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BASIC RESEARCH ARTICLE



Prevalence and potency of trauma reminders 8.5 years after a terrorist attack

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ABSTRACT

Background: Empirical knowledge about the prevalence and potency of reminders several years post-trauma, and how experiences with reminders relate to mental health and functioning, is scarce.

Objective: The aim of this study was threefold: (1) systematically describe the type and frequency of trauma reminders experienced by survivors 8.5 years after a terrorist attack; (2) explore the intensity and duration of reactions evoked by various reminders; and (3) examine whether experiences with trauma reminders are associated with psychological distress and level of functioning almost a decade post-trauma.

Method: 289 survivors (51.2% females, M age = 27.7, SD = 4.6) of the 2011 massacre on Utøya island, Norway, were interviewed 8.5 years post-terror. Participants were presented with a list of ten potential trauma reminders and asked to rate how frequently they had experienced each one in the past month, and the intensity and duration of the reactions evoked. Current posttraumatic reactions were measured using the UCLA PTSD-RI and the HSCL-8. Associations between experiences with reminders, psychological distress, and functioning, were analysed by linear regressions.

Results: At 8.5 years post-terror, approximately 90% of the participants had experienced trauma reminders within the past month (35.6% often or very often). Almost 30% had become distressed, afraid, sad, or experienced bodily reactions to a great or very great extent. The vast majority reported that the reactions only lasted for a few minutes or hours. Frequency of exposure to reminders, and the intensity of the reactions evoked, were significantly associated with psychological distress. Frequency of exposure to trauma reminders was negatively related to the survivors' level of functioning.

Conclusions: Trauma reminders can still be a central source of psychological distress and impaired functioning among survivors almost a decade post-trauma. While everyone who is directly exposed to a terrorist attack does not need psychotherapy, most would probably benefit from psychoeducation about reminders.

Prevalencia y potencia de los recordatorios de trauma 8.5 años después de un ataque terrorista

Antecedentes: El conocimiento empírico sobre la prevalencia y la potencia de los recordatorios del trauma varios años después de ocurrido, y cómo las experiencias con los recordatorios se relacionan con la salud mental y el funcionamiento, es escaso.

Objetivo: El objetivo de este estudio fue triple: (1) describir sistemáticamente el tipo y la frecuencia de recordatorios de trauma experimentados por los sobrevivientes 8,5 años después de un ataque terrorista; (2) explorar la intensidad y duración de las reacciones evocadas por varios recordatorios; y (3) examinar como las experiencias con recordatorios de trauma se asocian con angustia psicológica y nivel de funcionamiento casi una década después del trauma.

Método: 289 supervivientes (51.2% mujeres, edad M = 27.7, DE = 4.6) de la masacre de 2011 en la isla de Utøya, Noruega, fueron entrevistados 8.5 años después del evento terrorista. A los participantes se les presentó una lista de diez posibles recordatorios de trauma y se les pidió que calificaran con qué frecuencia habían experimentado cada uno en el último mes, y la intensidad y duración de las reacciones evocadas. Las reacciones postraumáticas actuales se midieron utilizando el UCLA PTSD-RI y el HSCL-8. Las asociaciones entre las experiencias con recordatorios, la angustia psicológica y el funcionamiento se analizaron mediante regresiones lineales.

Resultados: A los 8.5 años posteriores al evento terrorista, aproximadamente el 90% de los participantes habían experimentado recordatorios de trauma en el último mes (35.6% a menudo o muy a menudo). Casi el 30% se había angustiado, asustado, entristecido o experimentado reacciones corporales en gran o muy gran medida. La gran mayoría informó que las reacciones solo duraron unos pocos minutos u horas. La frecuencia de exposición a los recordatorios y la intensidad de las reacciones evocadas se asociaron significativamente con la angustia psicológica. La frecuencia de exposición a los recordatorios del trauma se relacionó

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关键词

创伤提示物; 创伤后反应; 功能; 恐怖袭击

HIGHLIGHTS

- Ca. 90% had experienced trauma reminders almost a decade post-terror.
- Reminders can be a central source of distress and impaired functioning many years post-trauma.
- Most people directly exposed to a terror attack would probably benefit from psychoeducation about reminders.

negativamente con el nivel de funcionamiento de los sobrevivientes.

