



# The prevalence of severe grief reactions after bereavement and their associations with mental health, physical health, and health service utilization: a population-based study

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## ABSTRACT

**Background:** Previous research has shown that bereaved individuals are at risk of developing physical and mental health problems. However, knowledge is scarce about the associations between severe grief reactions after bereavement and physical and mental health problems and the use of health services.

**Objectives:** The present study sought to investigate the prevalence of severe grief reactions and to study the associations of severe grief reactions with mental and physical health and health care utilization.

**Method:** The sample comprised 20,453 adults aged 40 and above (mean age = 57.2 years, SD = 11.3 years, 52.4% female) who participated in the seventh wave of the Tromsø study. Severe grief was assessed with one question asking whether the respondent has experienced the death of a loved one and currently has difficulty accepting the loss, yearns for the deceased, and experiences intense emotional pain related to the loss. Furthermore, participants answered questions about their current physical health, mental health (Hopkins Symptom Checklist – 10), and the use of health services in the past year.

**Results:** Overall, 5.2% of the participants reported severe grief after a loss in childhood, 25.9% after bereavement in adulthood and 4.1% after bereavement in the previous year. Female gender, higher age, living without a partner, non-Norwegian ethnicity, and lower socio-economic status were associated with severe grief. Severe grief reactions were negatively related to self-reported health, predicted positively current levels of depression and anxiety, and were positively associated with the use of health services. Effect sizes were small. Gender differences in the use of health services were observed.

**Conclusion:** Severe grief reactions are common in individuals aged 40 and older and associated with self-reported physical and mental health problems as well as increased use of health services. Health service providers should be attentive to possible severe grief in connection with health complaints.

## La prevalencia de las reacciones severas de duelo luego de la pérdida de un ser querido y sus asociaciones con la salud mental, la salud física, y la utilización de los servicios de salud: Un estudio basado en la población

**Antecedentes:** Investigaciones previas han mostrado que los individuos que han perdido a seres queridos se encuentran en mayor riesgo de desarrollar problemas de salud física y mental. Sin embargo, es escaso el conocimiento sobre las asociaciones entre las reacciones severas de duelo luego de la pérdida y los problemas de salud física y mental y el uso de los servicios de salud.

**Objetivo:** El presente estudio buscó investigar la prevalencia de las reacciones severas de duelo y estudiar las asociaciones de las reacciones severas de duelo con la salud física y mental y la utilización de atención de salud.

**Método:** La muestra se compuso de 20.453 adultos de 40 años y más (edad promedio = 57.2 años, DS = 11.3 años, 52.4% mujeres) que participaron en la séptima etapa del estudio Tromsø. El duelo severo se midió con una pregunta indagando si el encuestado ha experimentado la muerte de un ser querido y si actualmente tiene dificultades aceptando la pérdida, ansia del fallecido/a, y experimenta dolor emocional intenso relacionado a la pérdida. Además, los participantes respondieron preguntas sobre su actual salud física, salud mental (Lista de Chequeo de Síntomas de Hopkins-10), y el uso de los servicios de salud en el último año.

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## PALABRAS CLAVE

reacciones severas de duelo; pérdida de un ser querido; salud física; salud mental; uso de los servicios de salud; estudio basado en la población

## 关键词

严重哀伤反应; 丧亲; 身体健康; 心理健康; 健康服务使用; 基于人群的研究

## HIGHLIGHTS:

- In a population-based study of adults aged 40 and older, approximately one third reported that they experience severe grief after the loss of a loved one.
- Grief was associated with physical and mental health problems and increased use of health services.

**Resultados:** En general, 5.2% de los participantes reportaron duelo severo después de una pérdida en la infancia, 25.9% luego de la pérdida de un ser querido en la adultez y 4.1% luego de una pérdida en el último año. Se asociaron con el duelo severo el género femenino, una mayor edad, vivir sin una pareja, no ser de etnia noruega, y estatus socioeconómico más bajo. Las reacciones severas de duelo se relacionaron negativamente con el auto-reporte de salud, predijo positivamente los niveles actuales de depresión y ansiedad, y fueron asociados positivamente con el uso de los servicios de salud. Los tamaños de los efectos fueron pequeños. Se observaron diferencias de género en el uso de los servicios de salud.

**Conclusión:** Las reacciones severas de duelo son comunes en los individuos de 40 y más años y se asociaron con el auto-reporte de problemas de salud física y mental como también con un incremento del uso de los servicios de salud. Los proveedores de los servicios de salud deberían estar atentos a la posible conexión entre el duelo severo y las quejas de salud.

### 丧亲后严重哀伤反应的流行率及其与心理健康, 身体健康和健康服务使用的关系: 一项基于人群的研究

**背景:** 前人研究表明, 丧亲者有发展身心健康问题的风险。然而, 对丧亲后严重哀伤反应与身心健康问题以及健康服务使用之间的联系了解很少。

**目的:** 本研究旨在考查严重哀伤反应的流行率, 并研究严重哀伤反应与心理和身体健康以及医疗保健使用之间的关系。

**方法:** 样本包括 20,453 位 40 岁及以上的成年人 (平均年龄 = 57.2 岁, SD = 11.3 岁, 女性占 52.4%), 他们参加了第七次特罗姆瑟研究。询问应答者是否经历过亲人死亡的问题, 目前是否难以接受丧亲, 对死者向往以及体验到丧亲相关的强烈情感痛苦, 对严重哀伤进行了评估。此外, 参与者回答了有关他们当前的身体健康, 心理健康 (霍普金斯症状清单-10) 以及在过去一年中健康服务使用的问题。

**结果:** 总体而言, 5.2% 的参与者报告了童年丧亲后的严重哀伤, 25.9% 报告了成年丧亲后, 4.1% 报告了近一年丧亲后的严重哀伤。女性, 年龄较大, 生活上没有伴侣, 非挪威族裔和较低的社会经济地位与严重哀伤有关。严重哀伤反应与自我报告的健康呈负相关, 与当前的抑郁和焦虑水平呈正相关, 与使用健康服务呈正相关。效应量很小。在使用健康服务方面存在性别差异。

**结论:** 严重哀伤反应常见于 40 岁及 40 岁以上的人群, 与自我报告的身心健康问题以及健康服务使用增加有关。健康服务提供者应注意与健康疾病相关的可能的严重哀伤。

Bereavement is a common life event that can be followed by a period of suffering and distress. Indeed, the death of a loved one has been ranked as one of the most stressful life events (Holmes & Rahe, 1967). Grief is a natural, universal and adaptive response to loss (Stroebe, Hansson, Stroebe, & Schut, 2001). Immediately after the loss, bereaved individuals can experience a variety of negative emotions such as deep sadness, disbelief, yearning, anxiety, anger, or guilt. In addition, physical symptoms such as fatigue and sleep problems are common. For most bereaved, the loss is distressing and disruptive, but they come to terms with the loss after a while (Zisook et al., 2014). However, a group of bereaved (approximately 10% following natural deaths and around 50% when the death is due to unnatural causes; Djelantik, Smid, Mroz, Kleber, & Boelen, 2020; Lundorff, Holmgren, Zachariae, Farver-Vestergaard, & O'Connor, 2017) experience intense grief that persists longer than would normally be expected and is characterized by an enduring and overwhelming sense of yearning or preoccupation with the deceased and significant emotional suffering, and that is associated with functional impairment in daily life. This condition has been termed prolonged grief disorder

(Prigerson et al., 2009; World Health Organization, 2018), complicated grief (Shear et al., 2011), and persistent complex bereavement disorder (American Psychiatric Association, 2013). In the most recent wave of the longitudinal population-based Tromsø study (Tromsø 7; Jacobsen, Eggen, Mathiesen, Wilsgaard, & Njølstad, 2012), participants were asked whether they have lost a loved one to death and have difficulty accepting the loss, yearn for the deceased, and feel intense emotional pain related to the loss. Due to the emotional distress involved, the experience of these symptoms can be considered severe grief without necessarily meeting the diagnostic criteria for a grief disorder. This so-termed “severe grief” is the focus of the present study.

