Proximity to terror and post-traumatic stress: A follow-up survey of governmental employees after the 2011 Oslo bombing attack

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-002692
Article Type:	Research
Date Submitted by the Author:	06-Feb-2013
Complete List of Authors:	Hansen, Marianne; Norwegian Centre for Violence and Traumatic Stress Studies, Nissen, Alexander; Norwegian Centre for Violence and Traumatic Stress Studies, Heir, Trond; Norwegian Centre for Violence and Traumatic Stress Studies,
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, PSYCHIATRY, MENTAL HEALTH

Proximity to terror and post-traumatic stress: A follow-up survey of governmental employees after the 2011 Oslo bombing attack

Marianne B Hansen, Alexander Nissen, & Trond Heir

Norwegian Centre for Violence and Traumatic Stress Studies

Correspondence to:

Marianne B Hansen, Norwegian Centre for Violence and Traumatic Stress Studies, Kirkeveien 166, B48**,** 0450 OSLO

E-mail: marianne.hansen@nkvts.unirand.no

Phone: +47 22 59 55 91

Objective: To assess the prevalence of PTSD symptoms among governmental employees after the 2011 Oslo bombing attack targeted towards the Norwegian Ministries, and to explore the importance of proximity to the bomb explosion as a predictor of PTSD.

Design: A cross-sectional study

Setting: Data were collected from a survey ten months after the Oslo bombing at 22nd of July 2011.

Participants: 3 520 employees was invited to the study. Net samples comprised 1 927 employees in 14 of the 17 Norwegian Ministries.

Outcome measures: The employees reported where they were at the time of the bomb explosion. Posttraumatic stress disorder (PTSD) was assessed with the Norwegian version of the PTSD Checklist (PCL).

Results: 207 of the 1881 (11 %) ministerial employees who completed the survey were present at work when the bomb exploded. Of these, a quarter (24%, CI 4,4-14,9) had symptom levels equivalent to PTSD, while the prevalence was approximately 4 % among those not present at work. In the latter group the prevalence was similar irrespective of whether their location was in Oslo, other places in Norway, or abroad. Leadership responsibility was associated with lower risk for PTSD.

Conclusion: Given similar circumstances, risk of PTSD is mainly associated with being present at work at the time of a terror attack. For those not being at work, the risk of PTSD is low, and independent of proximity to the terror scene. The findings may have implications for planning and priority of health services after a work place terror attack.

Article summary

Article focus

- Little is known about the impact of workplace directed terror on employees' mental health.
- Previous studies indicate that indirectly exposed individuals are at risk for mental health adversities after terror attacks.
- In this study, we determined the prevalence of PTSD in groups of employees' exposed to a work place terror attack in relation to where they were at the time of the attack.

Key messages

- The prevalence of PTSD is high among employees directly exposed to a terror attack targeting their workplace.
- For employees who were not at work at the time of the attack, the risk of PTSD is low, and independent of proximity to the terror scene.
- After a work place directed terror attack, psychosocial interventions should primarily be targeted towards employees directly exposed.

Strengths and limitations

- All employees in the Ministries was included in the study, reducing sample selection bias
- Moderate response rate (56 %)

Research on employees' mental health in the aftermath of work place directed terror attacks is rare. Available studies of Pentagon staff members after the 9/11 attacks in the US in 2001 have revealed high prevalence of PTSD among employees who were at work on the day of the attack (Grieger, Fullerton et al. 2004; Grieger 2005). Those injured or exposed to dead bodies had higher rates of psychiatric illness including probable PTSD (Grieger 2005). Mental health consequences for employees who were not present at work at the time of the attack are explored to a lesser extent (Neria and Sullivan 2011). There is some evidence that individuals indirectly exposed to a terror attack through watching mass media may develop PTSD symptoms (Schlenger We and et al. 2002). Also, there is some evidence that proximity to a terror scene may increase the risk of PTSD symptoms for individuals not directly exposed (Schlenger We and et al. 2002). However, it is not clear whether individuals indirectly exposed to a terror attack should be included in a strategy for screening populations at risk for posttraumatic reactions.

The Oslo bombing in July 2011 was a terror attack on the Government ministries of Norway. A car bomb blast shattered governmental buildings, killing eight people and injuring 209 more. Approximately 4000 ministry employees had their office in close proximity to the epicenter of the explosion. In the weeks following the terror attack, the governmental occupational health service, with assistance from experienced occupational physicians, offered employees psychological first aid, medical examinations, and referrals to specialist health services when required (Skogstad, Skorstad et al. 2013). High priority was given to ensuring that the needs of the most at-risk individuals were addressed, though how one should define and reach these individuals was subject to discussion. Different selection strategies were proposed, such as proximity to the explosion, degree of exposure, or a screening program for posttraumatic reactions and functioning. The final decision was to include all

employees who were at work on the day of the explosion, regardless of which department they belonged to.

The aim of the present study was to assess the prevalence of PTSD symptoms among employees ten months after a terror attack, and more specifically, to what extent proximity to the site of the attack was a predictor of PTSD.

Methods

Participants

The present study is based on data from a survey conducted ten months after the bomb explosion in Oslo, and comprised employees in 14 of the 17 Norwegian ministries on the 22nd of July 2011. A total of 3520 employees were included in the study. Of these, 1971 responded, giving a response rate of 56 percent. From this sample, 44 were excluded from the analyses due to missing data, giving a net sample of 1 927 employees. The respondents' age ranged from 19 to 70 years, with an average of 45.4 years, and 42.3 percent were male. Both age and the proportion of females were higher in our final sample compared to the excluded group. In our net sample, 89 % had more than 12 years of education, 73 % were married or cohabiting, and 18 percent was in a leadership position.

The study was approved by the Regional committees for medical and health research ethics.

Measures

A questionnaire was made available online via a web portal established for this purpose. All employees received an invitation letter with a personal code to log on to the web portal and the questionnaire.

Proximity to the bomb explosion was assessed by asking employees where they were located at the moment when the bomb went off next to the government buildings on the afternoon of the 22nd of July 2011. Respondents were given the following five answer choices: 1) in the government district downtown, 2) in downtown Oslo, but not in the government district, 3) in Oslo, but not downtown, 4) in Norway, but not in Oslo, 5) abroad. There was no significant difference in the distribution of age and gender between these location groups.

To assess PTSD symptoms, the Norwegian version of the PTSD Checklist (PCL), was applied (Hem, Hussain et al. 2012). The PCL was first introduced in 1993 by Weathers and colleagues and is now one of the most frequently used self-reported measures on PTSD symptoms (Weatherts, Litz et al. 1993). The PCL is a 17-item self-administered questionnaire that assesses the full domain of DSM-IV PTSD symptoms (Blanchard, Jones-Alexander et al. 1996). The PTSD diagnosis requires one positive score in cluster B, three in cluster C and two in cluster D, which is the same number of positive items required in the three clusters in the DSM-IV system (APA 1994).The same procedure has been shown to perform well for detecting PTSD in the Norwegian population in epidemiological research (Hem, Hussain et al. 2012).

We also assessed the following demographic characteristics: educational level, marital status, and leadership position.

Statistical analyses

The association between proximity to the bomb explosion and risk of PTSD was examined using logistic regression. Multiple logistic regression analysis was used to adjust for gender, age, education, marital status and leadership responsibility. All tests were two-tailed and differences were considered significant if $p < 0.05$. The statistical analysis was performed with the software package SPSS version 20.0 for Windows.

Results

The prevalence of PTSD among the employees of the Norwegian ministries was highly dependent of whether they were present at work or not when the bomb exploded. Whereas a quarter (24%) of the employees who were present at work in the governmental district had PTSD 10 months after the terror attack, the prevalence was around 4% for employees not present at work, regardless of their proximity to the explosion (table 2).

Table 2 about here

The difference in risk of PTSD between those present at work and those not present was similar after adjustment for gender, age, education, marital status, and leadership position (table 3). Furthermore, there was no association between proximity to the terror attack and risk of PTSD for employees who were not present at work.

Table 3 about here

Women were twice as likely as men to have PTSD. Furthermore, those with leadership responsibilities had less PTSD, whereas age, educational level and marital status were not associated with PTSD.