Conclusiones: Los recordatorios de trauma aún pueden ser una fuente central de angustia psicológica y deterioro del funcionamiento entre los sobrevivientes casi una década después del trauma. Si bien todos los que están directamente expuestos a un ataque terrorista no necesitan psicoterapia, la mayoría probablemente se beneficiaría de la psicoeducación sobre los recordatorios.

恐怖袭击 8.5 年后创伤提示物的流行率和效力

背景: 关于创伤后几年提示物的流行率和效力, 以及提示物的经历如何与心理健康和功能相关的实证知识很少。

目的: 本研究有三个目的: (1) 系统描述恐怖袭击后 8.5 年后幸存者所经历创伤提示物的类型和频率; (2) 探究各种提示物所引发反应的强度和持续时间; (3) 考查创伤提示物经历是否与创伤后近十年的心理困扰和功能水平相关。

方法: 2011 年挪威于特岛大屠杀的 289 名幸存者 (51.2% 女性, M 年龄 = 27.7, SD = 4.6) 在恐怖事件发生 8.5 年后接受了采访。参与者收到了一份包含十种潜在创伤提示物的清单, 并被要求评价他们在过去一个月中经历每种创伤的频率, 以及引发反应的强度和持续时间。使用 UCLA PTSD-RI 和 HSCL-8 测量当前的创伤后反应。通过线性回归分析了提示物、心理困扰和功能之间的关联。

结果: 恐怖事件发生后 8.5 年, 大约 90% 的参与者在过去一个月内经历过创伤提示物 (35.6% 经常或非常频繁)。近 30% 的人变得痛苦、害怕、悲伤, 或经历了很大或非常大的身体反应。绝大多数人报告说反应只持续几分钟或几小时。接触提示物的频率以及引起反应的强度与心理困扰显著相关。接触创伤提示物的频率与幸存者的功能水平呈负相关。

结论: 创伤提示物仍然可能是创伤后近十年幸存者心理困扰和功能受损的主要根源。虽然不是每个直接遭受恐怖袭击的人都需要心理治疗, 但大多数人可能会从有关提示物的心理教育中受益。

For months, sometimes years, after a traumatic event, physical or emotional stimuli that relate to the traumatic experience can evoke involuntary, intrusive and distressing feelings, thoughts, or mental images of the original trauma (Glad et al., 2017). These phenomena are known as trauma reminders (also referred to as ‘cues’ or ‘triggers’) (Glad et al., 2017). In the literature, two different channels for exposure to reminders have been described: external and internal cues (Layne et al., 2006). *External trauma cues* are things we hear, see, taste, touch, and smell in the external environment; while *internal trauma cues* are internal phenomena, such as thoughts, dreams, bodily sensations, images and emotions (Layne et al., 2006). Empirical knowledge about the prevalence and potency of reminders several years post-trauma, and how experiences with trauma reminders relate to mental health and functioning, is scarce (Glad et al., 2016). This paper investigates experiences with trauma reminders among nearly 300 survivors of the terrorist attack on Utøya island, Norway, almost a decade after the attack.

Though trauma reminders are explicitly included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) diagnostic criteria for posttraumatic stress disorder (PTSD), few have empirically examined trauma reminder characteristics, how frequently trauma reminders are experienced, and how exposure to reminders is related to PTSD (i.e. Glad et al., 2016, 2017; Goenjian et al., 2011; Howell et al., 2015; Pynoos et al., 1993; Scrimin et al., 2011). In brief, findings from the existing studies suggest that distressing reminders are relatively common in the first few years post-trauma (particularly sensory-based cues, such as auditory reminders), and