A number of studies have shown associations between bereavement and an increased risk of developing physical and mental health problems (Stroebe, Schut, & Stroebe, 2007; Stroebe, Stroebe, Schut, & Boerner, 2017). With respect to physical health, a heightened risk of mortality after bereavement has been observed in widowed populations (e.g., Moon, Kondo, Glymour, & Subramanian, 2011; Shor et al., 2012; Ytterstad & Brenn, 2015). This so-called “widowhood effect” has also been

reported for losses other than the death of a spouse, e.g., the loss of a child or a sibling in childhood (e.g., Espinosa & Evans, 2013; Rostila, Saarela, & Kawachi, 2011, 2014; Yu et al., 2017). The negative health consequences of bereavement have been linked especially to cardiovascular and cerebrovascular events (e.g., Bartrop, Buckley, & Tofler, 2016; Carey et al., 2014), but associations with several other conditions and diseases have also been reported, including infections (Lu et al., 2016; Vitlic, Lord, Carroll, & Phillips, 2015) and type I diabetes (Virk, Ritz, Li, Obel, & Olsen, 2016). In terms of mental health, study findings suggest an increased risk of depression, anxiety and substance use disorders after bereavement (e.g., Cole & Dendukuri, 2003; Kaplow, Saunders, Angold, & Costello, 2010; Keyes et al., 2014; Onrust & Cuijpers, 2006). In accordance with the heightened likelihood for mental and physical health problems, the majority of studies on health care utilization after bereavement found an increase in the use of health services (e.g., Guldin, Jensen, Zachariae, & Vedsted, 2013; Miles et al., 2016; Oksuzyan et al., 2011; Ornstein et al., 2019). With respect to mental health, register-based studies have found an increased occurrence of psychiatric treatment (Munk-Olsen et al., 2014) and hospitalization (Li, Laursen, Precht, Olsen, & Mortensen, 2005) in conjunction with bereavement.

Compared to the large body of research on the consequences of bereavement on health, there are considerably fewer studies examining how bereaved individuals who experience severe grief report their physical and mental health and their use of health care services. For example, Toblin et al. (2012) found in a military sample that difficulties with coping with grief predicted a broad range of physical health problems. It has been observed that complicated grief often co-occurs with other psychiatric diagnoses, especially depression and posttraumatic stress disorder (Simon et al., 2007). Lannen, Wolfe, Prigerson, Onelov, and Kreicbergs (2008) reported that parents who had lost a child due to cancer and felt that they had not worked through their grief were more likely to experience anxiety, depression, and physical health problems than parents who had worked through their grief. In addition, for the mothers, it was observed that they visited their physician more often because of anxiety and depression.

Thus, using data from the Tromsø 7 study, the present study sought to investigate the prevalence of severe grief reactions. The current study further aimed to add to the knowledge base about bereavement and grief by examining the associations of severe grief reactions with mental and physical health and health care utilization in the Tromsø 7 sample.

## 1. Method

### 1.1. Participants

The study used data from the seventh wave of the Tromsø study (Tromsø 7). The Tromsø study is a longitudinal general population-based study initiated in 1974 to investigate causes and risk factors of cardiovascular diseases in men in Northern Norway (Jacobsen et al., 2012). In the subsequent waves, the study was extended to other chronic conditions and diseases and included men and women. Tromsø 7 was completed in the fall of 2016. In Tromsø 7, all residents of Tromsø over the age of 40 ( $N = 32,591$ ) were invited to participate. In total, 65% of the invited (11,074 women and 10,009 men) took part in the study.

Out of the 21,083 participants, 20,453 (97%) answered the question about severe grief reactions and were included in the present study, 10,716 (52.4%) women and 9,737 (47.6%) men. The mean age in the sample was 57.2 years ( $SD = 11.3$  years, range 40–97 years). The majority of participants ( $N = 19,509$ , 95.6%) identified themselves as Norwegians, 971 participants identified themselves as Sami / Kven (4.7%), and 847 (4.2%) of the participants indicated that they had another ethnicity (multiple responses were possible). Further demographic information about the sample is displayed in Table 1.

Tromsø 7 was approved by the Regional Committee of Medical and Health Research Ethics (REK 2014/940). Written consent was obtained from all participants. The Norwegian Data Protection Service (NSD) was notified about the present study.

### 1.2. Measures

In Tromsø 7, three questionnaires were administered. The first questionnaire (Q1) was a four-page paper-and-pencil form that was sent along with the letter of invitation. The second questionnaire (Q2) was completed online. A third questionnaire about diet was administered digitally when attending the clinical examination.

#### 1.2.1. Severe grief reactions

In Q2, a list of potential traumatic life events was included (e.g., life-threatening illness or accident, sexual abuse, or violence), and the participants were asked whether they have ever experienced one or more of these events. There were four response categories (no; yes, before age 18; yes, after age 18; yes, previous year). It was possible to select multiple response options for a given event. One item of this list assessed bereavement and the current experience of severe grief: “[Have you experienced the] [d]eath

**Table 1.** Prevalence of severe grief reactions after bereavement before age 18, after age 18, and in the previous year.

		N <sup>1</sup> (%)	Before age 18 N (%)	<i>p</i>	After age 18 N (%)	<i>p</i>	Previous year N (%)	<i>p</i>
Total		20,453	1,064 (5.2%)		5,300 (25.9%)		844 (4.1%)	
Gender	Female	10,716 (52.4%)	615 (5.7%)		3,200 (29.9%)		528 (4.9%)	
	Male	9,737 (47.6%)	449 (4.6%)	<.001	2,100 (21.6%)	<.001	316 (3.2%)	<.001
Age group	40–49	6,293 (30.8%)	391 (6.2%)		1,368 (21.7%)		219 (3.5%)	
	50–59	5,882 (28.8%)	275 (4.7%)		1,519 (25.8%)		238 (4.0%)	
	60–69	5,038 (24.6%)	227 (4.5%)		1,355 (26.9%)		211 (4.2%)	
	70–79	2,561 (12.5%)	131 (5.1%)		806 (31.5%)		134 (5.2%)	
	80–97	679 (3.3%)	40 (5.9%)	<.001	252 (37.1%)	<.001	42 (6.2%)	<.001
Living with spouse / partner	Yes	14,916 (77.1%)	751 (5.0%)		3,525 (23.6%)		509 (3.4%)	
	No	4,430 (22.9%)	252 (5.7%)	.085	1,425 (32.2%)	<.001	267 (6.0%)	<.001
Ethnicity	Norwegian	18,729 (91.8%)	937 (5.0%)		4,816 (25.7%)		759 (4.1%)	
	Sami/Kven	210 (1.0%)	19 (9.0%)		70 (33.3%)		5 (2.4%)	
	Norwegian-Sami/Kven	618 (3.0%)	42 (6.8%)		161 (26.1%)		34 (5.5%)	
	Other	847 (4.2%)	63 (7.4%)	<.001	232 (27.4%)	.061	43 (5.1%)	.080
Education	Primary/partly secondary education	4,550 (22.6%)	219 (4.8%)		1,429 (31.4%)		263 (5.8%)	
	Upper secondary education	5,593 (27.8%)	320 (5.7%)		1,553 (27.8%)		259 (4.6%)	
	Tertiary education, short	3,920 (19.5%)	183 (4.7%)		976 (24.9%)		136 (3.5%)	
	Tertiary education, long	6,054 (30.1%)	330 (5.5%)	.060	1,235 (20.4%)	<.001	165 (2.7%)	<.001
Household income	Less than NOK 551,000	6,537 (33.2%)	377 (5.8%)		2,107 (32.2%)		371 (5.7%)	
	NOK 551,000–1,000,000	8,165 (41.5%)	438 (5.4%)		1,966 (24.1%)		317 (3.9%)	
	More than NOK 1,000,000	4,963 (25.2%)	210 (4.2%)	<.001	971 (19.6%)	<.001	110 (2.2%)	<.001

Note. NOK = Norwegian Krone (1 NOK ≈ 0.09 Euro). <sup>1</sup> Ns that do not add up to 20,453 for a demographic variable are due to missing data.

of a loved one and do you have difficulty accepting the loss, yearn for the deceased, and experience intense emotional pain related to the loss”.

