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BASIC RESEARCH ARTICLE

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Somatic symptoms and insomnia among bereaved parents and siblings eight years after the Utøya terror attack

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ABSTRACT

Background: Levels of prolonged grief symptoms (PGS) and post-traumatic stress symptoms (PTSS) can be high, many years following bereavement after terror, but knowledge concerning somatic health is scarce. Terrorism is a serious public health challenge, and increased knowledge about long-term somatic symptoms and insomnia is essential for establishing follow-up interventions after terrorism bereavement.

Objective: To study the prevalence of somatic symptoms and insomnia and their association with PGS, PTSS, and functional impairment among terrorism-bereaved parents and siblings.

Methods: A cross-sectional quantitative study included 122 bereaved individuals from the Utøya terror attack in Norway in 2011. The sample comprised 88 parents and 34 siblings aged 19 years and above (M_{age} = 49.7 years, SD_{age} = 13.8 years, 59.8% females). The participants completed questionnaires 8 years after the attack assessing somatic symptoms (Children's Somatic Symptoms Inventory) and insomnia (Bergen Insomnia Scale) along with measures of PGS (Inventory of Complicated Grief), PTSS (Impact of Event Scale–Revised), and functional impairment (Work and Social Adjustment Scale).

Results: Fatigue was the most frequently reported somatic symptom (88% of females and 65% of males). Females reported statistically significantly more somatic symptoms than males. In total, 68% of the bereaved individuals scored above the cut-off for insomnia. There were no statistically significant gender differences for insomnia. Female gender, intrusion, and arousal were associated with somatic symptoms. Intrusion and somatic symptoms were associated with insomnia. Somatic symptoms, avoidance, and hyperarousal were associated with functional impairment.

Conclusion: Many bereaved parents and siblings report somatic symptoms and insomnia eight years after the terror attack. Somatic symptoms are associated with functional impairment. Long-term follow-up and support after traumatic bereavement should focus on somatic symptoms and insomnia.

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Bereavement; traumatic grief; somatic symptoms; insomnia; prolonged grief; post-traumatic stress; pain; functional impairment; terrorism; siblings

PALABRAS CLAVES

Duelo; duelo traumático; síntomas somáticos; insomnio; duelo prolongado; Estrés postraumático; TEPT; dolor; deterioro funcional; terrorismo; padres; hermanos

HIGHLIGHTS

- Many bereaved individuals, especially females, reported insomnia and somatic symptoms, including fatigue, pain, and other related symptoms.
- Somatic symptoms, avoidance, and hyperarousal were identified as being associated with functional impairment among the bereaved.
- Post-traumatic stress symptoms played a more significant role than prolonged grief symptoms in explaining the reduced physical health experienced by the bereaved.

Síntomas somáticos e insomnio en padres y hermanos en duelo ocho años después del ataque terrorista de Utøya

Antecedentes: Los niveles de síntomas de duelo prolongado (PGS de su sigla en inglés) y síntomas de estrés post traumático (PTSS por sus siglas en inglés) pueden ser altos, incluso muchos años posterior al duelo por ataque terrorista, sin embargo, el conocimiento sobre la salud somática es escaso. El terrorismo se presenta como un gran reto para la salud pública, y el conocimiento sobre los efectos somáticos a largo plazo y el insomnio son esenciales para establecer intervenciones después del duelo por terrorismo.

Objetivo: Estudiar la prevalencia de los síntomas somáticos e insomnio, y su asociación con síntomas de duelo prolongado (PGS), síntomas de estrés post traumático (PTSS) y la disfuncionalidad en padres y hermanos afectados por el terrorismo.

Método: Un estudio de corte transversal cuantitativo incluyó a 122 individuos en duelo por el ataque terrorista de Utøya en Noruega en 2011. La muestra, estuvo compuesta por 88 padres y 34 hermanos de 19 años o más (Edad media = 49,7 años, desviación estándar edad = 13,8 años, 59,8% mujeres). Los participantes completaron un cuestionario 8 años después del ataque, evaluando síntomas somáticos (Inventario de síntomas somáticos infantiles) y el insomnio (Escala de insomnio de Bergen) junto con mediciones de PGS (Inventario de duelo complicado), PTSS (Escala de impacto del evento-revisada), y deterioro funcional (Escala de Ajuste Laboral y Social).

Resultados: La fatiga fue el síntoma somático más reportado (88% de las mujeres, y 65% de los hombres). Las mujeres informaron de manera estadísticamente significativa más síntomas somáticos que los hombres. En total, el 68% de las personas en duelo, obtuvieron puntuaciones sobre el límite para el insomnio. No hubo diferencias de género estadísticamente significativas para el insomnio. El género femenino, la intrusión y la

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excitación se asociaron con síntomas somáticos. La intrusión y los síntomas somáticos se asociaron con el insomnio. Los síntomas somáticos, la evitación y la hiperactivación se asociaron con deterioro funcional.
Conclusión: Muchos padres y hermanos en duelo reportan síntomas somáticos e insomnio 8 años después del ataque terrorista. Los síntomas somáticos están asociados con deterioro funcional. El seguimiento a largo plazo y el apoyo posterior a un duelo traumático deberían centrarse en los síntomas somáticos y el insomnio.

1. Introduction

Grief is a natural reaction to the loss of a loved one, and many studies have shown that most people will recover from their loss without professional treatment. Recent studies, however, have documented that the loss of a loved one can also lead to deterioration in both physical and mental health in the bereaved (Stroebe et al., 2007; Stroebe et al., 2017). For example, bereavement can increase the risk of serious illness, such as cardiovascular disease, inflammations, infections, diabetes, and cancer, to mention a few (Bartrop et al., 2016; Brown et al., 2022; Fagundes et al., 2018; Knowles et al., 2019; Lu et al., 2016; Vitlic et al., 2015). In the days or weeks following a loss, the bereaved commonly report somatic symptoms such as pain, headaches, hyperarousal, bodily tension, and energy loss (Hauskov Graungaard et al., 2019; Stroebe et al., 2007). Studies indicate that trauma, bereavement, and grief can cause sleep disturbances such as insomnia (Germain et al., 2005; Lancel et al., 2020; Milic et al., 2019; Porcheret et al., 2022). Insomnia is characterized by reduced sleep quality and quantity, difficulty falling asleep, and frequent nighttime and early awakenings (Pallesen et al., 2008). Insomnia exhibits high chronicity and comorbidity with somatic health ailments, as well as with other mental health conditions such as prolonged grief and post-traumatic stress (de Zambotti et al., 2018).