that exposure to trauma reminders may drive PTSD symptom development and chronicity. Of note, in our previous longitudinal study on psychological distress and exposure to trauma reminders among survivors of the terrorist attack on Utøya island (up to 2.5 years post-terror), we found that the relationship between frequency of exposure to trauma reminders and symptoms of PTSD became stronger over time, suggesting that the role of reminders in PTSD may increase rather than decrease over time (Glad et al., 2017). That said, because most studies have been conducted relatively soon after the traumatic event (i.e. one to three years post-trauma), knowledge about the prevalence and intensity of reminders several years post-trauma is scarce. A noteworthy exemption, is the recent qualitative study by Adebäck et al. (2022), on reminders nine years after the disaster among adults who as children or adolescents had been exposed the tsunami in Southeast Asia in 2004. Adebäck et al. interviewed 17 heavily exposed survivors and found that everyone experienced trauma reminders nine years after the tsunami, including internal (e.g. dreams) and external (sounds, smell, the feeling of water) reminders. Also, a few case studies have illuminated how trauma reminders may evoke strong post-traumatic reactions and impair functioning several years, even decades, post-trauma (e.g. Hilton, 1997; Kaplow et al., 2006; Vermetten & Bremner, 2003). For example, Hilton (1997) described how an old war veteran experienced intrusive wartime memories, loss of interests in activities, and poor appetite, after the media commemoration the fiftieth anniversary of the end of World War II. Similarly, in another

case study, Kaplow et al. (2006) noted how a young girl, who witnessed the murder of her mother by her father at the age of 19 months, experienced re-experiencing, avoidance and hyperarousal symptoms, after being exposed to a trauma reminder ten years after the murder. This caused clinically significant impairment for the young girl, including feeling 'shaky' all the time, loss of appetite, and being unable to be alone in a room in the house, even for a minute (Kaplow et al., 2006).

In summary, while the existing findings indicate that the presence and potency of trauma reminders may be high for a long time after a traumatic experience, this has not been explored quantitatively, in a larger population. Also, of note, while trauma reminders can evoke strong emotional and behavioural responses that impair functioning among trauma survivors, to our knowledge, only one empirical study has explored the association between exposure to reminders and post-trauma functioning (i.e. Glad et al., 2017). Here, the authors found that individuals who experienced reminders often functioned worse in their everyday life (including school/work, leisure activities, and interpersonal relationships), compared to those who reported experiencing reminders less frequently. Given the large amount of people who have experienced a potentially traumatic event and whom may be troubled by distressing reminders in their daily life, more knowledge about trauma reminders and how they are related to daily functioning could improve our ability to help trauma exposed individuals.

The aim of this study was to systematically describe the type, frequency, intensity, and duration of trauma reminders experienced by survivors 8.5 years after a terrorist attack. We also wanted to examine whether experiences with trauma reminders are associated with psychological distress and level of functioning almost a decade post-trauma.

1. Method

The Utøya Study (2011–2020) is a comprehensive longitudinal interview study designed to determine the level of posttraumatic stress reactions and potential predictors of PTSD among survivors of the terrorist attack on Utøya island, Norway, in 2011. The study consists of four data collection waves, conducted at 4–5 months (T1), 14–15 months (T2), 30–32 months (T3), and 8.5 years (T4) post-terror. The current paper uses data from T4.

1.1. The terrorist attack

On 22 July 2011, two terrorist attacks in Norway were conducted by one perpetrator. First, a bomb was detonated in central Oslo, outside the executive government quarter. Less than two hours later, the perpetrator

opened fire at a summer camp hosting members of the Norwegian Labor Party's youth organisation on Utøya. At the time of the shooting, almost 600 people were gathered on the small island, mostly adolescents and young adults. For over one hour and 20 min, the perpetrator shot, killed, and wounded those he came across. Sixty-eight people were killed in the attack on Utøya, one died later in the hospital, and many more were injured (The Norwegian Directorate of Health, 2012). For a more elaborate description of the attack and its aftermath, see Dyb et al. (2014) and Glad et al. (2021).

1.2. Participants and procedure

In total, 502 people survived the massacre on Utøya and all were invited to participate in the Utøya Study at T4. A postal information letter was sent out to all potential participants with information about the rationale, design and other relevant aspects of the study. Subsequently, they were telephoned by an interviewer and asked if they were willing to participate. In total, 289 (57.6%) of the survivors agreed to participate at T4; the remaining declined or could not be reached. Participants were aged between 22 and 65 years ($M = 27.7$, $SD = 4.6$), 51.2% females.