### 1.2.2. Self-reported physical and mental health

In Q1, participants were asked how they consider their health on a five-point scale from ‘very bad’ (1) to ‘excellent’ (5). In addition, participants rated their health now compared to others at the same age on a five-point scale from ‘much worse’ (1) to ‘much better’ (5).

Mental health problems were assessed in Q2 with the Hopkins Symptom Checklist-10 (HSCL-10; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). The HSCL-10 comprises ten items assessing symptoms of anxiety and depression on a four-point scale from ‘no complaint’ (1) to ‘very much’ (4). In the study, the anxiety, depression, and total scores of the HSCL-10 were used; these have shown adequate internal consistencies (Schmalbach et al., *in press*; Strand, Dalgard, Tambs, & Rognerud, 2003).

### 1.2.3. Use of health care services

Q1 contained a list of health care services (ie, general practitioner, emergency room, psychologist / psychiatrist, other medical specialist than psychiatrist, dentist / dental service, pharmacy, physiotherapist, chiropractor, complementary and alternative medicine (CAM) provider (including acupuncturist and traditional healer), communication with health services via internet, hospital admission, psychiatric outpatient clinic, hospital outpatient clinic other than psychiatric). The participants were asked to indicate if and how often they had used these services during the past 12 months.

### 1.2.4. Smoking, height, and weight

Daily smoking was assessed with one question having three response categories (yes; yes, previously; never). Participants’ height and weight were used to calculate body mass index (BMI).

## 1.3. Analyses

Missing data were not replaced, and listwise deletion was used in the statistical analyses. Item mean scores were calculated for the HSCL-10 scales when at least 80% of the items were answered. The prevalence of severe grief reactions was calculated for the entire sample. Differences in prevalence by gender, age group, living with spouse / partner, ethnicity, education, and income were evaluated by using chi-square tests. When the chi-square test was significant at  $p < .05$ , the standardized residuals (SR) were examined to identify the cells that contributed to the significant chi-square.

Regression analyses were conducted to examine the associations between severe grief reactions after bereavement and self-report health, mental health problems, and the use of health care services. The analyses were performed separately for women and men. Logistic regressions were applied to predict the use of the different health care services in the previous twelve months from severe grief reactions after bereavement before and after age 18. The associations between severe grief reactions and the number of times the health care services were used during the previous year were examined with negative binomial regressions. Crude coefficients and coefficients adjusted for the control variables age, BMI, smoking, education, and living with spouse /

partner were calculated in all regression analyses. Ethnicity and income were not included as control variables because multidimensional contingency tables of the categorical predictor variables exhibited cells with zero counts when these variables were entered. In the logistic regression analyses, standardized mean differences (Cohen's  $d$ ) were calculated as a measure of effect size in addition to odd ratios by multiplying the log odd ratios with  $\sqrt{3} / \pi$  (Borenstein, Hedges, Higgins, & Rothstein, 2009). An online effect size calculator (Coxe, 2018) was used to obtain  $d$  for the negative binomial regression analyses. Cohen (1988) suggested that  $d$ -values of 0.2, 0.5, and 0.8 represent small, medium, and large effects, respectively. Participants with missing data on the control variables were excluded from all regression analyses to ensure that the crude and adjusted coefficients are comparable. Categorical variables with more than two categories were dummy coded before they were entered in the models. In addition, tests were conducted for separation in the logistic regressions. The analyses were performed in R 3.6.3 (R Core Team, 2020) and the package `gmodels` (Warnes, Bolker, Lumley, & Johnson, 2018), `beta lm` (Behrendt, 2014), `brglm2` (Kosmidis, 2020), and `MASS` (Venables & Ripley, 2002).

## 2. Results

The prevalence of severe grief reactions after bereavement before age 18, after age 18, and during the previous year is displayed in Table 1, presented for the entire sample and broken down by gender, age group, living with a spouse / partner, ethnicity, education, and income. As shown in Table 1, in the entire sample, the prevalence of severe grief reactions was 5.2% after bereavement before age 18, 25.9% after bereavement after age 18, and 4.1% after bereavement in the previous year. Severe grief reactions after bereavement in more than one of the time intervals were reported by 1.7% of the participants. There was a significant association between gender and severe grief reactions across the three time intervals with more women reporting severe grief reactions than men. Similarly, age was significantly related to severe grief reactions for all three time intervals, although in different directions. For severe grief reactions after bereavement before age 18, there were significantly more participants in the age group 40 to 49 years ( $z = 3.52, p < .001$ ) and significantly fewer participants in the age group 60 to 69 ( $z = -2.17, p < .05$ ) than expected. For severe grief reactions after bereavement after age 18 and the previous year, there were significantly fewer participants in the age group 40 to 49 ( $z = -6.51, p < .001$ , and  $z = -2.53, p < .05$ , respectively) and significantly more

participants in the age group 70 to 79 ( $z = 5.53, p < .001$ , and  $z = 2.76, p < .01$ , respectively) and 80 to 97 ( $z = 5.73, p < .001$ , and  $z = 2.64, p < .01$ , respectively) than expected. Further, as shown in Table 1, significantly more participants who lived alone had severe grief reactions after bereavement after age 18 and the previous year than participants who lived with a spouse or partner. Ethnicity was significantly related to severe grief reaction after bereavement before age 18. The standardized residuals were significant for Sami / Kven ( $z = 2.45, p < .05$ ) and the group of participants having ethnicities other than Norwegian and / or Sami / Kven ( $z = 2.86, p < .01$ ). There was a significant association between education and severe grief reactions after bereavement after age 18 and the previous year. For both time intervals, there were significantly more participants with primary school / some secondary ( $z = 7.43, p < .001$  and  $z = 5.63, p < .001$ , respectively) and upper secondary education ( $z = 2.88, p < .01$  and  $z = 2.20, p < .05$ , respectively) and significantly fewer participants with lengthy tertiary education ( $z = -8.29, p < .001$  and  $z = -5.25, p < .001$ , respectively) than expected. Household income was significantly related to severe grief reactions after bereavement for all three time intervals. At the three time intervals, standardized residuals showed that there were significantly more participants in the lowest income group ( $z = 1.97, p < .05$ ,  $z = 10.51, p < .001$ , and  $z = 6.49, p < .001$ , respectively) and significantly fewer participants in the highest income group ( $z = -3.03, p < .01$ ,  $z = -8.46, p < .001$ , and  $z = -6.44, p < .001$ , respectively) reporting severe grief reactions than expected. For severe grief reactions after bereavement after age 18, there were significantly fewer participants from the middle-income group than expected ( $z = -2.80, p < .01$ ).