Prolonged grief symptoms (PGS) are defined by intense yearning, longing, and preoccupation with the deceased, along with functional impairment, emotional pain, and avoidance of reminders of the deceased, especially after a longer period following the loss (American Psychiatric Association [APA], 2022; World Health Organization, 2022). Unnatural causes of death increase the likelihood of high levels of PGS and slow recovery years after the loss compared to death by natural causes (Pociunaite et al., 2023). Similarly, individuals who have experienced trauma, such as terrorism, can develop post-traumatic stress symptoms (PTSS) (Cozza et al., 2019; Nordström et al., 2022). PTSS is defined by intrusive memories of the traumatic event, avoidance of trauma triggers, and bodily arousal and vigilance (World Health Organization, 2022). After a traumatic loss, such as after a terrorist attack, there's a high risk of developing traumatic grief, characterized by both PGS and PTSS (Djelantik et al., 2020). In long-term terrorism studies, bereaved individuals had a prevalence of PGS ranging from 43% to 82%, and the prevalence of PTSS ranged from 37% to 72% (Dyregrov et al., 2015; Neria et al., 2007; Nordström et al., 2022; Pirard et al., 2020). According to research, the interplay between PGS and PTSS can delay the recovery process, which is theorized as the PTSS interfering with and interrupting the grief process (Glad et al., 2022; Layne et al., 2017).

Previous studies have established the relationship between psychological trauma and somatic symptoms (Gupta, 2013; McEwen, 1998). Individuals with PTSS often exhibit somatic symptoms such as heightened activation of the autonomic nervous system, hyperarousal, pain, fatigue, and gastrointestinal issues (Graham et al., 2022; Gupta, 2013; Lewis et al., 2020; Osório et al., 2012; Sugiyama et al., 2020). In general, the number of somatic symptoms has shown to be related to the diagnoses of mental health problems (Kapfhammer, 2006). Research further suggests that the comorbidity of PTSS and somatic symptoms causes decreased daily functioning and worse prognoses than PTSS alone (Germain et al., 2008). It is argued that it is not the loss or trauma per se that presents the major risk for somatic symptoms over time, but rather the duration and intensity of the grief or trauma reaction (Mason & Duffy, 2019; O'Connor, 2019). Recent studies have shown that somatic symptoms among terrorism survivors predict PTSS at a later point (Bugge et al., 2017; Stensland et al., 2020). Overall, most studies show divergent results and suggest different directions of association between psychological disorders and somatic symptoms (McAndrew et al., 2019).

To gain a better understanding of whether somatic symptoms and insomnia are common issues among individuals who have experienced traumatic loss, it is essential to study their prevalence in traumatic bereaved samples (Hauskov Graungaard et al., 2019). A deeper understanding of the physical and psychological aspects of traumatic bereavement can be valuable in customizing interventions and treatments for those who have suffered traumatic losses.

1.1. Aim and research questions

This study aimed to investigate the associations between traumatic bereavement and somatic

symptoms and insomnia among parents and siblings who lost loved ones in the Utøya terror attack, eight years after the incident. To achieve this, we formulated the following research questions: What is the prevalence of somatic symptoms and insomnia among bereaved parents and siblings? Are PGS and PTSS associated with somatic symptoms and insomnia? Finally, are somatic symptoms and insomnia associated with functional impairment after controlling for PGS and PTSS?

2. Method

2.1. Study context

On July 22nd, 2011, a right-wing terrorist detonated a 950 kg bomb at the main Norwegian government building, killing eight people and seriously injuring ten. The terrorist then went to the summer camp for the Norwegian Labour Party that was being held on the island of Utøya. In the space of one hour and twenty minutes, the terrorist killed sixty-nine people and physically injured fifty-six; most victims were children and adolescents (NOU 2012: 14, 2012).

2.2. Design, eligibility criteria, and ethical considerations

This cross-sectional study of bereaved parents and siblings following the 2011 Utøya terror attack is part of the longitudinal bereavement study conducted by the Center for Crisis Psychology, University of Bergen, Norway. The Utøya bereavement project aims to develop knowledge concerning the bereaved parents, siblings, and close friends after the terror attack. At the start of that longitudinal project, public records concerning the deceased were matched to the National Population Register (NPR) in order to identify parents and siblings. The overall Utøya project excluded relatives of two of the deceased, who were non-Norwegian citizens and, therefore not registered in the NPR. One of the deceased did not have living parents. Data was collected 18 months (T1), 28 months (T2), 40 months (T3), and 96 months (T4) after the terror attack. Data collection at T4 was reviewed and approved by the Regional Committee for Medical and Health Research Ethics in Norway (2018/2174).

The present study used data from T4. For T4, the entire cohort of bereaved parents and siblings were sent an invitation by mail to participate in this survey eight years after the Utøya terror attack. That letter included information about the study design, the procedures, and the advantages and disadvantages of participating. Participants were informed that they could withdraw from the study at any time and that their contribution was voluntary and not compensated. The data are stored and analyzed on a secure server at the University. One week later, they received the questionnaire, the informed consent form, and instructions on how to use the digital questionnaire or answer by mail. Written informed consent to engage in this study was provided by all participants. Participants could respond to the questionnaire on paper or via the Survey Monkey internet platform. Of the 69 individuals who died in the terror attack, 48 (69%, 24 females and 24 males, with an average age of 19.9 years) had family members who participated in the study.

Of the 201 bereaved individuals, 122 participated in the study, resulting in a response rate of 59%. The sample consisted of 88 parents (40 fathers, 48 mothers), and 34 siblings (9 brothers and 25 sisters). The study participants were informed that they could contact the research team if they needed assistance to receive guidance or referrals, considering their health situation.

2.3. Measures

In this study, we included the following self-reported questionnaires: socio-demographics of the deceased and the bereaved, and self-reported scales assessing somatic symptoms, insomnia, PGS, PTSS, and degree of functional impairment.