Approximately 8.5 years after the terrorist-attack semi-structured face-to-face interviews were conducted by health care personnel (mostly psychologists, medical doctors, and nurses) who attended a one-day training programme. Interviewers also assessed unmet needs among the participants, and if identified they were instructed to arrange for assistance. Eighteen participants, who were not able to attend a face-to-face interview, responded to the same measures in an online questionnaire. The study was based on written consent and was approved by the Regional Committee for Medical and Health Research Ethics in Norway.

1.3. Measures

Trauma reminders. In the Utøya Study, exposure to trauma reminders was measured using a list of eight reminders, developed by the authors based on data collected at an earlier timepoint (for more information, see Glad et al., 2016). At T4, two new reminders were added: (1) Films/documentaries etc. about the terrorist attack 22nd of July, and (2) other terrorist attacks in Norway or abroad. Participants were presented with the list 8.5 years after the terrorist attack and asked to report how frequently each reminder had reminded them about the attack and made them distressed, on a 5-point scale ranging from 1 (never) to 5 (very often) in the last month. Participants were also asked to report to what extent they had become very distressed, afraid, sad, or experienced bodily reactions, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent); and how long it took for

them to calm down again, on a four-point scale ranging from 1 (a few minutes), 2 (a few hours), 3 (a few days) to 4 (a few weeks).

Posttraumatic stress reactions. Posttraumatic stress reactions over the past month were measured using the University of California at Los Angeles PTSD Reaction Index (UCLA PTSD-RI) (Pynoos et al., 1998; Steinberg et al., 2004). To cover the diagnostic criteria in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorder (DSM-5; APA, 2013), the index was customised in collaboration with the authors of the original instrument in preparation for the first data collection of the Utøya Study in 2011. The measure comprises 20 items, with subscales to assess symptoms of the four diagnostic criteria for PTSD: Re-experiencing (five items), avoidance (two items), negative alterations in cognitions and mood (seven items), and arousal and reactivity (six items). Each question is explicitly related to the attack, and responses were endorsed on a 5-point scale, ranging from 0 (never) to 4 (almost all the time). The mean score was calculated using all 20 items. The Cronbach's alpha of the total scale was .92 at T4.

Symptoms of depression and anxiety. To measure the participants' level of depression and anxiety within the past two weeks, an eight-item version of the Hopkins Symptom Checklist-25 was used (HSCL-8; Solberg et al., 2011). Each item was rated on a scale from 1 (not at all bothered) to 4 (very much bothered). Short versions of the HSCL have previously been used in Norwegian population surveys and have shown high correlations with the 25-item scale and good psychometric properties (Strand et al., 2003; Tambs & Moum, 1993). The mean score was calculated using all eight items. The Cronbach's alpha of the total scale was .90 at T4.

Level of functioning. To determine participants' level of functioning, survivors were asked to report to what degree they were back to normal functioning in the following five areas: School/studies/work, leisure time, relationship with friends, relationship with the family, and domestic work (duties in the house, laundry, etc.). Each item was rated on a five-point scale, ranging from 1 (not at all) to 5 (totally back). The mean score was calculated using all five items. The Cronbach's alpha of the scale was .84 at T4.

1.4. Statistical analysis

Means and standard deviations were calculated for reminder variables. A single variable for each metric of trauma reminders (i.e. frequency of exposure; intensity of reactions to reminders; and duration of reactions to reminders) was created by collapsing across all the reminder types (i.e. auditory, emotional, visual, situational, other terrorist attacks, films/documentaries, bodily reactions, pain, olfactory and tactile) and using the maximum score given by each

participant for at least one reminder type. Separate linear regression models were then used, with these scores, to investigate the associations between the trauma reminder metrics and (1) symptoms of PTSD ($n = 245$), (2) symptoms of anxiety/depression ($n = 245$), and (3) level of functioning ($n = 244$). Each model was adjusted for sex and age. A linear regression model was also used to explore the association between age, sex, and frequency of exposure to reminders ($n = 289$). Linear regression models were performed in R version 4.1.2 (The R Foundation for Statistical Computing, Vienna, Austria) and all analyses included all complete cases.