The results of the regression analyses predicting self-reported physical and mental health from severe grief reactions for women and men are shown in Tables 2 and 3, respectively. For both genders, severe grief reactions after bereavement before age 18, after age 18, and the previous year was a significant negative predictor of self-rated current health, also after controlling for age, BMI, living with a spouse/partner, education, and smoking. Severe grief reactions after bereavement before and after age 18 predicted negatively and significantly self-rated health compared to others at the same age for women after adjustment for the control variables but not for men. For both genders, severe grief reactions after bereavement in the three time categories were a significant positive predictor of the anxiety, depression, and total score of the HSCL-10. The variance explained in the physical and mental health variables by severe grief ranged from 0% (health compared to others at the same

**Table 2.** Regression analysis predicting self-reported physical and mental health from severe grief reactions after bereavement (women).

	After bereavement before age 18				After bereavement after age 18				After bereavement in the previous year			
	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$
Health	-0.10 (0.03)	-0.03**	.001	.115	-0.17 (0.02)	-0.10***	.009	.117	-0.19 (0.04)	-0.05***	.003	.115
Health compared	-0.09 (0.04)	-0.02*	.001	.114	-0.08 (0.02)	-0.04***	.002	.114	-0.07 (0.04)	-0.02	.000	.113
Anxiety	0.10 (0.02)	0.06***	.004	.025	0.09 (0.01)	0.10***	.011	.033	0.13 (0.02)	0.07***	.005	.026
Depression	0.11 (0.02)	0.06***	.003	.003	0.12 (0.01)	0.11***	.012	.037	0.18 (0.02)	0.08***	.006	.031
HSCL-10 total score	0.11 (0.02)	0.06***	.004	.031	0.11 (0.01)	0.12***	.014	.040	0.16 (0.02)	0.08***	.007	.033

\*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ . Adj. = adjusted for age, BMI, smoking, education, and living with partner/spouse.  $R^2$  = adjusted  $R^2$  when all control variables are included in the model.  $R_c^2$  = adjusted  $R^2$  when all control variables are included in the model.

**Table 3.** Regression analysis predicting self-reported physical and mental health from severe grief reactions after bereavement (men).

	After bereavement before age 18				After bereavement after age 18				After bereavement in the previous year			
	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$	crude $B$ (SE)	crude $\beta$	$R^2$	$R_c^2$
Health	-0.10 (0.04)	-0.03**	.001	.105	-0.10 (0.02)	-0.06***	.003	.105	-0.16 (0.04)	-0.04***	.001	.105
Health compared	-0.10 (0.04)	-0.03 *	.001	.108	-0.06 (0.02)	-0.03 **	.001	.108	-0.11 (0.05)	-0.02 *	.000	.108
Anxiety	0.10 (0.02)	0.07 ***	.005	.026	0.07 (0.01)	0.09 ***	.008	.031	0.11 (0.02)	0.06 ***	.004	.025
Depression	0.15 (0.02)	0.07 ***	.005	.041	0.11 (0.01)	0.11 ***	.013	.049	0.16 (0.02)	0.07 ***	.005	.040
HSCL-10 total score	0.13 (0.02)	0.08 ***	.006	.041	0.10 (0.01)	0.12 ***	.013	.050	0.14 (0.02)	0.07 ***	.005	.040

\*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ . Adj. = adjusted for age, BMI, smoking, education, and living with partner / spouse.  $R^2$  = adjusted  $R^2$ .  $R_c^2$  = adjusted  $R^2$  when all control variables are included in the model.

age regressed on severe grief after bereavement in the previous year) to 1.4% (anxiety in women regressed on severe grief after bereavement after age 18).

Tables 4 and 5 display the results of regression analyses predicting the use of health services in the previous year from bereavement before and after age 18 for women and men, respectively. As shown in Table 4, for women, severe grief reactions after bereavement before age 18 was significantly and positively associated with the use of the emergency room, psychologist / psychiatrist, physiotherapist, chiropractor, and psychiatric outpatient clinic after adjustment for the control variables. The odds ratio (OR) was highest for use of psychiatric outpatient clinic ( $OR = 2.14, d = 0.42$ ) and psychologist / psychiatrist ( $OR = 1.68, d = 0.29$ ). Furthermore, severe grief reactions after bereavement before age 18 predicted significantly and positively the number of times the general practitioner and psychologist / psychiatrist was visited during the previous year. When the severe grief reactions were related to bereavement after age 18, a significant and positive relationship was found in terms of the use of the general practitioner, emergency room, psychologist / psychiatrist, pharmacy, physiotherapist, and chiropractor after adjustment for the control variables. The highest effect size was for psychologist / psychiatrist ( $OR = 1.42, d = 0.19$ ). The number of visits of the general practitioner, emergency room, psychologist / psychiatrist, medical specialist other than psychiatrist, dentist / dental service, and pharmacy as well as hospital admissions and use of outpatient clinic other than psychiatric was significantly and positively predicted by severe grief reactions after bereavement after age 18 in women. For men, severe grief reactions after bereavement before age 18 was significantly and positively associated with the use of pharmacy, chiropractor, and communication with health-care services via internet in the previous year after adjustment for the control variables (Table 5). The effect size was highest for the use of chiropractor ( $OR = 1.73, d = 0.30$ ). Severe grief reactions after bereavement before age 18 predicted significantly and positively the number of visits of a general practitioner, emergency room, dentist / dental service, pharmacy, chiropractor, communication with health services via internet, and outpatient clinic other than psychiatry. When the severe grief reactions were related to bereavement after age 18, a significant and positive association was found for the use of a general practitioner, emergency room, medical specialist other than psychiatrist, pharmacy, physiotherapist, CAM provider, and hospital admissions. The effect size was highest for the use of CAM provider ( $OR = 1.45, d = 0.21$ ). Further, the number of visits of a general practitioner, emergency room, medical specialist other than psychiatrist, dentist /

dental service, pharmacy, physiotherapist, CAM provider, outpatient clinic other than psychiatric, and hospital admissions were significant and positively associated with severe grief reactions after bereavement after age 18 in men.

### 3. Discussion

The present study investigated the prevalence of severe grief reactions after bereavement in a large, general sample of adults aged 40 and above. The associations of severe grief reactions with current physical and mental health and the use of health care services were examined.

Overall, 5.2% of the participants reported that they have experienced the death of a loved one in childhood and have difficulty accepting the loss, yearn for the deceased, and experience intense emotional pain related to the loss, 25.9% after bereavement in adulthood, and 4.1% after bereavement in the previous year. Thus, the experience of severe grief is common in the population investigated. The results further showed that the prevalence of severe grief reactions varied between demographic groups. Women were more likely to experience severe grief than men. This finding is in line with previous studies suggesting that women respond more often to bereavement with psychological symptoms (Chen et al., 1999) and have a higher prevalence of complicated or prolonged grief than men (e.g., Kersting, Braehler, Glaesmer, & Wagner, 2011). Participants living without a spouse or a partner reported more often severe grief reactions after bereavement after age 18 and in the previous year, possibly because the person lost was the spouse or partner. This finding may also indicate remoteness of close friends and family members for social support. We also observed an association between severe grief and age. There were significantly more participants in the youngest age group in the sample (40 to 49 years) reporting severe grief after bereavement in childhood than in all the other age groups. In contrast, the two oldest age groups (70 to 79 years and 80 to 97 years) had significantly more participants with severe grief after bereavement in adulthood and the previous year than the other age groups. The former age effect might be explained by the shorter time since a loss in childhood and therefore less time to resolve the grief. Moreover, the likelihood of losing a significant person in one's life naturally increases with age, and the youngest participants had less time to experience losses in adulthood compared to the older age groups. On the other hand, it has been found that 87% of the individuals in the age group 50 to 70 years of age have experienced the loss of a close relative, ie, a parent, a spouse, a sibling, or a child (Miles et al., 2016). It is conceivable that more recent losses have

**Table 4.** Regression analysis predicting use of health services in the previous year from severe grief reactions after bereavement (women).analysis predicting use of health services in the previous year from severe grief reactions after bereavement (women).