A modified version of the *Children's Somatic Symptoms Inventory* (CSSI-8) (Walker & Garber, 2018) was used to assess somatic symptoms. The CSSI-8 was derived from the validated 24-item Children's Somatization Inventory (CSI-24) (Walker et al., 2009). This 8-item questionnaire assesses somatic distress and measures the extent to which the respondent has been bothered by various non-specific somatic symptoms in the past two weeks (Stone et al., 2019). For this study, the following adaptations of the CSSI-8 were made: the original fifth question, 'pain in shoulders and arms,' was changed to 'other pain conditions.' We also added the following three items: fatigue (tiredness)/lack of energy, pain throughout the body, and chest pain. In total, five items covered pain (pain throughout the body, abdominal, head, lumbar, and other pain symptoms), and six items contained other somatic complaints (fatigue (tiredness)/lack of energy, faintness, palpitations, nausea, and weakness/feeling weak in parts of the body). These modifications were primarily made to expand the assessment of somatic symptoms, driven by a clinical interest in including other potentially relevant somatic symptoms. Responses were scored on a Likert scale ranging from 0 (not at all) to 4 (a high degree). The sum score ranged from 0 to 44. When the Utøya project began, many participants (i.e. siblings and friends) were children and adolescents. This age diversity made the CSSI-8 instrument suitable for this project, as it can capture somatic symptoms relevant from childhood

to adulthood. A comparable modified CSSI-8 scale has previously been used for survivors of the 2011 Utøya terror attack (Bugge et al., 2017; Dyb et al., 2014; Stensland et al., 2020). The presence of a symptom was defined as a score of ≥2. In this sample, the scale yielded Cronbach's alpha of .90.

The *Bergen Insomnia Scale* (BIS) (Pallesen et al., 2008) assesses insomnia symptoms. The scale has six questions corresponding to the DSM-IV criteria for insomnia disorder (American Psychiatric Association [APA], 1994). Four questions assess criterion A – i.e. prolonged sleep onset, difficulties maintaining sleep, early morning awakening, and non-restorative sleep. Two questions assess criterion B – i.e. daytime sleepiness/daytime impairment and satisfaction with sleep. Participants were asked how many days per week they had experienced each criterion in the last month. All items were rated on an 8-point scale, ranging from 0–7 days per week. The total BIS score ranges from 0 to 42. Insomnia was defined as the bereaved person having experienced at least one symptom from criterion A at least three times per week and at least one of the criterion B symptoms at least three times per week (American Psychiatric Association [APA], 1994). The scale has been validated in Norwegian (Pallesen et al., 2008). In this sample, Cronbach's alpha was .88.

The *Inventory of Complicated Grief* (ICG) (Prigerson et al., 1995) was used to assess the frequency and severity of PGS in the past two weeks. Participants were instructed to relate their answers to the person they lost on Utøya. The ICG has 19 questions, with answers on a five-point Likert scale from 0 (never) to 4 (always). The total score ranged from 0 to 76. The recommended cut-off of ≥25 was applied to designate high PGS (Prigerson et al., 1995). The ICG is validated in Norwegian and is proven for internal, criteria, and convergent validity (Thimm et al., 2019). In this sample, Cronbach's alpha was .91.

The Impact of Event Scale – Revised (IES-R) (Horowitz et al., 1979; Weiss, 2007) was used to measure symptoms of PTSS in the past two weeks in connection with the terror attack. The IES-R is a self-reported measure containing 22 items. Answers are rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The total score can vary between 0 and 88. A score of 33 and above indicates probable PTSD (Creamer et al., 2003). The intrusion subscale comprises eight items (scores 0–32), the avoidance subscale eight items (scores 0–32), and the hyperarousal six items (scores 0–24). The Norwegian IES-R has displayed excellent psychometric properties in a non-clinical sample (Eid et al., 2009). Cronbach's alpha in the present sample was .94 (intrusion .91; avoidance .85; hyperarousal .88).

The Work and Social Adjustment Scale (WSAS) (Mundt et al., 2002) is a self-reported measure of functional impairment in daily life. The WSAS considers different areas of daily life functioning, such as work, housework, leisure activities, and the ability to maintain social relationships. Participants were asked to indicate the degree of which the terror attack has impaired their functioning in these areas in the last month. Answers are rated on a 9-point Likert scale from 0 (not at all) to 8 (severely impaired). The total score ranged from 0 to 40. A recommended cut-off score of ≥21 suggests moderately severe to severe functional social and work-life impairment (Mundt et al., 2002). The WSAS is validated in Norwegian (Pedersen et al., 2017). In the present sample, Cronbach's alpha was .89.

2.4. Data analysis

Missing responses (CSSI-8: 0%, BIS: 1.6%, ICG: 0.6%, IES-R: 0.5%, WSAS: 2.8%) were imputed as the mean of the remaining items on each scale. Descriptive statistics were calculated for the socio-demographic variables. We compared mean somatic symptoms and insomnia scores between genders using independent samples t-tests. Cohen's d was used as the effect size measure to quantify group differences. Spearman's correlation coefficients were computed to examine the relationships between insomnia, somatic symptoms, and PGS and PTSS.

We conducted multiple hierarchical regression analyses to identify associations with somatic symptoms and insomnia. First, the independent variables of PGS and PTSS were used as regressors for analyzing their relationship with the dependent variables of somatic symptoms and insomnia, controlling for age, gender, and relation to the deceased. We employed a two-step approach in this model: first, entering PGS along with the socio-demographics, and second, adding the PTSS scales. To address item-overlap between the scales, we removed similar items in the ICG and IES-R scales that overlapped with the outcome variable during linear regression analyses to avoid inflated correlations (Boateng et al., 2018; Lambert & Newman, 2022; Pedhazur & Schmelkin, 1991). With respect to the independent variable ICG and the outcome variable CSSI, the ICG included the question, 'I have pain in my body,' while CSSI encompassed questions related to 'Pain in the entire body' and 'Other pain conditions.' Concerning item-overlap between IES-R and BIS, the following two items from IES-R were identified: 'I have slept restlessly and woke up at night' and 'I have had difficulty falling asleep due to thoughts or images from the disaster.' This approach allowed us to distinguish their respective contributions to the independent variable.