2. Results

Of the 289 survivors who participated 8.5 years after the terrorist attack on Utøya in 2011, 259 (89.6%) reported that they had experienced reminders within the last month, and 103 (35.6%) reported having experienced at least one reminder often or very often during this time period. Auditory reminders were experienced most frequently; 202 survivors (69.9%) reported that they had experienced such reminders within the last month; 48 (16.6%) often or very often (Table 1). Olfactory and tactile reminders were experienced least frequently.

In terms of the intensity of the reactions evoked, 82 (28.4%) participants reported that they had become distressed, afraid, sad, or experienced bodily reactions to a great or very great extent after having encountered one, or more, reminder(s) within the last month. Bodily reminders were reported to evoke the highest level of distress, followed by tactile and auditory reminders, respectively (Table 2). The reminders evoking the least reactions, at a group level, were visual reminders and pain.

In terms of the duration of the distress, fear, sadness, or bodily reactions evoked by each reminder, the vast majority reported that it only lasted for a few minutes or hours (Table 2). For example, more than 70% reported that the reactions evoked after experiences with olfactory, visual and auditory reminders only lasted for a few minutes, and less than 2% reported that it lasted for days or weeks. That said, about 10% of the participants who had experienced any of the following four reminders: emotional, bodily reactions, films/documentaries about the 22nd of July terrorist attack and other terrorist attacks, reported being distressed for days or weeks afterwards (Table 2).

Both frequency of exposure to reminders, and the intensity of the reactions evoked, were significantly associated with symptoms of PTSD and anxiety/depression (Table 3). The duration of the reactions evoked was not associated with posttraumatic psychopathology. Only frequency of exposure to trauma reminders (not intensity or duration of reactions

Table 1. Table displaying the frequency of trauma reminders experienced the last month on a scale from 1 to 5 ($N = 289$).

Reminder	Never %	Rarely %	Sometimes %	Often %	Very often %	Total sample Mean (SD)
Auditory (e.g. gunshots, screams, sharp noises, fireworks, alarms, sirens, helicopter)	30.1	26.6	26.6	10.0	6.6	2.36(1.20)
Emotional (e.g. feeling sad, scared, stressed, emptiness, fear)	37.2	28.1	18.4	12.8	3.5	2.15(1.16)
Visual (e.g. pictures, newspaper articles, uniforms, police, weapons, Facebook profiles/ updates)	36.1	32.6	21.5	7.3	2.4	2.07(1.04)
Situational (e.g. running, crowds of people, certain places, buildings/tents, the AUF ¹ , nature (islands, water, the woods, rain))	46.9	28.8	12.5	7.3	4.5	1.94(1.14)
Other terrorist attacks in Norway or abroad	45.3	30.4	17.6	5.2	1.4	1.87(0.97)
Bodily reactions (e.g. palpitations, difficulty breathing)	60.2	17.0	10.0	10.0	2.8	1.78(1.14)
Films/documentaries etc. about the terrorist attack 22nd of July	61.1	23.2	10.0	3.1	2.4	1.62(0.96)
Pain	86.5	4.8	5.5	1.4	1.7	1.27(0.77)
Olfactory (e.g. smell from gunshot, blood, hospital, perfume, the forest, rocks)	86.9	8.0	3.8	1.0	0.3	1.20(0.58)
Tactile (e.g. contact with water, bodily contact)	89.3	5.5	2.8	1.7	0.7	1.19(0.63)

¹AUF = Norwegian Labor Party's youth organisation.**Table 2.** Table displaying the level and duration of the distress evoked by the various trauma reminders in the last month, on a scale from 1 to 5.