Health care service	After bereavement before age 18						After bereavement after age 18					
	crude OR			adj. OR			crude OR			adj. OR		
	crude B (SE)	adj. B (SE)	adj. OR (95% CI)	d	B	adj. B (SE)	crude B (SE)	adj. B (SE)	adj. OR (95% CI)	d	B	adj. B (SE)
General practitioner	0.23 (0.13)	0.24 (0.13)	1.27 (0.99, 1.64)	0.13 (0.05)	0.11 * (0.05)	0.11 * (0.05)	0.30 *** (0.06)	0.10 (0.05)	1.18 (1.04, 1.35)	0.09	0.13 *** (0.02)	0.09 *** (0.02)
Emergency room	0.26 * (0.12)	0.26 * (0.12)	1.30 (1.02, 1.63)	0.15 (0.06)	0.08 (0.13)	0.08 (0.13)	0.32 *** (0.06)	0.02	1.27 (1.12, 1.44)	0.13	0.35 *** (0.07)	0.28 *** (0.07)
Psychologist / psychiatrist	0.58 *** (0.17)	0.52 ** (0.17)	1.68 (1.18, 2.48)	0.29 (0.05)	1.04 ** (0.40)	0.91 * (0.38)	0.26 * (0.10)	0.19	1.42 (1.15, 1.75)	0.19	0.32 (0.21)	0.60 ** (0.20)
Medical specialist	0.13 (0.10)	0.13 (0.10)	1.14 (0.93, 1.39)	0.07 (0.03)	0.05 (0.11)	0.05 (0.11)	0.06 (0.05)	0.02	1.09 (0.98, 1.21)	0.05	0.19 *** (0.06)	0.22 *** (0.06)
Dentist / dental service	-0.21 * (0.10)	-0.19 (0.10)	0.83 (0.66, 0.99)	-0.10 (0.05)	0.02 (0.05)	0.02 (0.05)	-0.01 (0.06)	0.01	1.00 (0.89, 1.12)	0.00	0.10 *** (0.02)	0.07 ** (0.02)
Pharmacy	0.18 (0.10)	0.17 (0.10)	1.19 (0.98, 1.46)	0.09 (0.06)	0.07 (0.06)	0.07 (0.06)	0.19 *** (0.05)	0.05	1.16 (1.05, 1.29)	0.08	0.11 *** (0.03)	0.11 ** (0.03)
Physiotherapist	0.21 * (0.10)	0.20 * (0.10)	1.22 (1.01, 1.47)	0.11 (0.06)	0.13 (0.16)	0.17 (0.16)	0.19 *** (0.05)	0.05	1.20 (1.09, 1.33)	0.10	0.03 (0.08)	0.00 (0.08)
Chiropractor	0.36 * (0.15)	0.34 * (0.15)	1.40 (1.04, 1.89)	0.19 (0.09)	0.09 (0.29)	0.05 (0.29)	0.21 ** (0.08)	0.01	1.27 (1.07, 1.49)	0.13	0.32 * (0.15)	0.26 (0.15)
CAM provider	0.24 * (0.12)	0.23 (0.12)	1.25 (0.98, 1.62)	0.12 (0.08)	0.32 (0.22)	0.27 (0.22)	0.05 (0.07)	0.06	1.06 (0.93, 1.20)	0.03	0.06 (0.11)	0.04 (0.11)
Internet	0.10 (0.19)	0.05 (0.19)	1.05 (0.75, 1.56)	0.02 (0.07)	-0.06 (0.29)	-0.06 (0.29)	-0.20 * (0.10)	-0.01	0.96 (0.78, 1.17)	-0.02	-0.18 (0.15)	-0.12 (0.15)
Hospital admission	-0.02 (0.14)	-0.01 (0.14)	0.99 (0.74, 1.29)	-0.01 (0.14)	-0.14 (0.17)	-0.14 (0.17)	0.22 ** (0.07)	-0.03	1.13 (0.98, 1.30)	0.07	0.25 ** (0.08)	0.23 ** (0.09)
Psychiatric outpatient clinic	0.81 ** (0.25)	0.76 ** (0.25)	2.14 (1.34, 3.56)	0.42 (0.06)	0.90 (0.66)	0.70 (0.61)	0.17 (0.17)	0.07	1.12 (0.84, 1.64)	0.06	0.16 (0.17) <sup>1</sup>	0.16 (0.33)
Outpatient clinic other than psychiatric	0.10 (0.09)	0.11 (0.09)	1.11 (0.92, 1.33)	0.06 (0.10)	0.04 (0.10)	0.04 (0.10)	0.11 * (0.05)	0.02	1.08 (0.92, 1.23)	0.04	0.10 * (0.05)	0.11 * (0.05)

\*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ . Adj. = adjusted for age, BMI, smoking, education, and living with partner / spouse. CAM = complementary and alternative medicine.  $d$  = Cohen's  $d$  for the adjusted model. OR = odds ratio. <sup>1</sup> Poisson regression used.



**Table 5.** Regression analysis predicting use of health services in the previous year from severe grief reactions after bereavement (men).analysis predicting use of health services in the previous year from severe grief reactions after bereavement (men).