We conducted multiple hierarchical regression analyses to investigate the associations of somatic symptoms and insomnia with functional impairment. Functional impairment was entered as the dependent

variable, and the independent variables were entered in three cumulative steps: step 1) age, gender, and relation to the deceased; step 2) insomnia and somatic symptoms; and step 3) PGS, intrusion, avoidance, and hyperarousal. We used two-tailed tests and set statistical significance at $p < .05$. Assumptions for the regression analyses, including normality, linearity, homoscedasticity, and independence in residuals were checked. We observed that less than 5% of the total sample had standardized residuals above 2, which aligns with our expectations. Additionally, no subjects deviated more than 3 standardized residuals. Consequently, we assessed the outliers not requiring further data transformation. Due to the nesting of individuals within families, correlated data could exist. We found that intra-class correlation (ICC) for somatic symptoms was .00, and .19 for the insomnia and functional impairments scales. Therefore, we used a linear mixed model for additional testing of the regression models. All statistical analyses were performed using IBM SPSS Statistics version 25.

3. Results

3.1. Socio-demographics

Nearly eight out of ten were married or cohabiting. Regarding education, over half of the participants had completed college or university. In terms of employment, seven out of ten were actively employed (working full-time or part-time or being a student without receiving a disability pension). In comparison, three out of ten had a non-active employment status (unemployed, sick leave/work assessment allowance, old-age, or early retiree, incapacity to work) (see Table 1).

Table 1. Socio-demographic characteristics and psychological outcomes of the sample.

Variables	Total
Females *n* (%)	73 (59.8)
Marital status	
Married/Cohabiting	93 (76.9)
Single	17 (14.0)
Separated/Divorced	11 (9.1)
Level of education	
Elementary school/High school	56 (45.9)
College/University	66 (54.1)
Relationship to deceased	
Parent	88 (72.1)
Sibling	34 (27.9)
Mean age years *(SD, range)*	
Siblings	30.79 (9.57, 19–55)
Parents	57.02 (5.98, 43–76)
Employment status	
Active employment status	83 (69.8)
Non-active employment status	36 (30.1)
Levels of prolonged grief symptoms above ICG cut-off >25	69.9% ($M = 30.71$, $SD = 13.13$)
Levels of post-traumatic stress symptoms above IES-R cut-off >33	45.9% ($M = 30.21$, $SD = 17.98$)
IES subscales M (SD)	
Intrusion	11.17 (7.42)
Avoidance	10.41 (6.73)
Hyperarousal	8.63 (5.95)

3.2. Prevalence of somatic symptoms, insomnia, and post-traumatic stress symptoms

Females reported a higher prevalence of somatic symptoms compared to males, this difference was statistically significant. The prevalence of different somatic symptoms for females varied between 20.7% with faintness to 87.8% with fatigue/lack of energy, and for males between 12.2% with nausea to 65.3% with fatigue/lack of energy. Somatic symptoms were prevalent across genders, but females had a statistically significant higher frequency of somatic symptoms than males. The frequency analyses showed that almost seven out of ten of all bereaved individuals reported experiencing insomnia, with a higher prevalence among women than men, but this difference was not statistically significant. Regarding post-traumatic stress symptoms, females scored higher on both avoidance and hyperarousal symptoms than males, these differences were statistically significant. There was no statistically significant gender difference regarding intrusion symptoms (see Table 2).

3.3. Prolonged grief and post-traumatic stress symptoms' relation to somatic symptoms and insomnia

Spearman's product correlation showed significant correlations between all variables (see Table 3). The BIS and CSSI-8 were moderately to highly correlated with the ICG and the IES scales, ranging from .35 (BIS with IES-avoidance) to .69 (CSSI-8 with IES-arousal). IES-arousal was found to have the strongest correlation with all the other variables. For participants who scored above the cut-off for PGS, 73.2% also scored above the cut-off for insomnia. Similarly, for those who scored above the cut-off for PTSS, 56.1% also scored above the cut-off for insomnia.

The results from the hierarchical multiple regression analyses, examining associations with somatic symptoms, are presented in Table 4. In step 1, gender, age, kinship, insomnia, and PGS were included as independent variables. It was found that gender ($\beta = -.18$, $p < .001$), insomnia ($\beta = .32$, $p < .001$), and PGS ($\beta = .28$, $p = .002$) were individually significantly associated with somatic symptoms $R^2 = .43$, Adjusted $R^2 = .41$, $F(5, 114) = 17.27$, $p < .001$. Including PTSS in step 2 resulted in insomnia and PGS no longer were significantly associated with somatic symptoms. Including PTSS in step 2 diminished the significance of insomnia and PGS as significant regressors associated with somatic symptoms. In the final model, IES-intrusion ($\beta = -.30$, $p = .030$), IES-arousal ($\beta = .69$, $p < .001$), and female gender ($\beta = .20$, $p = .004$) were significantly associated with somatic symptoms. The final model explained 52% of the variance in somatic symptoms ($R^2 = .55$, Adjusted $R^{2\,=}$ .52, $F(8, 111) = 17.10$, $p < .001$).

Table 2. Somatic symptoms, insomnia, and post-traumatic stress symptoms.