Discussion

In this study of employees in the Norwegian ministries 10 months after the 2011 Oslo bombing, the prevalence of PTSD was highly dependent on the employees' localization when the bomb exploded. While a quarter of those who were present at work in the governmental district had PTSD, the prevalence was around 4% among those not present at work. In the latter group the prevalence of PTSD was similar irrespective of whether they were in Oslo, other places in Norway, or abroad.

The high prevalence of PTSD among employees who were present at work at the time of the explosion is comparable to previous research on work place terror which have shown a prevalence of probable PTSD varying from 14 to 23 percent in individuals directly exposed, assessed seven to 36 months after the terror attack (Grieger, Fullerton et al. 2003; Grieger, Fullerton et al. 2004; Grieger 2005; Grieger, Waldrep et al. 2005; DiGrande, Neria et al. 2011). Thus, it seems obvious that direct exposure to the bombing of the Norwegian Ministries had great impact on the employees' mental health. The high prevalence of PTSD occurred despite the fact that the study population represented a low risk group with high education and access to a cohesive working environment, factors that are known to protect against the development of PTSD (Stephens, Long et al. 1997; van der Ploeg and Kleber 2003; Heir, Rosendal et al. 2011).

The 4% prevalence of PTSD in employees not present at work was comparable to estimates of PTSD prevalence in the US general population after the 9/11 terror attacks (Schlenger We and et al. 2002; Silver, Holman et al. 2002). Research on indirectly exposed individuals after work place terror attacks, i.e. employees not present at the time of the incident, is rather scarce. However, the PTSD level is similar to what was found in a Norwegian study of employees not present at work at the time of an industrial disaster (Weisæth and Eitinger 1993). In our study, it seemed that being an employee at the site of the terror attack was of minor importance for the development of PTSD, compared to the importance of being directly exposed to the bomb explosion.

The bomb explosion could be heard throughout the city, and generated massive pressure waves and smoke that were noticeable in large parts of Oslo and the surrounding region. The lack of a relationship between proximity to the bomb explosion and PTSD among those not at work, however, suggests that witnessing the explosion at a certain distance was not related to a higher risk of developing PTSD. The risk of PTSD among those not at work may rather be related to the feeling of being targeted in a terror attack and finding their office bombed, as well as personality, vulnerability, and previous experiences. These findings are in contrast to findings published after the 9/11 attacks , where it was suggested that the severity of PTSD symptoms was higher among those who were close enough to hear, feel or witness the attack (Schlenger We and et al. 2002). However, witnessing the two different events at a distance may not be completely comparable as the scenes of the 9/11 attacks were of a larger scale and probably more threatening and terrifying.

Gender differences in the risk for PTSD have yet to be explained. However, the two fold increase in risk for PTSD among women in our study is in line with previous findings in the aftermath of mass violence (North C and et al. 1999; Galea, Ahern et al. 2002) (Jordan 2004), as well as after technological and natural disasters (Norris 2002). Possible hypotheses include

gender differences in how traumatic events are perceived, how men and women react differently to adverse events, or how psychological distress is reported differently (Olff, Langeland et al. 2007; Heir and Weisæth 2008).

We furthermore found that individuals with leadership responsibility had considerable lower risk for developing PTSD compared to non-leaders. This was consistent also after adjustment for education. Leadership responsibilities may increase one's sense of control which in turn may serve as a buffer against stress (Shimazu, deJonge et al. 2008; Smith, Frank et al. 2008). Although leadership positions traditionally have been associated with increased stress levels (Levinson 1981), it has been demonstrated that leaders have lower levels of anxiety and lower levels of the stress hormone cortisol compared to non-leaders (Sherman, Jooa et al. 2012). Based on our results, we hypothesize that similar mechanisms may be responsible for the effect associated with having leadership responsibility in terms of developing PTSD.

Methodological considerations

This study has a number of methodological benefits. All the staff members who were employed in the Ministries at the time of the explosion were asked to participate in our study, reducing sample selection bias. Also, our study sample is probably not confounded by high rates of pre-existing psychopathology or other risk factors for PTSD. In fact, our sample had higher than average levels of socioeconomic status and education, which are known protective factors for psychopathology.

Limitations of our study include a moderate response rate of 56%. An overrepresentation of women may have resulted in a slight overestimation of PTSD. The study population consisted of a high proportion of highly educated bureaucrats and government officials, and thus, our results may not be applicable to other populations.

The prevalence of PTSD was assessed by the PCL self-report inventory, which implies that our results must be interpreted with caution. However, the Norwegian version of PCL has been shown to perform well as a diagnostic instrument for detecting PTSD in epidemiological research (Hem, Hussain et al. 2012). Also, we have not considered fulfillment of the DSM A-criteria, but only taken into account the number of symptoms in each symptom cluster. It is likely that the stress-criterion was not fulfilled for those not at work, and that the prevalence of PTSD secondary to the bomb explosion therefore is overestimated. On the other hand, virtually all employees who were present at work were in a life-threatening situation, and a high proportion experienced death or suffering of self or others.

Implications

For future psychosocial intervention after work place terror and disasters, our findings support the notion that priority should be given to those who were present during the event. When planning psychosocial interventions for the employees after the Oslo bombing, it was emphasized that many of the employees not present at work had acute stress reactions. This was probably caused by the realization that their workplace and they themselves had been the target of a terror attack. That they found their offices and belongings destroyed. However, due to limited resources, a follow-up intervention program was restricted to those who had been at work. Our findings clearly show that this priority was appropriate. For employees not present at work when the bomb exploded, proximity to the terror scene was not associated with increased risk for PTSD. To be on target for terror as present employees were on 22/7 seems to be the strongest predictor for PTSD.

References

APA (1994). Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV). Washington DC, American Psychiatric Association.

Blanchard, E. B., J. Jones-Alexander, et al. (1996). "Psychometric properties of the PTSD checklist (PCL)." Behaviour Research and Therapy **34**(8): 669-673.

DiGrande, L., Y. Neria, et al. (2011). "Long-term Posttraumatic Stress Symptoms Among 3,271 Civilian Survivors of the September 11, 2001, Terrorist Attacks on the World Trade Center." Am J Epidemiol **173**(3): 271-281.

Galea, S., J. Ahern, et al. (2002). "Psychological Sequelae of the September 11 Terrorist Attacks in New York City." New England Journal of Medicine **346**(13): 982-987.

Grieger, T. (2005). "Follow-up of Pentagon employees two years after the terrorist attack of September 11, 2001." Psychiatric Services **56**(11): 1374-1378.

Grieger, T. A. (2005). "PTSD plus depression are comorbid conditions but depression can occur independently in the acute aftermath of trauma." Evid Based Ment Health **8**(1): 27.

Grieger, T. A., C. S. Fullerton, et al. (2003). "Posttraumatic Stress Disorder, AlcoholUse, and Perceived Safety After the Terrorist Attack on thre Pentagon." Psychiatric Services **54**(10): 1380-1382.

Grieger, T. A., C. S. Fullerton, et al. (2004). "Posttraumatic stress disorder, depression, and perceived safety 13 months after September 11." Psychiatr Serv **55**(9): 1061-1063.

Grieger, T. A., C. S. Fullerton, et al. (2004). "Posttraumatic Stress Disorder, Depression, and Perceived Safety 13 Months After September 11." Psychiatric Services **55**(9): 1061-1063.

Grieger, T. A., D. A. Waldrep, et al. (2005). "Follow-up of Pentagon employees two years after the terrorist attack of September 11, 2001." Psychiatr Serv **56**(11): 1374-1378.

Heir, T., S. Rosendal, et al. (2011). "Tsunami-affected Scandinavian tourists: Disaster exposure and post-traumatic stress symptoms." Nordic Journal of Psychiatry **65**(1): 9-15.

Heir, T. and L. Weisæth (2008). "Acute Disaster Exposure and Mental Health Complaints of Norwegian Tsunami Survivors Six Months Post Disaster." Psychiatry: Interpersonal and Biological Processes **71**(3): 266-276.

Hem, C., A. Hussain, et al. (2012). "The Norwegian version of the PTSD Checklist (PCL): Construct validity in a community sample of 2004 tsunami survivors." Nordic Journal of Psychiatry **66**(5): 355-359.

Levinson, H. (1981). "When executives burnout." Harvard Business Review **59**: 73-81.

Neria, Y. and G. M. Sullivan (2011). "Understanding the mental health effects of indirect exposure to mass trauma through the media." JAMA **306**(12): 1374-1375.