Health care service	After bereavement before age 18						After bereavement after age 18									
	crude			times used			crude			times used						
	crude B (SE)	adj. B (SE)	adj. OR (95% CI)	d	B	adj. B	OR (95% CI)	adj. B (SE)	d	B	adj. B	adj. OR (95% CI)	d			
General practitioner	0.13 (0.12)	0.15 (0.12)	1.16 (0.92, 1.49)	0.08	0.15 ** (0.06)	0.13 * (0.06)	1.29 (1.15, 1.46)	0.26 *** (0.06)	0.09	0.15 ** (0.06)	0.17 ** (0.06)	1.19 (1.05, 1.35)	0.10	0.23 *** (0.03)	0.18 *** (0.03)	0.12
Emergency room	0.26 (0.14)	0.26 (0.14)	1.29 (0.97, 1.68)	0.14	0.35 * (0.14)	0.34 * (0.14)	1.23 (1.06, 1.43)	0.21 ** (0.07)	0.09	0.27 *** (0.08)	0.17 * (0.08)	1.19 (1.02, 1.37)	0.09	0.27 *** (0.08)	0.24 ** (0.08)	0.06
Psychologist / psychiatrist	0.35 (0.29)	0.28 (0.29)	1.32 (0.70, 2.26)	0.15	0.69 (0.63)	0.64 (0.60)	1.22 (0.88, 1.67)	0.20 (0.16)	0.08	0.25 (0.33)	0.24 (0.17)	1.27 (0.91, 1.75)	0.13	0.25 (0.33)	0.18 (0.31)	0.02
Medical specialist	-0.16 (0.14)	-0.16 (0.14)	0.85 (0.64, 1.11)	-0.09	-0.26 (0.16)	-0.22 (0.16)	1.25 (1.09, 1.42)	0.22 *** (0.07)	-0.05	0.22 *** (0.07)	0.21 ** (0.07)	1.24 (1.09, 1.41)	0.12	0.41 *** (0.08)	0.39 *** (0.08)	0.11
Dentist / dental service	0.06 (0.11)	0.08 (0.12)	1.09 (0.85, 1.37)	0.05	0.13 * (0.05)	0.12 * (0.05)	1.02 (0.91, 1.14)	0.02 (0.06)	0.09	0.02 (0.06)	0.01 (0.06)	1.01 (0.90, 1.13)	0.00	0.09 ** (0.03)	0.07 * (0.03)	0.05
Pharmacy	0.24 * (0.11)	0.24 * (0.11)	1.27 (1.03, 1.57)	0.13	0.25 *** (0.07)	0.22 ** (0.07)	1.26 (1.13, 1.40)	0.23 *** (0.05)	0.14	0.23 *** (0.05)	0.20 *** (0.06)	1.22 (1.09, 1.36)	0.11	0.23 *** (0.04)	0.21 *** (0.04)	0.13
Physiotherapist	-0.07 (0.13)	-0.06 (0.13)	0.94 (0.72, 1.22)	-0.03	0.00 (0.22)	0.08 (0.22)	1.18 (1.03, 1.34)	0.16 * (0.07)	0.02	0.16 * (0.07)	0.16 * (0.07)	1.17 (1.03, 1.34)	0.09	0.27 * (0.11)	0.25 * (0.11)	0.06
Chiropractor	0.56 *** (0.14)	0.55 *** (0.14)	1.73 (1.29, 2.28)	0.30	0.56 * (0.28)	0.60 * (0.27)	1.04 (0.87, 1.23)	0.03 (0.09)	0.15	0.03 (0.09)	0.04 (0.09)	1.04 (0.87, 1.24)	0.02	0.18 (0.15)	0.13 (0.14)	0.03
CAM provider	0.19 (0.18)	0.20 (0.18)	1.22 (0.84, 1.70)	0.11	0.36 (0.33)	0.58 (0.32)	1.49 (1.25, 1.78)	0.40 *** (0.09)	0.12	0.40 *** (0.09)	0.37 *** (0.09)	1.45 (1.21, 1.74)	0.21	0.42 * (0.17)	0.51 ** (0.17)	0.10
Internet	0.38 (0.20)	0.39 * (0.20)	1.48 (0.99, 2.15)	0.22	0.64 * (0.32)	0.74 * (0.31)	0.89 (0.70, 1.12)	-0.11 (0.12)	0.17	-0.11 (0.12)	-0.02 (0.12)	0.98 (0.77, 1.24)	-0.01	0.23 (0.17)	0.25 (0.17)	0.04
Hospital admission	0.09 (0.16)	0.11 (0.16)	1.11 (0.81, 1.50)	0.06	0.07 (0.18)	0.11 (0.18)	1.33 (1.14, 1.55)	0.29 *** (0.08)	0.01	0.29 *** (0.08)	0.19 * (0.08)	1.21 (1.03, 1.41)	0.11	0.39 *** (0.09)	0.35 *** (0.09)	0.03
Psychiatric outpatient clinic	0.06 (0.42)	0.05 (0.42)	1.05 (0.41, 2.20)	0.02	0.22 (0.81)	0.14 (0.79)	1.56 (1.04, 2.29)	0.45 * (0.20)	0.01	0.45 * (0.20)	0.36 (0.20)	1.43 (0.95, 2.11)	0.20	0.15 (0.42)	-0.23 (0.41)	-0.01
Outpatient clinic other than psychiatric	0.07 (0.11)	0.08 (0.11)	1.08 (0.86, 1.34)	0.04	0.64 *** (0.12)	0.44 *** (0.12)	1.17 (1.04, 1.31)	0.15 ** (0.06)	0.10	0.15 ** (0.06)	0.11 (0.06)	1.11 (0.99, 1.25)	0.06	0.26 *** (0.06)	0.16 * (0.06)	0.03

\* p <.05 \*\* p <.01 \*\*\* p <.001. Adj. = adjusted for age, BMI, smoking, education, and living with partner / spouse. CAM = complementary and alternative medicine. d = Cohen's d for the adjusted model. OR = odds ratio.

a larger impact on one's current life than earlier losses and are therefore associated with more severe grief, which might explain the increased prevalence of severe grief reactions after bereavement in adulthood in the older study participants. The number of participants self-reporting severe grief reactions also varied between different ethnic groups. Sami / Kven or ethnic identity other than Norwegian or Sami / Kven was significantly associated with severe grief reactions after bereavement in childhood. Observations in different cultures and ethnic groups suggest that the experience of grief is at least partially shaped by the individual's sociocultural environment (Granek & Peleg-Sagy, 2017). Sami and Kven are minorities in Norway that have been exposed to forced assimilation and who experience more ethnic discrimination than ethnic Norwegians (Hansen, Melhus, Høgmo, & Lund, 2008). The experience of discrimination and acculturative stress may make individuals with non-Norwegian ethnicity vulnerable to respond more strongly to the loss of a loved one. However, no significant differences between ethnic groups were found for severe grief after bereavement in adulthood or in the previous year. The increased incidence of severe grief reactions related to bereavement in childhood in the groups of Sami / Kven and other non-Norwegian ethnicities should be investigated in more depth in future research. Finally, severe grief reactions were relatively overrepresented in individuals with low education and low income, which aligns with findings of previous studies showing associations of complicated grief with low socio-economic status (e.g., Kersting et al., 2011; Newson, Boelen, Hek, Hofman, & Tiemeier, 2011).

With respect to physical and mental health, severe grief reactions predicted self-reported health status and current level of symptoms of anxiety and depression in accordance with previous studies that reported associations of bereavement and grief with health problems and psychological disorders (Onrust & Cuijpers, 2006; Stroebe et al., 2017). It should be noted, however, that, although statistically significant, the associations were of small magnitude in the present sample. Moreover, in line with previous research on bereavement and health service use (Guldin et al., 2013; Miles et al., 2016), severe grief reactions were related to increased use of a broad range of health services, especially after bereavement in adulthood. Severe grief reactions were associated with both an increased likelihood of using these services and the number of times the services were sought during in the previous twelve months. The reasons for the observed relationships remain unclear from the present study. It has been suggested that the biological response to psychological trauma (e.g., inflammatory processes) can increase the risk of physical illness and mental disorders (Danese & Baldwin, 2017; Kendall-

Tackett, 2009), which may explain the elevated use of health services by bereaved individuals. Diminished self-care following bereavement may be another explanation for the increased need for health care services (cf. King et al., 2013), e.g., dental treatments due to poor dental care. Most effect sizes were small based on Cohen's (1988) criteria with the highest effect sizes being in the small to medium range. However, given the large number of individuals who experience bereavement and severe grief, small effects may be relevant. Considerable economic costs to society due to bereavement have been demonstrated (Stephen et al., 2015; van den Berg, Lundborg, & Vikström, 2017).

Separate analyses for gender revealed similarities and differences between women and men with respect to health service use. For both genders, severe grief reactions after bereavement in childhood and after age 18 were related to more visits of a general practitioner. In addition, severe grief in connection with a loss in adulthood was for women and men associated with more frequent visits of emergency room, medical specialist, dental services, pharmacy, and hospital admissions, indicating more health concerns and health problems in individuals with severe grief compared to individuals who do not experience severe grief. On the other hand, for women, the odds ratios were highest for utilizing psychological and psychiatric health services, whereas men were most likely to use chiropractor when the severe grief was related to a loss in childhood, and a CAM provider when the loss occurred in adulthood. This discrepancy may reflect gender differences in coping with bereavement where women tend to be more confrontational and more comfortable with talking about the loss than are men (Stroebe, Stroebe, & Schut, 2001), which is a hallmark of psychiatrist / psychiatrist treatment. However, previous study findings suggest that the bereaved generally underutilize mental health services because they find it too painful to talk about the loss and experience difficulties finding help (Lichtenthal et al., 2015, 2011). These results show that health service providers and especially general practitioners should be attentive to possible severe grief underlying health complaints, particularly in men.