Reminder	N	Level of distress						Duration of distress				
		Not at all %	A little %	Some %	Much %	Very much %	Mean (SD)	N	Minutes %	Hours %	Days %	Weeks %
Auditory	202	7.4	44.6	29.2	15.3	3.5	2.63(0.95)	187	71.1	26.7	1.0	0.5
Emotional	181	8.3	45.9	28.7	12.2	5.0	2.60(0.98)	166	47.6	41.0	8.4	3.0
Visual	184	11.4	53.8	26.6	7.1	1.1	2.33(0.81)	163	73.0	25.2	1.2	0.6
Situational	153	14.4	41.2	26.1	13.7	4.6	2.53(1.05)	131	59.5	34.4	4.6	1.5
Bodily reactions	115	8.7	28.7	38.3	14.8	9.6	2.88(1.08)	105	48.6	41.0	9.5	1.0
Pain	39	20.5	38.5	28.2	12.8	–	2.33(0.96)	31	45.2	48.4	6.5	–
Olfactory	38	10.5	60.5	13.2	10.5	5.3	2.39(1.00)	34	73.5	26.5	–	–
Tactile	31	12.9	35.5	29.0	9.7	12.9	2.74(1.21)	27	63.0	29.6	7.4	–
Films/documentaries etc. about the terrorist attack 22nd of July	112	17.9	40.2	23.2	13.4	5.4	2.48(1.10)	92	46.7	41.3	10.9	1.1
Other terrorist attacks in Norway or abroad	158	13.3	48.7	25.9	9.5	2.5	2.39(0.92)	152	58.4	29.9	11.7	–

¹AUF = Norwegian Labor Party's youth organisation.**Table 3.** Linear regression analyses displaying associations between symptoms of PTSD ($n = 245$), anxiety and depression ($n = 245$), level of functioning ($n = 244$), and experiences with reminders.

	PTSD symptoms ¹				Anxiety/depression ¹				Functioning ¹			
	Coeff	CI lower	CI upper	p-value	Coeff	CI lower	CI upper	p-value	Coeff	CI lower	CI upper	p-value
Reminder frequency	5.98	4.28	7.67	<.001	0.19	0.09	0.29	<.001	–0.20	–0.33	–0.07	0.003
Reminder intensity	3.80	1.89	5.70	<.001	0.15	0.04	0.27	0.007	–0.08	–0.23	0.07	0.278
Reminder duration	1.76	–0.25	3.76	0.085	0.12	–0.00 ⁺	0.24	0.051	–0.09	–0.25	0.07	0.255

¹Adjusted for sex and age.

evoked) was significantly related to the survivors' level of functioning (school/work, leisure activities, and interpersonal relationships) post-terror (Table 3). Women reported experiencing trauma reminders significantly more often than men ($p < .001$). There was no significant relationship between age and exposure to reminders ($p = .448$).

3. Discussion

The aim of the present study was to explore the type, frequency, intensity and duration of trauma reminders experienced by survivors 8.5 years after a terrorist attack. We also wanted to examine the association between experiences with trauma reminders, psychological distress, and daily functioning. We found that most participants were still struggling with reminders

almost a decade post-trauma. Approximately 90% reported that they had experienced trauma reminders within the past month (35.6% often or very often), and almost 30% had become distressed, afraid, sad, or experienced bodily reactions to a great or very great extent. Auditory reminders were experienced most frequently, and bodily reminders elicited the highest level of distress. The vast majority reported that the reactions evoked by the reminders only lasted for a few minutes or hours. Both frequency of exposure to reminders, and the intensity of the reactions evoked, was significantly associated with symptoms of PTSD and anxiety/depression at 8.5 years post-trauma, but not the duration of the reactions evoked. Frequency of exposure to trauma reminders was negatively related to the survivors' level of functioning post-terror.

Even though almost a decade had passed since the terrorist attack on Utøya, experiences with distressing reminders were highly prevalent. Only 10% of the participants reported that they had not experienced any reminders within the last month, suggesting that the attack is still very much present in most of the survivors' daily lives. Clinically, it is perhaps not surprising that after having been directly exposed to such a traumatic experience as the massacre on Utøya island (including significant life threat via human-made trauma, and witnessing people being injured or killed), most will be distressed when internal or external cues remind them of it, even though several years have passed. Rather, this illustrates how, while the traumatic event itself can be relatively brief, the effects can last a lifetime, and based on the findings in the present study, distressing responses to reminders seem to be one such lasting psychological consequence.