North C, N. S. S. S. and et al. (1999). "Psychiatric disorders among survivors of the oklahoma city bombing." JAMA: The Journal of the American Medical Association **282**(8): 755-762.

Olff, M., W. Langeland, et al. (2007). "Gender differences in posttraumatic stress disorder." Psychological Bulletin **133**(2): 183-204.

Schlenger We, C. J. M. E. L. and et al. (2002). "Psychological reactions to terrorist attacks: Findings from the national study of americans' reactions to september 11." JAMA: The Journal of the American Medical Association **288**(5): 581-588.

Silver, R., E. A. Holman, et al. (2002). "Nationwide longitudinal study of psychological responses to September 11." JAMA (Chicago, Ill.) **288**(10): 1235-1244.

Skogstad, M., M. Skorstad, et al. (2013). "Work-related post-traumatic stress disorders: in-depth review." Occupational Medicine.

Stephens, C., N. Long, et al. (1997). "The impact of trauma and social support on Posttraumatic Stress Disorder: A study of New Zealand police officers." Journal of Criminal Justice **25**(4): 303-314.

van der Ploeg, E. and R. J. Kleber (2003). "Acute and chronic job stressors among ambulance personnel: predictors of health symptoms." Occupational and Environmental Medicine **60**(suppl 1): i40-i46.

Weatherts, F. W., B. T. Litz, et al. (1993). The PTSD Checklist: Reliability, validity, and diagnostic utility. Annual Meeting of the International Society for Traumatic Stress Studies. San Antonio, TX, October.

Table 1 Age, gender and proportion of employees at work during the 2011 Oslo bombing

	Subjects included in the study (n = 1970)	**Excluded group (n = 1550)**
Age, years (SD)	45.4 (10.9)	43.8 (11.4)*
Gender, n (%) Female Male	 1133 (57.5) 837 (42.5)	 760 (49.0)* 790 (51.0)*
At work in the Government area when the bomb exploded, n (%)	207 (10.5)	145 (9.4)

* P<0.001

Table 2 Employees of the Norwegian ministries with PTSD 9-10 months after the 2011 Oslo bombing according to their localization during the bomb attack

	n (%)	OR (95% CI)	p
- Abroad (n=357)	13 (3.6)	ref	-
- Norway (n=855)	32 (3.7)	1.03 (0.5-2.0)	0.93
- Oslo periphery (n=342)	12 (3.5)	0.96 (0.4-2.1)	0.93
- Oslo downtown (n=169)	7 (4.1)	1.14 (0.4-2.9)	0.78
- Government district (n=204)	49 (24.0)	8.37 (4.4-15.9)	<0.001

Table 3. Probability of PTSD in employees of the Norwegian ministries, according to localization during the bomb attack adjusted for gender, age, education, marital status and leadership position.

	OR	95% CI	p
Location			
- Abroad	ref	-	-
- Norway	0.97	0.49-1.95	0.94
- Oslo periphery	0.92	0.40-2.10	0.83
- Oslo downtown	1.11	0.42-2.92	0.83
- Government district	8.79	4.45-17.37	<0.001
Gender (women vs men)	2.03	1.28-3.23	0.003
Age (increase of 10 years)	1.04	0.85-1.26	0.72
Education			
More than 16 years	ref	-	-
13-16 years	1.65	1.04-2.63	0.35
12 years or less	1.53	0.80-2.92	0.20
Married or cohabiting (yes versus no)	0.98	0.62-1.53	0.92
Leadership (yes versus no)	0.42	0.20-0.86	0.02

Notes:

Contributors: MBH and TH conceived, designed and coordinated the study, collected and analysed the data, and wrote the paper. AN collected the data and assisted in the analyses and writing of the paper. All the authors approved the final manuscript.

Funding: This work was supported by The Norwegian Directorate of Health.

Competing interests: None declared

Data sharing statement: No additional data are available

Proximity to terror and post-traumatic stress: A follow-up survey of governmental employees after the 2011 Oslo bombing attack

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-002692.R1
Article Type:	Research
Date Submitted by the Author:	22-Apr-2013
Complete List of Authors:	Hansen, Marianne; Norwegian Centre for Violence and Traumatic Stress Studies, Nissen, Alexander; Norwegian Centre for Violence and Traumatic Stress Studies, Heir, Trond; Norwegian Centre for Violence and Traumatic Stress Studies,
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, PSYCHIATRY, MENTAL HEALTH

Proximity to terror and post-traumatic stress: A follow-up survey of governmental employees after the 2011 Oslo bombing attack

Marianne B Hansen, Alexander Nissen, & Trond Heir

Norwegian Centre for Violence and Traumatic Stress Studies

Correspondence to:

Marianne B Hansen, Norwegian Centre for Violence and Traumatic Stress Studies, Kirkeveien 166, B48**,** 0450 OSLO

E-mail: marianne.hansen@nkvts.unirand.no

Phone: +47 22 59 55 91

ABSTRACT

Objective: To assess the prevalence of PTSD symptoms among governmental employees after the 2011 Oslo bombing attack targeted towards the Norwegian Ministries, and to explore the importance of proximity to the bomb explosion as a predictor of PTSD.

Design: A cross-sectional study

Setting: Data were collected from a survey ten months after the Oslo bombing at 22nd of July 2011.

Participants: 3 520 employees was invited to the study. Net samples comprised 1 927 employees in 14 of the 17 Norwegian Ministries.

Outcome measures: The employees reported where they were at the time of the explosion. Posttraumatic stress disorder (PTSD) was assessed with the Norwegian version of the PTSD Checklist (PCL).

Results: 207 of the 1881 (11 %) ministerial employees who completed the survey were present at work when the bomb exploded. Of these, a quarter (24%, 95% CI: 18.4-30.0) had symptom levels equivalent to PTSD, while the prevalence was approximately 4 % among those not present at work. In the latter group the prevalence was similar irrespective of whether their location was in Oslo, other places in Norway, or abroad. Leadership responsibility was associated with lower risk for PTSD.

Conclusion: The risk of PTSD is mainly associated with being present at work at the time of a terror attack. For those not present at work, the risk of PTSD is low, and independent of proximity to the terror scene. The findings may have implications for planning and priority of health care services after a work place terror attack.

Article summary

Article focus

- Little is known about the impact of work place directed terror on employees' mental health.
- Previous studies indicate that indirectly exposed individuals are at risk for mental health adversities after terror attacks.
- In this study, we determined the prevalence of PTSD in groups of employees' exposed to a work place terror attack in relation to where they were at the time of the attack.

Key messages

- After a work place terror attack, the prevalence of PTSD is high among employees who were present at work at the time of the attack.
- For employees who were not at work at the time of the attack, the risk of PTSD is low, and independent of proximity to the terror scene.
- After a work place terror attack, psychosocial interventions should primarily be targeted towards employees who were present at work at the time of the attack.

Strengths and limitations

- All employees in the Ministries were included in the study, reducing sample selection bias
- Moderate response rate (56 %)

Research on employees' mental health in the aftermath of work place directed terror attacks is rare. Available studies of Pentagon staff members after the 9/11 attacks in the US in 2001 have revealed high prevalence of PTSD among employees who were at work on the day of the attack.[1, 2] Those injured or exposed to dead bodies had higher rates of psychiatric illness including probable PTSD.[1] Mental health consequences for employees who were not present at work at the time of the attack are explored to a lesser extent.[3] There is some evidence that individuals indirectly exposed to a terror attack through watching mass media may develop PTSD symptoms.[4] Also, there is some evidence that proximity to a terror scene may increase the risk of PTSD symptoms for individuals not directly exposed.[4] However, it is not clear whether individuals indirectly exposed to a terror attack should be included in a strategy for screening populations at risk for posttraumatic reactions.

The Oslo bombing in July 2011 was a terror attack on the Government ministries of Norway. A car bomb blast shattered governmental buildings, killing eight people and injuring 209 more. Approximately 4000 ministry employees had their office in close proximity to the epicenter of the explosion. In the weeks following the terror attack, the governmental occupational health service, with assistance from experienced occupational physicians, offered employees psychological first aid, medical examinations, and referrals to specialist health services when required.[5] High priority was given to ensuring that the needs of the most at-risk individuals were addressed, though how one should define and reach these individuals was subject to discussion. Different selection strategies were proposed, such as proximity to the explosion, degree of exposure, or a screening program for posttraumatic reactions and functioning. The final decision was to include all employees who were at work on the day of the explosion, regardless of which ministry they belonged to.