	Total				Women				Men							
Variable	*n* > *cut-off*	%	*M*	*SD*	*n* > *cut-off*	%	*M*	*SD*	*n* > *cut-off*	%	*M*	*SD*	*t*	*df*	*p*	*d*
Total sum CSSI			15.81	9.49			18.59	8.65			11.65	9.25	−4.23	120	<.001	−0.78
Total mean CSSI Somatic symptoms			1.44	.86			1.69	0.79			1.06	0.84	−4.23	120	<.001	−0.78
Fatigue/Lack of energy	96	78.7	2.54	1.19	64	87.8	2.73	1.06	32	65.3	2.27	1.34			.046	−0.39
Pain throughout the body	50	41.0	1.46	1.32	39	53.4	1.79	1.34	11	22.4	.96	1.14			<.001	−0.66
Chest pain	39	32.0	1.02	1.15	28	38.4	1.19	1.16	11	22.4	.78	1.10			.050	−0.37
Abdominal pain	53	43.4	1.13	1.20	40	54.8	1.37	1.27	13	26.5	.76	.97			.003	−0.53
Headaches	34	27.9	1.46	1.25	25	34.2	1.77	1.25	9	18.4	1.00	1.12			<.001	−0.64
Lumbar pain	75	61.5	2.08	1.34	57	78.1	2.47	1.19	18	36.7	1.51	1.36			<.001	−0.76
Other pain symptoms	55	45.1	1.44	1.21	41	56.2	1.72	1.21	14	28.6	1.04	1.10			.002	−0.58
Faintness	28	23.0	0.86	1.12	18	20.7	1.00	1.14	10	20.4	.65	1.05			.092	−0.31
Palpitations	40	32.8	1.10	1.14	30	41.1	1.33	1.08	10	20.4	.76	1.15			.574	−0.52
Nausea	31	25.4	0.98	1.07	25	34.2	1.29	1.17	6	12.2	.53	.71			<.001	−0.75
Weakness	62	50.8	1.73	1.34	44	60.3	1.95	1.32	18	36.7	1.41	1.31			.029	−0.41
Number of CSSI somatic symptoms							5.63	3.00			3.10	3.20	−4.44	120	<.001	−0.82
No symptoms	18	14.8			5	6.8			13	26.5						
1–3	29	23.7			12	16.4			17	34.7						
4–7	49	40.2			37	50.7			12	24.5						
8–11	26	15.5			19	26			7	14.2						
Total BIS insomnia symptoms	82	68.3	18.40	11.57	54	75.0	19.49	11.24	28	58.3	16.77	12.42	−1.24	118	.216	−0.23
IES-R-intrusion			11.17	7.42			11.70	7.12			10.38	7.86	-.96	120	.340	−0.18
IES-R-avoidance			10.41	6.73			11.64	6.75			8.57	6.33	−2.52	120	.013	−0.47
IES-R-hyperarousal			8.63	5.95			9.75	5.79			6.96	5.79	−2.60	120	.011	−0.48

Note. The table presents results from the independent samples T-test. *M*: Mean, *SD*: Standard deviation, *t*(df): *t* value (degrees of freedom), *p*: the probability value. Due to rounding, percentages might be less than 100%.

Table 3. Correlations of the ICG, IES, IES subscales, BIS, and CSSI.

	ICG	IES-R sum score	IES-R-intrusion	IES-R-avoidance	IES-R- hyperarousal	BIS	CSSI
ICG	–						
IES-R sum score	.80**	–					
IES-R-intrusion	.76**	.93**	–				
IES-R-avoidance	.65**	.84**	.64**	–			
IES-R-hyperarousal	.74**	.91**	.83**	.63**	–		
BIS	.57**	.62**	.65**	.35**	.66**	–	
CSSI	.57**	.58**	.50**	.40**	.69**	.52**	–

Note. ** Correlation is significant at the 0.01 level (2-tailed). BIS = Bergen Insomnia Scale. CSSI = modified Children's Somatic Symptoms Inventory. ICG = Inventory of Complicated Grief. IES-R = Impact of Event Scale – Revised.

The results from the hierarchical multiple regression analyses examining associations with insomnia are shown in Table 4. In step 1, gender, age, kinship, somatic symptoms and PGS were included as independent variables. It was found that somatic symptoms ($\beta = .31$, $p = .001$) and PGS ($\beta = .41$, $p < .001$) were significantly associated with insomnia ($R^2 = .39$, Adjusted $R^{2=}.37$, $F(5, 114) = 17.78$, $p < .001$). Including PTSS in step 2, resulted in somatic symptoms, and PGS no longer were significantly associated with insomnia. It was found that intrusion ($\beta = .36$, $p = .008$) was significantly associated with insomnia. The final model explained 44% of the variance in insomnia ($R^2 = .48$, Adjusted $R^2 = .44$, $F(8, 111) = 12.62$, $p < .001$). In addition, linear mixed model analyses showed that somatic symptoms were significantly associated with insomnia ($\beta = .28$, $p = .025$).

3.4. Associations of somatic symptoms and insomnia with functional impairment

In step 1 of the hierarchical multiple regression, gender, age, and kinship were found to explain 1% of the variance in functional impairment among the bereaved, ($R^2 = .04$, Adjusted $R^2 = .01$, $F(3, 122) = 1.47$, $p = .226$). In step 2 of the model, somatic symptoms ($\beta = .45$, $p < .001$) and insomnia ($\beta = .22$, $p = .020$) were significantly associated with functional impairment. This model explained 34% of the variance in functional impairment ($R^2 = .34$, Adjusted $R^2 = .31$, $F(2, 110) = 24.81$, $p < .001$). Incorporating PGS and PTSS in step 3 of the model diminished the significance of insomnia associated with functional impairment. In the final model, avoidance ($\beta = .23$, $p = .035$), hyperarousal ($\beta = .51$, $p = .004$), and somatic symptoms ($\beta = .26$, $p = .021$) were significantly associated with functional impairment. This final model explained 39% of the variance in functional impairment ($R^2 = .44$, Adjusted $R^2 = .39$, $F(9,106) = 9.28$, $p < .001$). Hyperarousal was the variable that explained most of the variance in functional impairment (see Table 5).

4. Discussion

Eight years after the terrorist attack on Utøya in 2011, bereaved parents and siblings reported high levels of somatic symptoms, with almost eight in ten reporting fatigue and more than two-thirds reporting insomnia. Furthermore, high comorbidity was observed between prolonged grief symptoms (PGS) and post-traumatic stress symptoms (PTSS) with insomnia. The results highlight the associations between a higher prevalence of post-traumatic stress symptoms and an increased occurrence of somatic symptoms and insomnia. Hyperarousal and intrusion, respectively, were

Table 4. Hierarchical regression analysis examining associations with somatic symptoms and insomnia.