A strength of the present study is the large sample size and the approximately even distribution of female and male participants. However, the interpretation of the study findings is limited by several shortcomings. Only self-report was used, and severe grief was measured with only one question, the use of which is common in epidemiological research but comes with a cost of low reliability and validity. Accordingly, information about the relationship with the deceased and the circumstances of the death (e.g., expectedness) was not collected although these factors have shown to be important for the severity of grief reactions (Piper,

Ogrodniczuk, Joyce, & Weideman, 2011). In addition, the presence of only three grief symptoms was measured. Although these symptoms are central to conceptualizations of grief disorders such as complicated or prolonged grief, these conditions are defined by more symptoms and diagnostic criteria (Prigerson et al., 2009; Shear et al., 2011). Importantly, impairment in personal, social, and occupational functioning due to the grief was not assessed. It is therefore not possible to determine the number of participants in the present sample who met the criteria for a grief disorder. Further, because bereavement was not assessed independently from grief reactions, the proportion of participants who experience severe grief reactions in relation to all bereaved could not be calculated. Therefore, it was also impossible to determine whether severe grief reactions add to the prediction of health and use of health services above only the experience of bereavement. The age range of the participants was restricted to the age of 40 and older, and the generalizability of the findings to younger individuals is unclear. Finally, due to the cross-sectional design of the study, causality of severe grief regarding physical and mental health and health service use cannot be inferred from the present investigation.

In conclusion, about a third of the participants reported severe grief reactions after a loss in childhood, adulthood, or the previous year in a population-based study for individuals aged 40 and older. Female gender, higher age, living without a partner, non-Norwegian ethnicity, and lower socio-economic status were associated with severe grief. Severe grief reactions were negatively related to self-reported health and predicted positively current levels of depression and anxiety as well as health service use in the previous year. However, effect sizes were small. Gender differences in the use of health services were observed. Although the associations were weak, health service providers should be aware of the relationships between grief and physical and mental health.

### Disclosure statement

The authors declare that they have no conflicts of interest.

### Data availability statement

The data that support the findings of this study are available from the Tromsø study upon application. Legal restrictions apply to the availability of these data, which were used under license for this study. Information on how to apply for access to data from the Tromsø study is available at [https://en.uit.no/forskning/forskningsgrupper/sub?p\\_document\\_id=453582&sub\\_id=669706](https://en.uit.no/forskning/forskningsgrupper/sub?p_document_id=453582&sub_id=669706).

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### References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Washington, DC: Author.
- Bartrop, R., Buckley, T., & Tofler, G. H. (2016). Bereavement and the risk of cardiovascular disease. In M. E. Alvarenga & D. Byrne (Eds.), *Handbook of psychocardiology* (pp. 229–246). New York: Springer.
- Behrendt, S. (2014). *lm.beta: Add standardized regression coefficients to lm-objects. R package version 1.5-1*. Retrieved from <https://CRAN.R-project.org/package=lm.beta>
- Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2009). *Introduction to meta-analysis*. Chichester, UK: John Wiley & Sons.
- Carey, I. M., Shah, Y. E., DeWilde, S., Harris, T., Victor, C. R., & Cook, D. G. (2014). Increased risk of acute cardiovascular events after partner bereavement: A matched cohort study. *JAMA Internal Medicine, 174*(4), 598–605.
- Chen, J. H., Bierhals, A. J., Prigerson, H. G., Kasl, S. V., Mazure, C. M., & Jacobs, S. (1999). Gender differences in the effects of bereavement-related psychological distress in health outcomes. *Psychological Medicine, 29*(2), 367–380.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Laurence Erlbaum.
- Cole, M. G., & Dendukuri, N. (2003). Risk factors for depression among elderly community subjects: A systematic review and meta-analysis. *American Journal of Psychiatry, 160*(6), 1147–1156.
- Coxe, S. (2018, February). Effect size measures for non-linear count regression models. *American Statistical Association Conference on Statistical Practice*. Portland, OR. February 15 - 17, 2018.
- Danese, A., & Baldwin, J. R. (2017). Hidden wounds? Inflammatory links between childhood trauma and psychopathology. *Annual Review of Psychology, 68*(1), 517–544.
- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins symptom checklist (HSCL): A self-report symptom inventory. *Behavioral Science, 19*(1), 1–15.
- Djelantik, A. A. A. M. J., Smid, G. E., Mroz, A., Kleber, R. J., & Boelen, P. A. (2020). The prevalence of prolonged grief disorder in bereaved individuals following unnatural losses: Systematic review and meta regression analysis. *Journal of Affective Disorders, 265*, 146–156.
- Espinosa, J., & Evans, W. N. (2013). Maternal bereavement: The heightened mortality of mothers after the death of a child. *Economics and Human Biology, 11*(3), 371–381.
- Graneek, L., & Peleg-Sagy, T. (2017). The use of pathological grief outcomes in bereavement studies on African Americans. *Transcultural Psychiatry, 54*(3), 384–399.
- Guldin, M.-B., Jensen, A. B., Zachariae, R., & Vedsted, P. (2013). Healthcare utilization of bereaved relatives of patients who died from cancer. A national population-based study. *Psycho-Oncology, 22*(5), 1152–1158.