The aim of the present study was to assess the prevalence of PTSD symptoms among employees ten months after a terror attack, and more specifically, to what extent proximity to the site of the attack was a predictor of PTSD.

Methods

Participants

The present study is based on data from a survey conducted ten months after the bomb explosion in Oslo, and comprised employees in 14 of the 17 Norwegian ministries on the 22nd of July 2011. Based on employees' lists provided by each of the 14 ministries, a total of 3520 individuals were invited to participate in the study. Each employee received a project specific identification number generated from their social security number. The key to match these numbers was kept on a unique, off-line server which only one administrative person had access to. Anonymity was secured in that neither the employers nor the researchers had access to this key, and could thus not identify the person behind a response. The procedure was thoroughly explained to the employees before the start of the study.

Of the 3520 invited employees, 1970 responded, giving a response rate of 56 percent. From this sample, 43 were excluded from the analyses due to missing data, giving a net sample of 1 927 employees. Both age and the proportion of females were higher among responders compared to non-responders, whereas the proportion of employees present at work was similar in the two groups (table 1). In our net sample, 89 % had more than 12 years of education, 73 % were married or cohabiting, and 18 percent was in a leadership position.

Participants were not identified in order to offer follow-up service to those who met criteria for PTSD. With support from our study, the government occupational health service upheld

the initial selection criteria in a second medical follow-up and contacted all employees who had been at work when the bomb exploded. Employees who had not been at work were advised to contact the government occupational health service if they had symptoms affecting daily life functioning and ability to work.

The study was approved by the Regional committees for medical and health research ethics.

Measures

A questionnaire was made available online via a web portal established for this purpose. All employees received an invitation letter with a personal code to log on to the web portal and the questionnaire. The code was confidential and only known to the administrative person in charge of data security.

Proximity to the explosion was assessed by asking employees where they were located at the moment when the bomb went off next to the government buildings on the afternoon of the 22nd of July 2011. Respondents were given the following five answer choices: 1) in the government district downtown, 2) in downtown Oslo, but not in the government district, 3) in Oslo, but not downtown, 4) in Norway, but not in Oslo, 5) abroad. There was no significant difference in the distribution of age and gender between these location groups.

To assess PTSD symptoms, the Norwegian version of the PTSD Checklist (PCL), was applied.[6] The PCL was first introduced in 1993 by Weathers and colleagues and it is now one of the most frequently used self-reported measures on PTSD symptoms.[7] The PCL is a 17-item self-administered questionnaire that assesses the full domain of DSM-IV PTSD symptoms.[8] The PTSD diagnosis requires one positive score in cluster B, three in cluster C and two in cluster D, which is the same number of positive items required in the three clusters in the DSM-IV system.[9] The same procedure has been shown to perform well for detecting PTSD in the Norwegian population in epidemiological research.[6]

We also assessed the following demographic characteristics: Gender, age, educational level, marital status, and leadership position. Finally, we asked whether the participants had witnessed dead people or people dying, whether they had witnessed people seriously injured, and whether they had been physically injured themselves.

Statistical analyses

The association between proximity to the bomb explosion and risk of PTSD was examined using logistic regression. Multiple logistic regression analysis was used to adjust for gender, age, education, marital status and leadership responsibility. We also used logistic regression to examine the association between potentially traumatic experiences and PTSD among those who were present at work in the governmental district when the bomb exploded. All tests were two-tailed and differences were considered significant if $p< 0.05$. The statistical analysis was performed with the software package SPSS version 20.0 for Windows.

Results

The prevalence of PTSD among the employees of the Norwegian ministries was highly dependent of whether they were present at work or not when the bomb exploded. Whereas a quarter (24%) of the responders who were present at work in the governmental district had PTSD 10 months after the terror attack, the prevalence was around 4% for employees not present at work, regardless of their proximity to the explosion (table 2).

Table 2 about here

The difference in risk of PTSD between those present at work and those not present was similar after adjustment for gender, age, education, marital status, and leadership position (table 3). Furthermore, there was no association between proximity to the terror attack and risk of PTSD for employees who were not present at work.

Table 3 about here

Women were twice as likely as men to have PTSD. Furthermore, those with leadership responsibilities and those with more than 16 years of education had less PTSD, whereas age and marital status were not associated with PTSD.

Of the 204 employees that were present at work, 67 (32.8%) witnessed dead people or people dying, 132 (64.7%) witnessed people seriously injured, and 52 (25.5%) were physically injured themselves. None of these experiences were significantly associated with PTSD according to unadjusted results (witnessing death OR=1.44, p=0.28; witnessing people seriously injured OR=2.05, p=0.060; physical injury to self (OR=1.82, p=0.092) or results adjusted for the other variables (OR=1.19, p=0.63; OR=1.82, p=0.14; OR=1.65, p=0.17; respectively).

Discussion

In this study of employees in the Norwegian ministries 10 months after the 2011 Oslo bombing, the prevalence of PTSD was highly dependent on the employees' localization when the bomb exploded. While a quarter of those who were present at work in the governmental district had PTSD, the prevalence was around 4% among those not present at work. In the

latter group the prevalence of PTSD was similar irrespective of whether they were in Oslo, other places in Norway, or abroad.

The high prevalence of PTSD among employees who were present at work at the time of the explosion is comparable to previous research on work place terror which have shown a prevalence of probable PTSD varying from 14 to 23 percent in individuals directly exposed, assessed seven to 36 months after the terror attack.[1, 2, 10, 11] Thus, it seems obvious that direct exposure to the bombing of the Norwegian Ministries had great impact on employees' mental health.

The 4% prevalence of PTSD in employees not present at work was comparable to estimates of PTSD prevalence in the US general population after the 9/11 terror attacks.[4, 12] Research on indirectly exposed individuals after work place terror attacks, i.e. employees not present at the time of the incident, is rather scarce. However, the PTSD level is similar to what was found in a Norwegian study of employees not present at work at the time of an industrial disaster.[13] In our study, it seemed that being an employee at the site of the terror attack was of minor importance for the development of PTSD, compared to the importance of being directly exposed to the bomb explosion.

The bomb explosion could be heard throughout the city, and it generated massive pressure waves and smoke that were noticeable in large parts of Oslo and the surrounding regions. The lack of a relationship between proximity to the bomb explosion and PTSD among those not at work, however, suggests that witnessing the explosion at a certain distance was not related to a higher risk of developing PTSD. These findings are in contrast to findings published after the 9/11 attacks , where it was suggested that the severity of PTSD symptoms was higher among those who were close enough to hear, feel or witness the attack.[4] However,

witnessing the two events at a distance may not be completely comparable as the scenes of the 9/11 attacks were of a larger scale and probably more threatening and terrifying.

Gender differences in the risk for PTSD have yet to be explained. However, the two fold increase in risk for PTSD among women in our study is in line with previous findings in the aftermath of mass violence,[14-16] as well as after technological and natural disasters,[17] and in the general population exposed to traumatic events.[18, 19] Possible hypotheses include gender differences in how traumatic events are perceived, how men and women react differently to adverse events, or how psychological distress is reported differently.[20, 21]

We furthermore found that individuals with leadership responsibility had considerable lower risk for developing PTSD compared to non-leaders. This was consistent also after adjustment for education. Leadership responsibilities may increase one's sense of control which in turn may serve as a buffer against stress.[22, 23] Although leadership positions traditionally have been associated with increased stress levels,[24] it has been demonstrated that leaders have lower levels of anxiety and lower levels of the stress hormone cortisol compared to non-leaders.[25] Based on our results, we hypothesize that similar mechanisms may contribute to an increased resilience among leaders against developing PTSD.

We did not find any relationship between age and psychological outcome. On this point, the disaster literature differs substantially in that older, middle-aged, and younger adults all have been shown to react with more distress after traumatic events, and partly contradictory hypotheses have been formulated.[17] In our study, all participants were in working age, and the catastrophic event was probably just as unexpected and unfamiliar to all age groups. Also, we found that a higher education level was associated with lower risk of posttraumatic stress, which is in line with many other studies,[26] including Scandinavian disaster populations.[27]

Methodological considerations

This study has a number of methodological benefits. All the staff members who were employed in the Ministries at the time of the explosion were asked to participate in our study, reducing sample selection bias. Also, our study sample is probably not confounded by high rates of pre-existing psychopathology or other risk factors for PTSD. In fact, our sample belonged to the working population, had access to a cohesive work environment, and had higher than average levels of socioeconomic status and education, which are known protective factors for psychopathology.[26, 28, 29]

Limitations of our study include a moderate response rate of 56%. Thus, we can not exclude the possibility of sampling bias. For instance, our findings could be biased if affected women or unaffected leaders were more willing to complete the survey. However, we have no theoretical reasons to believe this is the case. More likely, an overrepresentation of women may have resulted in a slight overestimation of PTSD. Furthermore, the study population consisted of a high proportion of highly educated bureaucrats and government officials, and thus, our results may not be applicable to other populations.

