013). Patterns in mortality among people with severe mental disorders across birth cohorts: a register-based study of Denmark and Finland in 1982-2006. *BMC Public Health*, 13, 834.
- Hjern A., & Manhica H. (2013). Barn som anhöriga till patienter i vården - hur många är de? [Children who are relatives of patients in health care: How many are they?]. Kalmar, Sweden: Nationellt kompetenscentrum anhöriga, Linnéuniversitetet, 2013.
- Hollingshaus M. S., & Smith K. R. (2015). Life and death in the family: early parental death, parental remarriage, and offspring suicide risk in adulthood. *Social Science & Medicine*, 131, 181–189.
- Jacobs J. R., & Bovasso G. B. (2009). Re-examining the long-term effects of experiencing parental death in childhood on adult psychopathology. *Journal of Nervous and Mental Disease*, 197(1), 24–27.
- Järvelin M. R., Hartikainen-Sorri A. L., & Rantakallio P. (1993). Labour induction policy in hospitals of different levels of specialisation. *British Journal of Obstetrics and Gynaecology*, 100(4), 310–315.
- Jeon H. J., Lee C., Fava M., Mischoulon D., Shim E., Heo J., ..., Park J.-H. (2014). Childhood trauma, parental death, and their co-occurrence in relation to current suicidality risk in adults: a nationwide community sample of Korea. *Journal of Nervous and Mental Disease*, 202(12), 870–876.
- Kennedy B., Valdimarsdóttir U., Sundström K., Sparén P., Lambe M., Fall K., & Fang F. (2014). Loss of a parent and the risk of cancer in early life: a nationwide cohort study. *Cancer Causes & Control*, 25(4), 499–506.

- Miettunen J., Suvisaari J., Haukka J., & Isohanni M. (2011). Use of register data for psychiatric epidemiology in the Nordic countries. In: M. T. Tsuang, M. Tohen & P. B. Jones (Eds.), *Textbook of psychiatric epidemiology* (3rd ed.) (pp. 117–131). Chichester, West Sussex: John Wiley & Sons.
- Nickerson A., Bryant R. A., Aderka I. M., Hinton D. E., & Hofmann S. G. (2013). The impacts of parental loss and adverse parenting on mental health: Findings from the National Comorbidity Survey-Replication. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(2), 119–127.
- Niemelä M., Marshall C. A., Kroll T., Curran M., Koerner S. S., Räsänen S., & García F. (2016a). Family-focused preventive interventions with cancer cosurvivors: a call to action. *American Journal of Public Health*, 106(8), 1381–1387.
- Niemelä M., Paananen R., Hakko H., Merikukka M., Gissler M., & Räsänen S. (2016b). Mental disorder diagnoses of offspring affected by parental cancer before early adulthood: the 1987 Finnish Birth Cohort study. *Psycho-Oncology*, 25(12): 1477–1484.
- Norton M. C., Østbye T., Smith K. R., Munger R. G., & Tschanz J. T. (2009). Early parental death and late-life dementia risk: findings from the Cache County Study. *Age and Ageing*, 38(3), 340–343.
- Phillips S. P., & Carver L. (2015). Early parental loss and self-rated health of older women and men: a population-based, multi-country study. *PLoS ONE*, 10(4), e0120762.
- Rauch P. K., Muriel A.C., & Cassem N.H. (2002). Parents with cancer: who's looking after the children? *Journal of Clinical Oncology*, 20(21), 4399–4402.
- Ravona-Springer R., Beerli M. S., & Goldbourt U. (2012). Younger age at crisis following parental death in male children and adolescents is associated with higher risk for dementia at old age. *Alzheimer Disease & Associated Disorders*, 26(1), 68–73.
- Rostila M., Berg L., Arat A., Vinnerljung B., & Hjern A. (2016). Parental death in childhood and self-inflicted injuries in young adults-a national cohort study from Sweden. *European Child & Adolescent Psychiatry*, 25(10), 1103–1111.
- Schooling C. M., Jiang C., Lam T. H., Zhang W., Cheng K. K., & Leung G.M. (2011). Parental death during childhood and adult cardiovascular risk in a developing country: the Guangzhou Biobank Cohort Study. *PLoS ONE*, 6(5), e19675.
- Shelleby E. C., Votruba-Drzal E., Shaw D. S., Dishion T. J., Wilson M. N., & Gardner F. (2014). Income and children's behavioral functioning: a sequential mediation analysis. *Journal of Family Psychology*, 28(6), 936–946.
- Smith K. R., Hanson H. A., Norton M. C., Hollingshaus M. S., & Mineau G. P. (2014). Survival of offspring who experience early parental death: early life conditions and later-life mortality. *Social Science & Medicine*, 119, 180–190.
- Stikkelbroek Y., Bodden D. H. M., Reitz E., Vollebergh W. A. M., & van Baar A. L. (2016). Mental health of adolescents before and after the death of a parent or sibling. *European Child & Adolescent Psychiatry*, 25(1), 49–59.
- Tsuchiya K. J., Agerbo E., & Mortensen P. B. (2005). Parental death and bipolar disorder: a robust association was found in early maternal suicide. *Journal of Affective Disorders*, 86(2–3): 151–159.