Somatic symptoms					Insomnia				
Variable	b	SE B	β	*p*	Variable	b	SE B	β	*p*
Step 1					**Step 1**				
Constant	14.02	8.59		.105	Constant	8.87	11.04		.423
Age	−0.12	0.10	−.18	.209	Age	−0.05	0.13	−.06	.688
Gender	5.34	1.45	.28	<.001	Gender	−2.22	1.94	−.09	.255
Kinship	−4.86	2.97	−.23	.104	Kinship	−2.99	3.80	−.12	.433
BIS	0.26	0.07	.32	<.001	CSSI	0.38	0.12	.31	.001
ICG	0.22	0.07	.28	.002	ICG	0.37	0.08	.41	<.001
Step 2					**Step 2**				
Constant	9.33	7.93		.242	Constant	11.95	10.58		.261
Age	−0.04	0.09	−.06	.642	Age	−0.08	0.12	−.09	.509
Gender	3.94	1.34	.20	.004	Gender	−1.04	1.86	−.04	.575
Kinship	−3.00	2.71	−.14	.270	Kinship	−2.98	3.60	−.11	.410
BIS	0.13	0.07	.16	.072	CSSI	0.24	0.13	.20	.063
ICG	0.11	0.08	.14	.198	ICG	0.16	0.11	.18	.145
IES-R-Intrusion	−0.38	0.17	−.30	.030	IES-R-Intrusion	0.66	0.24	.36	.008
IES-R-Avoidance	−0.07	0.13	−.05	.621	IES-R-Avoidance	−0.31	0.18	−.18	.077
IES-R-Hyperarousal	1.11	0.21	.69	<.001	IES-R-Hyperarousal	0.43	0.31	.19	.175

Note. b = unstandardized beta. SE B = standard error for unstandardized beta. β = standardized beta. For somatic symptoms, R^2 was .431 for step 1, and R^2 was .552 for step 2 ($p < .001$). For insomnia, R^2 was .393 for step 1, and R^2 was .476 for step 2 ($p < .001$). The analyses were conducted with the ICG and IES-R scales with items that overlapped with the outcome variables removed.

Table 5. Multiple hierarchal regression analyses of functional impairment.

	b	SE B	β	*p*
Step 1				
Constant	25.50	12.03		.036
Age	−0.11	0.14	−.14	.441
Gender	3.13	1.98	.15	.116
Kinship	−5.40	4.20	−.24	.201
Step 2				
Constant	5.93	10.45		.572
Age	−0.02	0.12	−.03	.870
Gender	−1.17	1.80	−.06	.518
Kinship	−0.15	3.60	−.01	.966
BIS	0.19	0.08	.22	.020
CSSI	0.48	0.11	.45	<.001
Step 3				
Constant	−0.81	10.03		.936
Age	0.07	0.12	.09	.547
Gender	−1.80	1.71	−.09	.294
Kinship	1.22	3.42	.05	.722
BIS	0.09	0.09	.10	.349
CSSI	0.27	0.12	.26	.021
ICG	−0.03	0.10	−.03	.787
IES-R-Intrusion	−0.38	0.23	−.28	.094
IES-R-Avoidance	0.35	0.16	.23	.035
IES-R-Hyperarousal	0.88	0.29	.51	.004

Note. The R^2 value for step 1 was .038, with R^2 of .337 for step 2 ($p < .001$) and R^2 of .441 for step 3 ($p = .001$). The analysis was conducted using the original ICG and IES-R scales.

significantly associated with somatic symptoms. Additionally, intrusion and somatic symptoms were showed to be associated with insomnia. Finally, the study found that somatic symptoms, but not insomnia, were associated with functional impairment when controlled for PGS and PTSS.

Fatigue was the most reported somatic symptom among the bereaved parents and siblings, and five in ten respondents also reported bodily weakness. Although there are no existing studies on bereavement after terrorism to compare our results on somatic symptom levels, we found a few studies on somatic symptoms reported by the bereaved following other types of loss. For instance, Grimby (1993) found that one year after the loss of a spouse, 50% of bereaved elderly individuals reported fatigue. Similarly, a study of younger bereaved individuals who lost a parent to cancer between six and nine years ago found that 37% of the sons and 64% of the daughters experienced fatigue, particularly those with unresolved grief (Bylund-Grenklo et al., 2016). Our results are consistent with these findings. Also, PTSS is associated with chronic fatigue (Cyr et al., 2014; Eglinton & Chung, 2011; Gupta, 2013), in agreement with our present findings. The bereaved reported various pain symptoms, as is common among the bereaved in general (Kaiser & Primavera, 1993; Sillis et al., 2022). Many participants often experienced multiple somatic symptoms, with over half reporting more than four such symptoms. Additionally, a significant proportion reported having between 8 and 11 somatic symptoms. Females reported significantly more severe somatic symptoms than males. This is consistent with established knowledge that females generally report more frequent and numerous somatic symptoms than males (Barsky et al., 2001; Stensland et al., 2020). Somatic symptoms have previously been associated with PTSS among veterans and terrorism survivors (Cyr et al., 2014; Stensland et al., 2020), and our study extends this to the traumatic bereaved.

Traumatic bereavement is a potentially highly stressful event that could active the stress response system, and there is evidence that the stress hormone cortisol can become dysregulated in patients with PGS or PTSS (Mason & Duffy, 2019). Abnormally rapid depletion of cortisol levels throughout the day, as seen in individuals with chronic fatigue or chronic stress, has been referred to as adrenal fatigue (Mason & Duffy, 2019). This phenomenon may help explain the fatigue, physical weakness, and lack of energy reported among bereaved people. For instance, the autonomic nervous system, when dysregulated, can also cause somatic symptoms such as palpitations and nausea (Kozlowska et al., 2020). A dysregulated nervous system maintains a vicious stressful state that might contribute to adverse somatic symptoms and other health consequences, and make the restorative process difficult (Devine et al., 2019; Germain et al., 2008). For instance, the mind–body connection can influence increased distress, where hyperarousal or anxiety may lead to muscle tension and headaches (Mallorquí-Bagué et al., 2016). Somatic symptoms may also be influenced by genetic factors, psychological processes, attentional mechanisms, and behavioural aspects, such as poor coping strategies, hopelessness, somatization, and high-risk behaviours like drinking and smoking (Hoge et al., 2007). As mentioned, the physiological mechanisms underlying somatic symptoms in traumatic bereavement are intricate and interconnected (Hemmings et al., 2017; Mallorquí-Bagué et al., 2016).