The prevalence of PTSD was assessed by the PCL self-report inventory, which implies that our results must be interpreted with caution. However, the Norwegian version of PCL has been shown to perform well as a diagnostic instrument for detecting PTSD in epidemiological research.[6] Also, we have not considered fulfillment of the DSM A-criteria, but only taken into account the number of symptoms in each symptom cluster. It is likely that the stress-criterion was not fulfilled for those not at work, and that the prevalence of PTSD secondary to the bomb explosion therefore is overestimated. On the other hand, virtually all employees who were present at work were in a life-threatening situation, and a high proportion experienced death or suffering of self or others.

Implications

When planning psychosocial interventions for the employees after the Oslo bombing, decision makers responsible for the allocation of health resources were presented with anecdotal reports about acute stress reactions among employees who had not been present at work. Nevertheless, due to limited resources, a follow-up intervention program was restricted to those who had been at work. Our findings clearly show that this priority was appropriate. For employees not present at work when the bomb exploded, physical proximity to the terror scene was not associated with increased risk for PTSD. For future psychosocial intervention after work place terror and disasters, priority should be given to those who are present during the event.

References

1. Grieger TA, Waldrep DA, Lovasz MM, et al. Follow-up of Pentagon employees two years after the terrorist attack of September 11, 2001. Psychiatric Services 2005;**56**(11):1374-78

2. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, depression, and perceived safety 13 months after September 11. Psychiatric Services 2004;**55**(9):1061-63

3. Neria Y, Sullivan GM. Understanding the mental health effects of indirect exposure to mass trauma through the media. JAMA : the journal of the American Medical Association 2011;**306**(12):1374-5 doi: 10.1001/jama.2011.1358[published Online First: Epub Date]|.

4. Schlenger We CJMEL, et al. Psychological reactions to terrorist attacks: Findings from the national study of americans' reactions to september 11. JAMA: The Journal of the American Medical Association 2002;**288**(5):581-88 doi: 10.1001/jama.288.5.581[published Online First: Epub Date]|.

5. Skogstad M, Skorstad M, Lie A, et al. Work-related post-traumatic stress disorder. Occupational Medicine 2013;**63**(3):175-82

6. Hem C, Hussain A, Wentzel-Larsen T, et al. The Norwegian version of the PTSD Checklist (PCL): Construct validity in a community sample of 2004 tsunami survivors. Nordic Journal of Psychiatry 2012;**66**(5):355-59 doi: doi:10.3109/08039488.2012.655308[published Online First: Epub Date]|.

7. Weatherts FW, Litz BT, Herman DS, et al. The PTSD Checklist: Reliability, validity, and diagnostic utility. Annual Meeting of the International Society for Traumatic Stress Studies. San Antonio, TX, October, 1993.

8. Blanchard EB, Jones-Alexander J, Buckley TC, et al. Psychometric properties of the PTSD checklist (PCL). Behaviour Research and Therapy 1996;**34**(8):669-73 doi: 10.1016/0005-7967(96)00033-2[published Online First: Epub Date]|.

9. APA. *Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV)*. Washington DC: American Psychiatric Association, 1994.

10. DiGrande L, Neria Y, Brackbill RM, et al. Long-term posttraumatic stress symptoms among 3,271 civilian survivors of the September 11, 2001, terrorist attacks on the World Trade Center. American journal of epidemiology 2011;**173**(3):271-81

11. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, alcohol use, and perceived safety after the terrorist attack on the Pentagon. Psychiatric Services 2003;**54**(10):1380-82

12. Silver R, Holman EA, McIntosh DN, et al. Nationwide longitudinal study of psychological responses to September 11. JAMA (Chicago, Ill.) 2002;**288**(10):1235-44

13. Weisæth L, Eitinger L. Posttraumatic Stress Phenomena. Common Themes across Wars, Disasters, and Traumatic Events. In: Wilson J, Raphael, B. (eds). ed. International Handbook of Traumatic Stress Syndromes. New York: Plenum Press, 1993:69-77.

14. Galea S, Ahern J, Resnick H, et al. Psychological Sequelae of the September 11 Terrorist Attacks in New York City. New England Journal of Medicine 2002;**346**(13):982-87 doi: doi:10.1056/NEJMsa013404[published Online First: Epub Date]|.

15. North C NSSS, et al. Psychiatric disorders among survivors of the oklahoma city bombing. JAMA: The Journal of the American Medical Association 1999;**282**(8):755-62 doi: 10.1001/jama.282.8.755[published Online First: Epub Date]|.

16. Jordan NN, Hoge CW, Tobler SK, et al. Mental health impact of 9/11 Pentagon attack: Validation of a rapid assessment tool. American journal of preventive medicine 2004;**26**(4):284-93 doi: 10.1016/j.amepre.2004.01.005[published Online First: Epub Date]|.

17. Norris FH, Friedman MJ, Watson PJ, et al. 60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981–2001. Psychiatry: Interpersonal and Biological Processes 2002;**65**(3):207-39 doi: 10.1521/psyc.65.3.207.20173[published Online First: Epub Date]|.

18. Breslau N, Davis GC, Andreski P, et al. Traumatic events and posttraumatic stress disorder in an urban population of young adults. Archives of general psychiatry 1991;**48**(3):216

19. Kessler RC, Sonnega A, Bromet E, et al. Posttraumatic stress disorder in the National Comorbidity Survey. Archives of general psychiatry 1995;**52**(12):1048

20. Heir T, Weisæth L. Acute Disaster Exposure and Mental Health Complaints of Norwegian Tsunami Survivors Six Months Post Disaster. Psychiatry: Interpersonal and Biological Processes 2008;**71**(3):266-76 doi: 10.1521/psyc.2008.71.3.266[published Online First: Epub Date]|.

21. Olff M, Langeland W, Draijer N, et al. Gender differences in posttraumatic stress disorder. Psychological Bulletin 2007;**133**(2):183-204 doi: 10.1037/0033-2909.133.2.183[published Online First: Epub Date]|.

22. Shimazu A, deJonge J, Irimajiri H. Lagged effects of Active Coping within the Demand-Control Model: A Three-Wave Panel Study among Japanese Employees International Journal of Behavioral Medicine 2008;**15**:44-53

23. Smith P, Frank J, Bondy S, et al. Do changes in Job Control Predict Differences in Health Status? Results From a Longitudinal National Survey of Canadians. Psychosomatic Medicine 2008;**70**:85-91

24. Levinson H. When executives burnout. Harvard Business Review 1981;**59**:73-81

25. Sherman GD, Jooa JL, Cuddy AJC, et al. Leadership is associate with lower levels of stress. Psychological and Cognitive Sciences 2012;**109** (44) doi: 10.1073/pnas.1207042109 [published Online First: Epub Date]|.

26. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. Journal of consulting and clinical psychology 2000;**68**(5):748-66

27. Heir T, Rosendal S, Bergh-Johannesson K, et al. Tsunami-affected Scandinavian tourists: Disaster exposure and post-traumatic stress symptoms. Nordic journal of psychiatry 2011;**65**(1):9-15

28. Stephens C, Long N, Miller I. The impact of trauma and social support on posttraumatic stress disorder: A study of New Zealand police officers. Journal of Criminal Justice 1997;**25**(4):303-14

29. Van Der Ploeg E, Kleber RJ. Acute and chronic job stressors among ambulance personnel: predictors of health symptoms. Occupational and Environmental Medicine 2003;**60**(suppl 1):i40-i46

Table 1 Age, gender and proportion of employees at work during the 2011 Oslo bombing

	Responders (n = 1970)	**Non-responders (n = 1550)**
Age, years (SD) range	45.4 (10.9) 19-70	43.8 (11.4)* 19-72
Gender, n (%) Female Male	 1133 (57.5) 837 (42.5)	 760 (49.0)* 790 (51.0)*
At work in the Government area when the bomb exploded, n (%)	207 (10.5)	145† (9.4)

* P<0.001

† Estimate based on the total number of employees who were present at work according to data from the 14 included ministries.