Results from the current study also showed that distressing reminders post-terror encompassed several different aspects of the survivors' internal and external environment, and were perceived through all five sensory systems, but that auditory reminders were particularly frequent. This is in line with our previous findings from two prior studies on the survivors from Utøya (i.e. Glad et al., 2016, 2017). More specifically, auditory reminders were reported to be experienced most frequently, with similar rates of survivors reporting such reminders occurring often or very often 2.5 years after the attack (Glad et al., 2017) as we have found in this study 8.5 years after the attack (i.e. 15% and 17%, respectively). These findings suggest that the frequency of exposure to auditory reminders in this group is highly stable, and even has increased slightly the last six years post-terror. The dominance of auditory reminders is probably strongly related to the loud and persistent sound of gunshots that the survivors were exposed to during the attack, combined with the inescapable nature of loud and sudden noises in daily life (Glad et al., 2017). However, given that PTSD is characterised by alterations in arousal and reactivity, it is possible that survivors in general, who struggle with post-trauma reactions, are particularly wary of loud and sudden noises in their daily life, independent of the type of event they have been exposed to. If so, informing patients that it is common to experience distressing reactions to loud and sudden noises post-trauma may be a useful addition to the psychoeducation provided to trauma patients, but more research is warranted.

Interestingly, we also found that the mean frequency of each reminder type reported 8.5 years after the attack was very consistent with those reported 2.5 years after for all reminders (five had slightly increased, two slightly decreased, and one was identical). In fact, the order for the most to least frequent reminder was identical (with auditory reminders being experienced most frequently and tactile least

frequently). Again, this suggests that the frequency of exposure to reminders in this group is highly stable, from 2.5 years to 8.5 years post-terror.

Whereas the variation was relatively low for the level of distress evoked by each reminder, we found that bodily reminders elicited the highest mean level of distress, followed by tactile and auditory, respectively. In terms of the duration of the distress elicited by each reminder, the vast majority reported that it lasted for only minutes or hours. However, about 10% of the participants who had experienced either of the following four reminders: emotional, bodily reactions, films/documentaries about the 22 July terrorist attack, and other terrorist attacks, reported being distressed for days or weeks afterwards. Given that both films/documentaries about the terrorist attack 22 July and other terrorist attacks are so directly related to the traumatic event they had experienced, it is perhaps not surprising that the reactions evoked by these reminders last longer. These reminders were included in the study because several movies about the attack have been released (and received a lot of media attention), and because terrorist attacks from time to time are covered by the news, but we know little about how this affects the survivors. For example, in 2018, about one year prior to our data collection, three movies (including one documentary) about the terrorist attack on Utøya were released. Based on the results from the present study, it appears that when movies about a traumatic event are released, it is important to notify and prepare the directly affected.

In previous studies on this sample, we found that the survivors reported auditory reminders to be the worst (i.e. the most distressing) (i.e. Glad et al., 2016, 2017). While we did not ask the participants which reminder they experienced to be the worst at 8.5 years post-terror, we found that auditory reminders were experienced most often and were among the reminders which elicited the highest level of distress. However, it is interesting to note that less than 2% experienced the distress to last for a long period of time (i.e. for days or weeks). This might suggest that it is the frequency of exposure, and the intensity of reactions evoked, that makes auditory reminders so taxing for survivors, not the duration of their reactions. In line with this hypothesis, we found that psychological distress (i.e. symptoms of PTSD and anxiety/depression) at 8.5 years post-terror was significantly associated with both frequency of exposure to and intensity of reactions evoked by trauma reminders, but not the duration of the reactions.

In terms of daily functioning, we found that only frequency of exposure to trauma reminders (not intensity or duration of reactions evoked) was related to the survivors' level of functioning almost a decade post-terror. That is, survivors who reported experiencing trauma reminders more frequently functioned

worse in their daily life (including school/work, leisure activities, and interpersonal relationships). This is in line with earlier findings (Glad et al., 2017), and suggests that simply experiencing distressing reminders frequently in daily life (notwithstanding the intensity and duration of the reactions evoked) may lead to functional impairment in survivors for a very long time post-trauma. Of note, although the link between impaired functioning and PTSD is well documented (see Rodriguez et al., 2012), it is important to note that relatively few people fulfil the PTSD diagnosis after exposure to a traumatic event. Many more are distressed by reminders in their daily life and may struggle to function normally post-trauma. Empirically demonstrating that there is an association between exposure to trauma reminders and functional impairment almost 10 years post-trauma is of significance, because it strongly suggests many survivors probably could benefit from receiving help handling these distressing reminders.