The prevalence of insomnia in the present sample (approximately 68%) was considerably higher than the reported 20% prevalence in the older adult population in Norway (Sivertsen et al., 2021). Our findings are supported by previous research demonstrating strong correlations and high comorbidity between PGS and insomnia; for example, Lancel et al. (2020) found that 80% of bereaved individuals with PGS experience insomnia, which tends to decrease over time. This high prevalence of insomnia eight years after the loss can be considered alarming. As reported in earlier grief studies, insomnia was also equally common among males and females (Boelen & Lancee, 2013; Tanimukai et al., 2015). This contrasts with general population studies showing that females often report a higher prevalence of insomnia than males (Hysing et al., 2020; Suh et al., 2018; Zhang & Wing, 2006). The strong association between somatic symptoms and insomnia is consistent with research that has examined the links between pain and insomnia. A

recent study by Mahoney et al. (2022) found that greater severity of PTSS is associated with more intense pain symptoms, leading to worsened insomnia. The finding that PTSS was significantly associated with both insomnia and somatic symptoms is consistent with earlier research (Lewis et al., 2020). A reason could be that intrusive thoughts, substantially impact our physiology and emotions (Ji et al., 2019). For example, intrusive thoughts can continue to interfere when we try to fall asleep. Intrusive thoughts can act as an internal trauma stimulus triggering bodily activation and vigilance. Insomnia is also associated with poorer emotional regulation (Watling et al., 2017), and it is considered a hyperarousal disorder that can heighten the body's stress response (de Zambotti et al., 2018; Levenson et al., 2015). Hyperarousal symptoms, which are often the most distressing among the symptoms of PTSS, may be those that are least under conscious control (Pfefferbaum et al., 1999). We found a correlation between hyperarousal and insomnia, consistent with previous studies and theoretical models (Sinha, 2016). However, hyperarousal can be conceptualized in various ways. For example, it is theorized that hyperarousal can be incorporated into a pluralistic perspective involving arousal in physiological, cortical, and cognitive-emotional domains. For a deeper overview of various theoretical models of insomnia, consult Perlis et al. (2011). When we included other post-traumatic stress symptoms in a regression analysis, the association between hyperarousal and insomnia did not reach statistical significance. The results showed that only intrusion was statistically significantly associated with insomnia in this sample. Insomnia patients commonly report that intrusive thoughts, worries, and nightmares interfere with their sleep (Perlis et al., 2011). The finding that intrusive thoughts but not hyperarousal showed a significant association in the regression analysis does not necessarily imply a contradiction. These symptoms are interrelated, and the theoretical underpinnings connecting them are complex. Clinically, this complexity suggests that treatments for trauma-related insomnia as well as nightmares, should focus broadly on aspects such as hyperarousal, cognitions, avoidance behaviours, and behavioural conditioning. For instance, medications, as well as exposure-based therapies, could be applied (Roberge & Bryan, 2021; Sinha, 2016).

In the present study, hyperarousal was found to be associated with somatic symptoms. Hyperarousal, in turn, may be associated with somatic symptoms because the experience of long-term hyperarousal, emotional dysregulation, and bodily pain may restrain the capability for relaxation and restoration and give further detrimental health consequences (de Zambotti et al., 2018; Levenson et al., 2015). There was a strong relationship between intrusion and hyperarousal in the present study. When we controlled for the variable of hyperarousal in the multiple hierarchal regression analyses, the influence of hyperarousal on intrusion was removed. In other words, when there is increased intrusion without accompanying hyperarousal, this is associated with lower levels of somatic symptoms. It is possible that those intrusive memories not associated with hyperarousal are more bearable and may induce feelings and bodily states related to somatic symptoms in a more positive way.

However, when it was controlled for PTSS, PGS no longer exhibited a significant independent association with insomnia nor somatic symptoms. Instead, PTSS emerged as the primary associated regressor of these outcomes. By removing the overlapping traumatic aspects within grief symptoms, the emerging results indicate that the remaining aspects of grief do not detrimentally impact health. Although the bereaved may still miss, think about, and remember the deceased, it does not have that destructive effect on the psychological and physical well-being compared to when the person is affected by the destructive symptoms of trauma. Perhaps it may even alleviate some suffering, as theorized within the theory of continuing bonds in bereavement (Root & Exline, 2014). In explaining the diminished physical health, PTSS take precedence over PGS. Our findings contribute to the research field by emphasizing the intricate interplay between PGS, PTSS, and somatic symptoms/insomnia within the context of traumatic bereavement. This highlights that PTSS play a more prominent role than PGS in explaining the decline in physical health.

Because this was a cross-sectional study, causality between PTSS and somatic symptoms cannot be established. Higher levels of PTSS could lead to higher levels of somatic symptoms, and vice versa. Recent studies have suggested that somatic symptoms predict PTSS after a traumatic event (McAndrew et al., 2019; Stensland et al., 2020). This may be due to the amount of hyperarousal and somatic symptoms experienced from exposure to trauma, leading to a higher allostatic load and bodily dysregulation, which can develop before the onset of PTSS and therefore predict its occurrence later (Graham et al., 2022; Stensland et al., 2020). Conversely, PTSS could increase the risk of somatic symptoms because of several complex processes, such as the alterations of the hypothalamic–pituitary–adrenal axis and the sympathoadrenal medullary axis, which affect the neuroendocrine and immune functions, which again affect the central nervous system, sleep-wake regulation, and the autonomic nervous system (Gupta, 2013).

Regarding the bereaved individuals daily functioning, the results showed that more somatic symptoms, avoidance and higher hyperarousal were significantly associated with functional impairment. The associations of somatic symptoms and hyperarousal with

functional impairment confirm findings in earlier research (Barlé et al., 2017). The finding that avoidance is significantly associated with long-term functional impairment among traumatic bereaved individuals due to terrorism could be explained by the fact that avoidance (avoiding reminders of the trauma and painful loss) can serve as a coping strategy for managing difficult life circumstances. Although it may provide short-term relief and be effective in the moment, in the long run it can perpetuate the trauma and impede the recovery process (Van Vliet, 2010). Evidence supports avoidance as a key element of PGS and PTSS (Eisma & Lenferink, 2023; Hodgkinson et al., 1995). The comorbidity of somatic symptoms and PTSS can further increase functional impairment and worsen the prognosis compared to individuals only having PTSD (Åkerblom et al., 2017).