Table 2 Employees of the Norwegian ministries with PTSD 9-10 months after the 2011 Oslo bombing according to their localization during the bomb attack

	n (%)	OR (95% CI)	p
- Abroad (n=357)	13 (3.6)	ref	-
- Norway (n=855)	32 (3.7)	1.03 (0.5-2.0)	0.93
- Oslo periphery (n=342)	12 (3.5)	0.96 (0.4-2.1)	0.93
- Oslo downtown (n=169)	7 (4.1)	1.14 (0.4-2.9)	0.78
- Government district (n=204)	49 (24.0)	8.37 (4.4-15.9)	<0.001

Table 3. Probability of PTSD in employees of the Norwegian ministries, according to localization during the bomb attack adjusted for gender, age, education, marital status and leadership position.

	OR	95% CI	p
Location			
- Abroad	ref	-	-
- Norway	0.97	0.49-1.95	0.94
- Oslo periphery	0.92	0.40-2.10	0.83
- Oslo downtown	1.11	0.42-2.92	0.83
- Government district	8.79	4.45-17.37	<0.001
Gender (women vs men)	2.03	1.28-3.23	0.003
Age (increase of 10 years)	1.04	0.85-1.26	0.72
Education			
More than 16 years	ref	-	-
13-16 years	1.65	1.04-2.63	0.035
12 years or less	1.53	0.80-2.92	0.20
Married or cohabiting (yes versus no)	0.98	0.62-1.53	0.92
Leadership (yes versus no)	0.42	0.20-0.86	0.019

Notes:

Contributors: MBH and TH conceived, designed and coordinated the study, collected and analysed the data, and wrote the paper. AN collected the data and assisted in the analyses and writing of the paper. All the authors approved the final manuscript.

Funding: This work was supported by The Norwegian Directorate of Health.

Competing interests: None declared

Data sharing statement: No additional data are available

Proximity to terror and post-traumatic stress: A follow-up survey of governmental employees after the 2011 Oslo bombing attack

Marianne B Hansen, Alexander Nissen, & Trond Heir

Norwegian Centre for Violence and Traumatic Stress Studies

Correspondence to:

Marianne B Hansen, Norwegian Centre for Violence and Traumatic Stress Studies, Kirkeveien 166, B48**,** 0450 OSLO

E-mail: marianne.hansen@nkvts.unirand.no

Phone: +47 22 59 55 91

Objective: To assess the prevalence of PTSD symptoms among governmental employees after the 2011 Oslo bombing attack targeted towards the Norwegian Ministries, and to explore the importance of proximity to the bomb explosion as a predictor of PTSD.

Design: A cross-sectional study

Setting: Data were collected from a survey ten months after the Oslo bombing at 22nd of July 2011.

Participants: 3 520 employees was invited to the study. Net samples comprised 1 927 employees in 14 of the 17 Norwegian Ministries.

Outcome measures: The employees reported where they were at the time of the explosion. Posttraumatic stress disorder (PTSD) was assessed with the Norwegian version of the PTSD Checklist (PCL).

Results: 207 of the 1881 (11 %) ministerial employees who completed the survey were present at work when the bomb exploded. Of these, a quarter (24%, 95% CI: 18.4-30.0) had symptom levels equivalent to PTSD, while the prevalence was approximately 4 % among those not present at work. In the latter group the prevalence was similar irrespective of whether their location was in Oslo, other places in Norway, or abroad. Leadership responsibility was associated with lower risk for PTSD.

Conclusion: The risk of PTSD is mainly associated with being present at work at the time of a terror attack. For those not present at work, the risk of PTSD is low, and independent of proximity to the terror scene. The findings may have implications for planning and priority of health care services after a work place terror attack.

Article summary

Article focus

- Little is known about the impact of work place directed terror on employees' mental health.
- Previous studies indicate that indirectly exposed individuals are at risk for mental health adversities after terror attacks.
- In this study, we determined the prevalence of PTSD in groups of employees' exposed to a work place terror attack in relation to where they were at the time of the attack.

Key messages

- After a work place terror attack, the prevalence of PTSD is high among employees who were present at work at the time of the attack.
- For employees who were not at work at the time of the attack, the risk of PTSD is low, and independent of proximity to the terror scene.
- After a work place terror attack, psychosocial interventions should primarily be targeted towards employees who were present at work at the time of the attack.

Strengths and limitations

- All employees in the Ministries were included in the study, reducing sample selection bias
- Moderate response rate (56 %)

Research on employees' mental health in the aftermath of work place directed terror attacks is rare. Available studies of Pentagon staff members after the 9/11 attacks in the US in 2001 have revealed high prevalence of PTSD among employees who were at work on the day of the attack.[1, 2] Those injured or exposed to dead bodies had higher rates of psychiatric illness including probable PTSD.[1] Mental health consequences for employees who were not present at work at the time of the attack are explored to a lesser extent.[3] There is some evidence that individuals indirectly exposed to a terror attack through watching mass media may develop PTSD symptoms.[4] Also, there is some evidence that proximity to a terror scene may increase the risk of PTSD symptoms for individuals not directly exposed.[4] However, it is not clear whether individuals indirectly exposed to a terror attack should be included in a strategy for screening populations at risk for posttraumatic reactions.

The Oslo bombing in July 2011 was a terror attack on the Government ministries of Norway. A car bomb blast shattered governmental buildings, killing eight people and injuring 209 more. Approximately 4000 ministry employees had their office in close proximity to the epicenter of the explosion. In the weeks following the terror attack, the governmental occupational health service, with assistance from experienced occupational physicians, offered employees psychological first aid, medical examinations, and referrals to specialist health services when required.[5] High priority was given to ensuring that the needs of the most at-risk individuals were addressed, though how one should define and reach these individuals was subject to discussion. Different selection strategies were proposed, such as proximity to the explosion, degree of exposure, or a screening program for posttraumatic reactions and functioning. The final decision was to include all employees who were at work on the day of the explosion, regardless of which ministry they belonged to.

The aim of the present study was to assess the prevalence of PTSD symptoms among employees ten months after a terror attack, and more specifically, to what extent proximity to the site of the attack was a predictor of PTSD.

Methods

Participants

The present study is based on data from a survey conducted ten months after the bomb explosion in Oslo, and comprised employees in 14 of the 17 Norwegian ministries on the 22nd of July 2011. Based on employees' lists provided by each of the 14 ministries, a total of 3520 individuals were invited to participate in the study. Each employee received a project specific identification number generated from their social security number. The key to match these numbers was kept on a unique, off-line server which only one administrative person had access to. Anonymity was secured in that neither the employers nor the researchers had access to this key, and could thus not identify the person behind a response. The procedure was thoroughly explained to the employees before the start of the study.

Of the 3520 invited employees, 1970 responded, giving a response rate of 56 percent. From this sample, 43 were excluded from the analyses due to missing data, giving a net sample of 1 927 employees. Both age and the proportion of females were higher among responders compared to non-responders, whereas the proportion of employees present at work was similar in the two groups (table 1). In our net sample, 89 % had more than 12 years of education, 73 % were married or cohabiting, and 18 percent was in a leadership position.

Participants were not identified in order to offer follow-up service to those who met criteria for PTSD. With support from our study, the government occupational health service upheld

the initial selection criteria in a second medical follow-up and contacted all employees who had been at work when the bomb exploded. Employees who had not been at work were advised to contact the government occupational health service if they had symptoms affecting daily life functioning and ability to work.

The study was approved by the Regional committees for medical and health research ethics.

Measures

A questionnaire was made available online via a web portal established for this purpose. All employees received an invitation letter with a personal code to log on to the web portal and the questionnaire. The code was confidential and only known to the administrative person in charge of data security.

Proximity to the explosion was assessed by asking employees where they were located at the moment when the bomb went off next to the government buildings on the afternoon of the 22nd of July 2011. Respondents were given the following five answer choices: 1) in the government district downtown, 2) in downtown Oslo, but not in the government district, 3) in Oslo, but not downtown, 4) in Norway, but not in Oslo, 5) abroad. There was no significant difference in the distribution of age and gender between these location groups.