- Hansen, K. L., Melhus, M., Høgmo, A., & Lund, E. (2008). Ethnic discrimination and bullying in the Sami and non-Sami populations in Norway: The SAMINOR study. *International Journal of Circumpolar Health*, 67(1), 99–115.
- Holmes, T. H., & Rahe, R. H. (1967). The Social Readjustment Rating Scale. *Journal of Psychosomatic Research*, 11(2), 213–218.
- Jacobsen, B. K., Eggen, A. E., Mathiesen, E. B., Wilsgaard, T., & Njølstad, I. (2012). Cohort profile: The Tromsø study. *International Journal of Epidemiology*, 41(4), 961–967.
- Kaplow, J. B., Saunders, J., Angold, A., & Costello, E. J. (2010). Psychiatric symptoms in bereaved versus nonbereaved youth and young adults: A longitudinal epidemiological study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 49, 1145–1154.
- Kendall-Tackett, K. (2009). Psychological trauma and physical health: A psychoneuroimmunology approach to etiology of negative health effects and possible interventions. *Psychological Trauma: Theory, Research, Practice, and Policy*, 1(1), 35–48.
- Kersting, A., Braehler, E., Glaesmer, H., & Wagner, B. (2011). Prevalence of complicated grief in a representative population-based sample. *Journal of Affective Disorders*, 131(1–3), 339–343.
- Keyes, K. M., Pratt, C., Galea, S., McLaughlin, K. A., Koenen, K. C., & Shear, M. K. (2014). The burden of loss: Unexpected death of a loved one and psychiatric disorders across the life course in a national study. *American Journal of Psychiatry*, 171(8), 864–871.
- King, M., Vasanathan, M., Petersen, L., Jones, L., Marston, L., & Nazareth, I. (2013). Mortality and medical care after bereavement: A general practice cohort study. *PloS One*, 8(1), e52561.
- Kosmidis, I. (2020). *brglm2: Bias reduction in generalized linear models. R package version 0.6.1*. Retrieved from <https://CRAN.R-project.org/package=brglm2>
- Lannen, P. K., Wolfe, J., Prigerson, H. G., Onelov, E., & Kreicbergs, U. C. (2008). Unresolved grief in a national sample of bereaved parents: Impaired mental and physical health 4 to 9 years later. *Journal of Clinical Oncology*, 26(36), 5870–5876.
- Li, J., Laursen, T. M., Precht, D. H., Olsen, J., & Mortensen, P. B. (2005). Hospitalization for mental illness among parents after the death of a child. *New England Journal of Medicine*, 352(12), 1190–1196.
- Lichtenthal, W. G., Corner, G. W., Sweeney, C. R., Wiener, L., Roberts, K. E., Baser, R. E., ... Prigerson, H. G. (2015). Mental health services for parents who lost a child to cancer: If we build them, will they come? *Journal of Clinical Oncology*, 33(twenty), 2246–2253.
- Lichtenthal, W. G., Nilsson, M., Kissane, D. W., Breitbart, W., Kacel, E., Jones, E. C., & Prigerson, H. G. (2011). Underutilization of mental health services among bereaved caregivers with prolonged grief disorder. *Psychiatric Services*, 62(10), 1225–1229.
- Lundorff, M., Holmgren, H., Zachariae, R., Farver-Vestergaard, I., & O'Connor, M. (2017). Prevalence of prolonged grief disorder in adult bereavement: A systematic review and meta-analysis. *Journal of Affective Disorders*, 212, 138–149.
- Lu, D., Sundström, K., Sparen, P., Fall, K., Sjölander, A., Dillner, J., ... Fang, F. (2016). Bereavement is associated with an increased risk of HPV infection and cervical cancer: An epidemiological study in Sweden. *Cancer Research*, 76(3), 643–651.
- Miles, T. P., Allegra, J. C., Ezeamama, A., Simpson, C., Gerst-Emerson, K., & Elkins, J. (2016). In a longevity society, loss and grief are emerging risk factors for health care use. *American Journal of Hospice and Palliative MedicinerMediciner*, 33(1), 41–46.
- Moon, J. R., Kondo, N., Glymour, M. M., & Subramanian, S. (2011). Widowhood and mortality: A meta-analysis. *PLoS One*, 6(8), e23465.
- Munk-Olsen, T., Bech, B. H., Vestergaard, M., Li, J., Olsen, J., & Laursen, T. M. (2014). Psychiatric disorders following fetal death: A population-based cohort study. *BMJ Open*, 4(6), e005187–e005187.
- Newson, R. S., Boelen, P. A., Hek, K., Hofman, A., & Tiemeier, H. (2011). The prevalence and characteristics of complicated grief in older adults. *Journal of Affective Disorders*, 132(1–2), 231–238.
- Oksuzyan, A., Jacobsen, R., Glaser, K., Tomassini, C., Vaupel, J. W., & Christensen, K. (2011). Sex differences in medication and primary healthcare use before and after spousal bereavement at older ages in Denmark: Nationwide register study of over 6000 bereavements. *Journal of Aging Research*, 8. doi:10.4061 / 2011/678289
- Onrust, S. A., & Cuijpers, P. (2006). Mood and anxiety disorders in widowhood: A systematic review. *Aging & Mental Health*, 10(4), 327–334.
- Ornstein, K. A., Garrido, M. M., Siu, A. L., Bollens-Lund, E., Rahman, O.-K., & Kelley, A. S. (2019). An examination of downstream effects of bereavement on healthcare utilization for surviving spouses in a national sample of older adults. *PharmacoEconomics*, 37(4), 585–596.
- Piper, W. E., Ogrodniczuk, J. S., Joyce, A. S., & Weideman, R. (2011). *Short-term group therapies for complicated grief: Two research-based models*. Washington, DC: American Psychological Association.
- Prigerson, H. G., Horowitz, M. J., Jacobs, S. C., Parkes, C. M., Aslan, M., Goodkin, K., ... Maciejewski, P. K. (2009). Prolonged grief disorder: Psychometric validation of criteria proposed for DSM-V and ICD-11. *PLoS Medicine*, 6(8), e1000121.
- R Core Team. (2020). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <http://www.R-project.org/>
- Rostila, M., Saarela, J., & Kawachi, I. (2011). Mortality in parents following the death of a child: A nationwide follow-up study from Sweden. *Journal of Epidemiology and Community Health*. doi:10.1136/jech-2011-200339
- Rostila, M., Saarela, J., & Kawachi, I. (2014). The psychological skeleton in the closet": Mortality after a sibling's suicide. *Social Psychiatry and Psychiatric Epidemiology*, 49(6), 919–927.
- Schmalbach, B., Zenger, M., Tibubos, A. N., Kliem, S., Petrowski, K., & Brähler, E. (in press). Psychometric properties of two brief versions of the Hopkins symptom checklist: HSCL-5 and HSCL-10. *Assessment*. doi:10.1177/1073191119860910
- Shear, M. K., Simon, N., Wall, M., Zisook, S., Neimeyer, R., Duan, N., ... Keshaviah, A. (2011). Complicated grief and related bereavement issues for DSM-5. *Depression and Anxiety*, 28, 103–117.
- Shor, E., Roelfs, D. J., Curreli, M., Clemow, L., Burg, M. M., & Schwartz, J. E. (2012). Widowhood and mortality: A meta-analysis and meta-regression. *Demography*, 49(2), 575–606.
- Simon, N. M., Shear, K. M., Thompson, E. H., Zalta, A. K., Perlman, C., Reynolds, C. F., ... Silowash, R. (2007). The prevalence and correlates of psychiatric comorbidity in

- individuals with complicated grief. *Comprehensive Psychiatry*, 48(5), 395–399.
- Stephen, A. I., Macduff, C., Petrie, D. J., Tseng, F.-M., Schut, H., Skår, S., ... Wilson, S. (2015). The economic cost of bereavement in Scotland. *Death Studies*, 39(3), 151–157.
- Strand, B. H., Dalgard, O. S., Tambs, K., & Rognerud, M. (2003). Measuring the mental health status of the Norwegian population: A comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nordic Journal of Psychiatry*, 57(2), 113–118.
- Stroebe, M., Schut, H., & Stroebe, W. (2007). Health outcomes of bereavement. *The Lancet*, 370(9603), 1960–1973.
- Stroebe, M., Stroebe, W., & Schut, H. (2001). Gender differences in adjustment to bereavement: An empirical and theoretical review. *Review of General Psychology*, 5(1), 62–83.
- Stroebe, M., Stroebe, W., Schut, H., & Boerner, K. (2017). Grief is not a disease but bereavement merits medical awareness. *The Lancet*, 389(10067), 347–349.
- Stroebe, M. S., Hansson, R. O., Stroebe, W., & Schut, H. (2001). *Handbook of bereavement research: Consequences, coping, and care*. Washington, DC: American Psychological Association.
- Toblin, R. L., Riviere, L. A., Thomas, J. L., Adler, A. B., Kok, B. C., & Hoge, C. W. (2012). Grief and physical health outcomes in U.S. Soldiers returning from combat. *Journal of Affective Disorders*, 136(3), 469–475.
- van den Berg, G. J., Lundborg, P., & Vikström, J. (2017). The economics of grief. *The Economic Journal*, 127, 1794–1832.
- Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics*. New York: Springer.
- Virk, J., Ritz, B., Li, J., Obel, C., & Olsen, J. (2016). Childhood bereavement and type 1 diabetes: A Danish national register study. *Pediatric and Perinatal Epidemiology*, 30(1), 86–92.
- Vitlic, A., Lord, J. M., Carroll, D., & Phillips, A. C. (2015). Increased risk of infection in bereaved older adults: From Broken heart to broken immune system. *Advances in Neuroimmune Biology*, 6(1), 25–30.
- Warnes, G. R., Bolker, B., Lumley, T., & Johnson, R. C. (2018). Gmodels: Various Rprogramming tools for model fitting. *R package version 2.18.1*. Retrieved from <https://CRAN.R-project.org/package=gmodels>
- World Health Organization. (2018). *International classification of diseases for mortality and morbidity statistics (11th Revision)*. Retrieved from <https://icd.who.int/browse11/lm/en>
- Ytterstad, E., & Brenn, T. (2015). Mortality after the death of a spouse in Norway. *Epidemiology*, 26(3), 289–294.
- Yu, Y., Liew, Z., Cnattingius, S., Vestergaard, M., Fu, B., & Li, J. (2017). Association of mortality with the death of a sibling in childhood. *JAMA Pediatrics*, 171(6), 538–545.
- Zisook, S., Iglewicz, A., Avanzino, J., Maglione, J., Glorious, D., Zetumer, S., ... Shear, M. K. (2014). Bereavement: Course, consequences, and care. *Current Psychiatry Reports*, 16. doi:10.1007 / s11920-014-0482-8