The present study's results have clinical implications. Loss and trauma can trigger somatic symptoms (Stroebe et al., 2007), which can be worsened and prolonged by PGS and PTSS (Gupta, 2013; Mason & Duffy, 2019). In primary care, it is possible that numerous bereaved individuals present somatic symptoms, yet the underlying cause may be overlooked during the screening process. Failing to recognize the potential connection between somatic symptoms and traumatic bereavement may result in patients not receiving the appropriate treatment targeting PGS and PTSS (Sillis et al., 2022). Therefore, it is essential to inquire about experiences of loss and trauma when somatic symptoms and hyperarousal are present without an apparent cause (Pfefferbaum et al., 1999). Somatic symptoms, such as fatigue, pain, and changes in appetite, can be characteristic of either a psychological disorder or a somatic illness (Kapfhammer, 2006). So, even if PTSS is associated with somatic symptoms, possible independent somatic illness requiring its treatment must not be overlooked. Integrated care models that prioritize trauma-informed healthcare within primary care can be a practical approach to comprehensively address potential root causes of clinical concerns and burdens. This approach could provide multidimensional care that respects patients' physical, psychological, and social health needs (Kazlauskas et al., 2016; Reifels et al., 2013). For more guidance in trauma-informed healthcare within primary care, we refer to Gerber (2019). An example of a short screening tool for trauma is PC-PTSD (Prins et al., 2016). For an overview of screening tools for prolonged grief symptoms (PGS), see Treml et al. (2020). For instance, the Brief Grief Questionnaire (BGQ), developed by Shear et al. (2006), is a concise five-item screening tool for (PGS). For a valid measurement that aligns with the new diagnostic criteria for prolonged grief disorder (PGD), the Traumatic Grief Inventory-Self Report Plus (TGI-SR+) is a suggested option (Lenferink et al., 2022).

It is currently unknown whether treating somatic symptoms separately or adopting a holistic approach (combination of psychological, physiological, and medical treatments) would be more effective in treating PGS after traumatic bereavement. However, evidence suggests that cognitive–behavioural therapy and medication can reduce the severity of somatic symptoms in individuals with PTSS and comorbid somatic symptoms (Gupta, 2013). Reducing bodily distress has been shown to decrease sympathetic nervous system activity and increase parasympathetic nervous system activity (Bernstein et al., 2000), indicating that interventions aimed at reducing bodily distress and tension may benefit the bereaved (Fagundes et al., 2018; Knowles et al., 2021; Mason & Duffy, 2019). As a result, a growing body of evidence supports adopting a more holistic and comprehensive treatment plan for individuals who have experienced traumatic bereavement and are concurrently dealing with somatic symptoms. Based on our research findings, we recommend that clinicians include somatic symptoms and insomnia indicators in their assessments and follow-up plans for individuals who have experienced traumatic bereavement. Incorporating somatic symptoms and insomnia into treatment plans may offer more effective care for individuals who have experienced traumatic bereavement. Health professionals and policymakers should acknowledge that traumatic bereavement can lead to somatic symptoms and insomnia that persist over time and require ongoing attention. A significant discussion should exist around implementing such a comprehensive treatment plan in clinical practice.

Future research could investigate the symptomatologic interplay of traumatic bereavement and hyperarousal symptoms (Stancombe et al., 2022), as well as the potential benefits of interventions targeting insomnia, hyperarousal, and somatic symptoms for individuals who have experienced traumatic bereavement (O'Connor, 2019; Sveen et al., 2021). Recent research demonstrated that treatments targeting PTSD and depression do not alleviate insomnia, whereas interventions targeting insomnia can improve insomnia, PTSD, and depression after a loss (Sveen et al., 2021). The absence of sleep interventions targeting comorbid insomnia in contemporary treatment manuals for PGS, such as prolonged grief therapy (Shear et al., 2016), represents a significant gap.

The study has several strengths, including a relatively high response rate, a balanced gender distribution, and only a few missing answers to the questionnaire. A significant advantage is the homogeneous sample of parents and siblings who lost a family member in the same terror attack. However, the study is based on self-reported data, without the inclusion of supervised self-reports or clinical interviews, which represents a limitation as participants

may overreport or underreport. Also, the non-participants' potentially higher or lower levels of distress create uncertainties regarding sample bias and the representation of symptom levels among the bereaved. Furthermore, there is no clinical cut-off for the modified CSSI-8 scale, which restricts our interpretation of the reported symptoms' severity compared to a more general population sample. The ICG has been criticized for not assessing prolonged grief disorder as defined in the diagnostic manual ICD-11 and for the risk of overestimating the prevalence of prolonged grief disorder (Prigerson & Maciejewski, 2017). The BIS scale has a limitation in that it measures acute insomnia rather than chronic insomnia. It is possible that our results might have been different if we had included additional variables in the regression analyses. Cumulative loss or trauma could have been a relevant factor that might have explained significant variance in the outcomes, particularly among those bereaved individuals who experienced more losses after the attack. Unfortunately, we didn't have this additional data available. Finally, as mentioned above, due to the cross-sectional design, we cannot imply causality between PGS and PTSS with somatic symptoms and insomnia.

5. Conclusion

In conclusion, this study, conducted eight years after the Utøya terror attack, reveals a high prevalence of somatic symptoms and insomnia among bereaved parents and siblings. The findings highlight the strong associations between a higher prevalence of post-traumatic stress symptoms and an increased occurrence of somatic symptoms and insomnia. Moreover, the study demonstrates that somatic symptoms are significantly associated with functional impairment in those affected by bereavement. These results underscore the importance of health professionals and policymakers being attentive to somatic symptoms and insomnia, in their work with bereaved families. Understanding that fatigue, bodily weakness, and pain in different body parts may be related to traumatic bereavement can be critical for directing the bereaved to the right treatment interventions.

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Data availability statement

Due to sensitive data and personally identifiable information, legal restrictions prohibit data sharing.

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