To assess PTSD symptoms, the Norwegian version of the PTSD Checklist (PCL), was applied.[6] The PCL was first introduced in 1993 by Weathers and colleagues and it is now one of the most frequently used self-reported measures on PTSD symptoms.[7] The PCL is a 17-item self-administered questionnaire that assesses the full domain of DSM-IV PTSD symptoms.[8] The PTSD diagnosis requires one positive score in cluster B, three in cluster C and two in cluster D, which is the same number of positive items required in the three clusters in the DSM-IV system.[9] The same procedure has been shown to perform well for detecting PTSD in the Norwegian population in epidemiological research.[6]

We also assessed the following demographic characteristics: Gender, age, educational level, marital status, and leadership position. Finally, we asked whether the participants had witnessed dead people or people dying, whether they had witnessed people seriously injured, and whether they had been physically injured themselves.

Statistical analyses

The association between proximity to the bomb explosion and risk of PTSD was examined using logistic regression. Multiple logistic regression analysis was used to adjust for gender, age, education, marital status and leadership responsibility. We also used logistic regression to examine the association between potentially traumatic experiences and PTSD among those who were present at work in the governmental district when the bomb exploded. All tests were two-tailed and differences were considered significant if $p< 0.05$. The statistical analysis was performed with the software package SPSS version 20.0 for Windows.

Results

The prevalence of PTSD among the employees of the Norwegian ministries was highly dependent of whether they were present at work or not when the bomb exploded. Whereas a quarter (24%) of the responders who were present at work in the governmental district had PTSD 10 months after the terror attack, the prevalence was around 4% for employees not present at work, regardless of their proximity to the explosion (table 2).

Table 2 about here

The difference in risk of PTSD between those present at work and those not present was similar after adjustment for gender, age, education, marital status, and leadership position (table 3). Furthermore, there was no association between proximity to the terror attack and risk of PTSD for employees who were not present at work.

Table 3 about here

Women were twice as likely as men to have PTSD. Furthermore, those with leadership responsibilities and those with more than 16 years of education had less PTSD, whereas age and marital status were not associated with PTSD.

Of the 204 employees that were present at work, 67 (32.8%) witnessed dead people or people dying, 132 (64.7%) witnessed people seriously injured, and 52 (25.5%) were physically injured themselves. None of these experiences were significantly associated with PTSD according to unadjusted results (witnessing death OR=1.44, p=0.28; witnessing people seriously injured OR=2.05, p=0.060; physical injury to self (OR=1.82, p=0.092) or results adjusted for the other variables (OR=1.19, p=0.63; OR=1.82, p=0.14; OR=1.65, p=0.17; respectively).

Discussion

In this study of employees in the Norwegian ministries 10 months after the 2011 Oslo bombing, the prevalence of PTSD was highly dependent on the employees' localization when the bomb exploded. While a quarter of those who were present at work in the governmental district had PTSD, the prevalence was around 4% among those not present at work. In the

latter group the prevalence of PTSD was similar irrespective of whether they were in Oslo, other places in Norway, or abroad.

The high prevalence of PTSD among employees who were present at work at the time of the explosion is comparable to previous research on work place terror which have shown a prevalence of probable PTSD varying from 14 to 23 percent in individuals directly exposed, assessed seven to 36 months after the terror attack.[1, 2, 10, 11] Thus, it seems obvious that direct exposure to the bombing of the Norwegian Ministries had great impact on employees' mental health.

The 4% prevalence of PTSD in employees not present at work was comparable to estimates of PTSD prevalence in the US general population after the 9/11 terror attacks.[4, 12] Research on indirectly exposed individuals after work place terror attacks, i.e. employees not present at the time of the incident, is rather scarce. However, the PTSD level is similar to what was found in a Norwegian study of employees not present at work at the time of an industrial disaster.[13] In our study, it seemed that being an employee at the site of the terror attack was of minor importance for the development of PTSD, compared to the importance of being directly exposed to the bomb explosion.

The bomb explosion could be heard throughout the city, and it generated massive pressure waves and smoke that were noticeable in large parts of Oslo and the surrounding regions. The lack of a relationship between proximity to the bomb explosion and PTSD among those not at work, however, suggests that witnessing the explosion at a certain distance was not related to a higher risk of developing PTSD. These findings are in contrast to findings published after the 9/11 attacks , where it was suggested that the severity of PTSD symptoms was higher among those who were close enough to hear, feel or witness the attack.[4] However,

witnessing the two events at a distance may not be completely comparable as the scenes of the 9/11 attacks were of a larger scale and probably more threatening and terrifying.

Gender differences in the risk for PTSD have yet to be explained. However, the two fold increase in risk for PTSD among women in our study is in line with previous findings in the aftermath of mass violence,[14-16] as well as after technological and natural disasters,[17] and in the general population exposed to traumatic events.[18, 19] Possible hypotheses include gender differences in how traumatic events are perceived, how men and women react differently to adverse events, or how psychological distress is reported differently.[20, 21]

We furthermore found that individuals with leadership responsibility had considerable lower risk for developing PTSD compared to non-leaders. This was consistent also after adjustment for education. Leadership responsibilities may increase one's sense of control which in turn may serve as a buffer against stress.[22, 23] Although leadership positions traditionally have been associated with increased stress levels,[24] it has been demonstrated that leaders have lower levels of anxiety and lower levels of the stress hormone cortisol compared to non-leaders.[25] Based on our results, we hypothesize that similar mechanisms may contribute to an increased resilience among leaders against developing PTSD.

We did not find any relationship between age and psychological outcome. On this point, the disaster literature differs substantially in that older, middle-aged, and younger adults all have been shown to react with more distress after traumatic events, and partly contradictory hypotheses have been formulated.[17] In our study, all participants were in working age, and the catastrophic event was probably just as unexpected and unfamiliar to all age groups. Also, we found that a higher education level was associated with lower risk of posttraumatic stress, which is in line with many other studies,[26] including Scandinavian disaster populations.[27]

Methodological considerations

This study has a number of methodological benefits. All the staff members who were employed in the Ministries at the time of the explosion were asked to participate in our study, reducing sample selection bias. Also, our study sample is probably not confounded by high rates of pre-existing psychopathology or other risk factors for PTSD. In fact, our sample belonged to the working population, had access to a cohesive work environment, and had higher than average levels of socioeconomic status and education, which are known protective factors for psychopathology.[26, 28, 29]

Limitations of our study include a moderate response rate of 56%. Thus, we can not exclude the possibility of sampling bias. For instance, our findings could be biased if affected women or unaffected leaders were more willing to complete the survey. However, we have no theoretical reasons to believe this is the case. More likely, an overrepresentation of women may have resulted in a slight overestimation of PTSD. Furthermore, the study population consisted of a high proportion of highly educated bureaucrats and government officials, and thus, our results may not be applicable to other populations.

The prevalence of PTSD was assessed by the PCL self-report inventory, which implies that our results must be interpreted with caution. However, the Norwegian version of PCL has been shown to perform well as a diagnostic instrument for detecting PTSD in epidemiological research.[6] Also, we have not considered fulfillment of the DSM A-criteria, but only taken into account the number of symptoms in each symptom cluster. It is likely that the stress-criterion was not fulfilled for those not at work, and that the prevalence of PTSD secondary to the bomb explosion therefore is overestimated. On the other hand, virtually all employees who were present at work were in a life-threatening situation, and a high proportion experienced death or suffering of self or others.

Implications

When planning psychosocial interventions for the employees after the Oslo bombing, decision makers responsible for the allocation of health resources were presented with anecdotal reports about acute stress reactions among employees who had not been present at work. Nevertheless, due to limited resources, a follow-up intervention program was restricted to those who had been at work. Our findings clearly show that this priority was appropriate. For employees not present at work when the bomb exploded, physical proximity to the terror scene was not associated with increased risk for PTSD. For future psychosocial intervention after work place terror and disasters, priority should be given to those who are present during the event.

References

1. Grieger TA, Waldrep DA, Lovasz MM, et al. Follow-up of Pentagon employees two years after the terrorist attack of September 11, 2001. Psychiatric Services 2005;**56**(11):1374-78

2. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, depression, and perceived safety 13 months after September 11. Psychiatric Services 2004;**55**(9):1061-63

3. Neria Y, Sullivan GM. Understanding the mental health effects of indirect exposure to mass trauma through the media. JAMA : the journal of the American Medical Association 2011;**306**(12):1374-5 doi: 10.1001/jama.2011.1358[published Online First: Epub Date]|.