3.1. Study strengths and limitations

This is the first large scale study to explore trauma reminders among survivors almost a decade after a terrorist attack, and the first to describe the type, frequency, intensity and duration of (reactions to) reminders post-trauma. The study was also strengthened by the inclusion of nearly 60% of the survivors of the attack, even after nearly a decade; as many males as females (males are often underrepresented in such studies); and low levels of missing data. Furthermore, the validity of the study is enhanced as interviews were performed face-to-face by trained professionals. Special care was taken to protect the study participants and interviewers due to the sensitive nature of the interviews: survivors in need of professional help were given advice and help in contacting health and social services and interviewers were provided supervision from the research team throughout the data collection.

While this study adds importantly to our understanding of the nature, prevalence, and potency of trauma reminders after a terrorist attack, the findings should be considered in light of several limitations. First, the participants were asked about their experiences with reminders within the *past month*. Given the 8.5 year time-lag since the event, this is a relatively short timeframe. From the interviews, we learned that some participants had experienced distressing reminders recently, just not within the past month. As such, it is possible that the reports of reminders are underreported in the present study, and that future studies of late reminders should have a longer timeframe. Second, although based on previous qualitative data of reminders collected at an earlier timepoint, participants may have experienced reminders other than those included in the list provided. Third, the generalisability of these findings

to other traumatic events and/or other traumatised populations is unknown.

3.2. Clinical implications and future directions

The clinically noteworthy finding in the present study is that trauma reminders can still be a central source of distress and impaired functioning among survivors many years post-trauma. We believe that increased awareness and more knowledge among clinicians about the importance of trauma reminders for patients' post-traumatic mental health and functioning may help them become more effective in working with people who are struggling after experiencing a highly distressing life event. For example, if clinicians become better at identifying reminders in the patients' history and understand how their patients' reactions to reminders are connected to what they have experienced, clinicians will be better able to help their patients see the historical reference behind their (often) exaggerated and seemingly absurd reactions in harmless situations (Glad et al., 2016). This is important, because it may not only reduce the patients' fear reactions, but also promote self-empathy and reduce feelings of shame. Further, as pointed out by Layne et al. (2006), trauma reminders have broad clinical utility, including 'establishing a therapeutic alliance based on recognition of the ongoing impact of the past trauma; psychoeducation regarding distress reactions and the cues that elicit them; developing coping strategies' (p. 251). That said, as noted by Glad et al. (2016), while everyone who is directly exposed to a terrorist attack does not need psychotherapy, most would probably benefit from psychoeducation about trauma reminders. Also, based on our results, we recommend that directly affected are notified and prepared when movies or documentaries about a traumatic event are to be released.

In a future study, to get a better understanding of the relationship between experiences with trauma reminders and psychopathology over time, it would be interesting to explore the direction of the relationship between experiences with trauma reminders and posttraumatic psychopathology (i.e. whether higher levels of symptoms make survivors susceptible to experiencing reminders more often and more intensely, or if the high frequency of exposure to and high intensity of reactions drive their symptoms). Given that trauma reminders are explicitly included in the DSM-5 criteria for PTSD, it may be questioned whether post-traumatic stress reactions and distressing reminders are distinguishable constructs. To examine this, Layne et al. (2003, as cited in Layne et al., 2006, p. 261) conducted an exploratory factor analysis on PTSD symptoms and frequency of exposure to reminders among war-exposed youth in Bosnia. Their results provided preliminary evidence that distressing reminders and post-traumatic stress

reactions are empirically distinct constructs, but more research is warranted. It would also be interesting to ask which reminder(s) they experience as the worst and *why*, and to explore what the trauma reminders primarily evoke so many years after the traumatic event (e.g. fear, distress, bodily reactions, or something else?). Finally, another important topic for future research is to explore the type, frequency, and potency trauma reminders after other type of traumas.

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