4. Schlenger We CJMEL, et al. Psychological reactions to terrorist attacks: Findings from the national study of americans' reactions to september 11. JAMA: The Journal of the American Medical Association 2002;**288**(5):581-88 doi: 10.1001/jama.288.5.581[published Online First: Epub Date]|.

5. Skogstad M, Skorstad M, Lie A, et al. Work-related post-traumatic stress disorder. Occupational Medicine 2013;**63**(3):175-82

6. Hem C, Hussain A, Wentzel-Larsen T, et al. The Norwegian version of the PTSD Checklist (PCL): Construct validity in a community sample of 2004 tsunami survivors. Nordic Journal of Psychiatry 2012;**66**(5):355-59 doi: doi:10.3109/08039488.2012.655308[published Online First: Epub Date]|.

7. Weatherts FW, Litz BT, Herman DS, et al. The PTSD Checklist: Reliability, validity, and diagnostic utility. Annual Meeting of the International Society for Traumatic Stress Studies. San Antonio, TX, October, 1993.

8. Blanchard EB, Jones-Alexander J, Buckley TC, et al. Psychometric properties of the PTSD checklist (PCL). Behaviour Research and Therapy 1996;**34**(8):669-73 doi: 10.1016/0005-7967(96)00033-2[published Online First: Epub Date]|.

9. APA. *Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV)*. Washington DC: American Psychiatric Association, 1994.

10. DiGrande L, Neria Y, Brackbill RM, et al. Long-term posttraumatic stress symptoms among 3,271 civilian survivors of the September 11, 2001, terrorist attacks on the World Trade Center. American journal of epidemiology 2011;**173**(3):271-81

11. Grieger TA, Fullerton CS, Ursano RJ. Posttraumatic stress disorder, alcohol use, and perceived safety after the terrorist attack on the Pentagon. Psychiatric Services 2003;**54**(10):1380-82

12. Silver R, Holman EA, McIntosh DN, et al. Nationwide longitudinal study of psychological responses to September 11. JAMA (Chicago, Ill.) 2002;**288**(10):1235-44

13. Weisæth L, Eitinger L. Posttraumatic Stress Phenomena. Common Themes across Wars, Disasters, and Traumatic Events. In: Wilson J, Raphael, B. (eds). ed. International Handbook of Traumatic Stress Syndromes. New York: Plenum Press, 1993:69-77.

14. Galea S, Ahern J, Resnick H, et al. Psychological Sequelae of the September 11 Terrorist Attacks in New York City. New England Journal of Medicine 2002;**346**(13):982-87 doi: doi:10.1056/NEJMsa013404[published Online First: Epub Date]|.

15. North C NSSS, et al. Psychiatric disorders among survivors of the oklahoma city bombing. JAMA: The Journal of the American Medical Association 1999;**282**(8):755-62 doi: 10.1001/jama.282.8.755[published Online First: Epub Date]|.

16. Jordan NN, Hoge CW, Tobler SK, et al. Mental health impact of 9/11 Pentagon attack: Validation of a rapid assessment tool. American journal of preventive medicine 2004;**26**(4):284-93 doi: 10.1016/j.amepre.2004.01.005[published Online First: Epub Date]|.

17. Norris FH, Friedman MJ, Watson PJ, et al. 60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981–2001. Psychiatry: Interpersonal and Biological Processes 2002;**65**(3):207-39 doi: 10.1521/psyc.65.3.207.20173[published Online First: Epub Date]|.

18. Breslau N, Davis GC, Andreski P, et al. Traumatic events and posttraumatic stress disorder in an urban population of young adults. Archives of general psychiatry 1991;**48**(3):216

19. Kessler RC, Sonnega A, Bromet E, et al. Posttraumatic stress disorder in the National Comorbidity Survey. Archives of general psychiatry 1995;**52**(12):1048

20. Heir T, Weisæth L. Acute Disaster Exposure and Mental Health Complaints of Norwegian Tsunami Survivors Six Months Post Disaster. Psychiatry: Interpersonal and Biological Processes 2008;**71**(3):266-76 doi: 10.1521/psyc.2008.71.3.266[published Online First: Epub Date]|.

21. Olff M, Langeland W, Draijer N, et al. Gender differences in posttraumatic stress disorder. Psychological Bulletin 2007;**133**(2):183-204 doi: 10.1037/0033-2909.133.2.183[published Online First: Epub Date]|.

22. Shimazu A, deJonge J, Irimajiri H. Lagged effects of Active Coping within the Demand-Control Model: A Three-Wave Panel Study among Japanese Employees International Journal of Behavioral Medicine 2008;**15**:44-53

23. Smith P, Frank J, Bondy S, et al. Do changes in Job Control Predict Differences in Health Status? Results From a Longitudinal National Survey of Canadians. Psychosomatic Medicine 2008;**70**:85-91

24. Levinson H. When executives burnout. Harvard Business Review 1981;**59**:73-81

25. Sherman GD, Jooa JL, Cuddy AJC, et al. Leadership is associate with lower levels of stress. Psychological and Cognitive Sciences 2012;**109** (44) doi: 10.1073/pnas.1207042109 [published Online First: Epub Date]|.

26. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. Journal of consulting and clinical psychology 2000;**68**(5):748-66

27. Heir T, Rosendal S, Bergh-Johannesson K, et al. Tsunami-affected Scandinavian tourists: Disaster exposure and post-traumatic stress symptoms. Nordic journal of psychiatry 2011;**65**(1):9-15

28. Stephens C, Long N, Miller I. The impact of trauma and social support on posttraumatic stress disorder: A study of New Zealand police officers. Journal of Criminal Justice 1997;**25**(4):303-14

29. Van Der Ploeg E, Kleber RJ. Acute and chronic job stressors among ambulance personnel: predictors of health symptoms. Occupational and Environmental Medicine 2003;**60**(suppl 1):i40-i46

Table 1 Age, gender and proportion of employees at work during the 2011 Oslo bombing

	Responders (n = 1970)	**Non-responders (n = 1550)**
Age, years (SD) range	45.4 (10.9) 19-70	43.8 (11.4)* 19-72
Gender, n (%) Female Male	 1133 (57.5) 837 (42.5)	 760 (49.0)* 790 (51.0)*
At work in the Government area when the bomb exploded, n (%)	207 (10.5)	145† (9.4)

* P<0.001

† Estimate based on the total number of employees who were present at work according to data from the 14 included ministries.

Table 2 Employees of the Norwegian ministries with PTSD 9-10 months after the 2011 Oslo bombing according to their localization during the bomb attack

	n (%)	OR (95% CI)	p
- Abroad (n=357)	13 (3.6)	ref	-
- Norway (n=855)	32 (3.7)	1.03 (0.5-2.0)	0.93
- Oslo periphery (n=342)	12 (3.5)	0.96 (0.4-2.1)	0.93
- Oslo downtown (n=169)	7 (4.1)	1.14 (0.4-2.9)	0.78
- Government district (n=204)	49 (24.0)	8.37 (4.4-15.9)	<0.001

Table 3. Probability of PTSD in employees of the Norwegian ministries, according to localization during the bomb attack adjusted for gender, age, education, marital status and leadership position.

	OR	95% CI	p
Location			
- Abroad	ref	-	-
- Norway	0.97	0.49-1.95	0.94
- Oslo periphery	0.92	0.40-2.10	0.83
- Oslo downtown	1.11	0.42-2.92	0.83
- Government district	8.79	4.45-17.37	<0.001
Gender (women vs men)	2.03	1.28-3.23	0.003
Age (increase of 10 years)	1.04	0.85-1.26	0.72
Education			
More than 16 years	ref	-	-
13-16 years	1.65	1.04-2.63	0.035
12 years or less	1.53	0.80-2.92	0.20
Married or cohabiting (yes versus no)	0.98	0.62-1.53	0.92
Leadership (yes versus no)	0.42	0.20-0.86	0.019

Notes:

Contributors: MBH and TH conceived, designed and coordinated the study, collected and analysed the data, and wrote the paper. AN collected the data and assisted in the analyses and writing of the paper. All the authors approved the final manuscript.

Funding: This work was supported by The Norwegian Directorate of Health.

Competing interests: None declared

Data sharing statement: No additional data are available