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Towards a rapid triage method addressing the potential for PTSD conditions following mass violence events

Bjarne Våge,
Retired - Independent scholar, Stavanger, Norway, bjarne.vage@lyse.net
Jon Tømmeråas Selvik
Department of Safety, Economics and Planning, University of Stavanger, Norway, jon.t.selvik@uis.no
Eirik Bjorheim Abrahamsen
Department of Safety, Economics and Planning, University of Stavanger, Norway, eirik.b.abrahamsen@uis.no

Numbers from past mass violence events, such as terrorist attacks or mass shootings, show that a significant fraction develop a posttraumatic stress disorder (PTSD) condition. For effective treatment, early identification is important. A method for rapid screening of the potential for PSTD development for individuals exposed in the event, allows for an appropriate treatment at an early stage. Such treatment could effectively mitigate consequences and reduce the number of individuals developing PTSD. There already exist rapid triage methods for trauma prioritization following mass violence events, but neither of these specifically include the risk of PSTD development. A starting point towards a rapid triage method having a PTSD focus, is to consider risk influencing factors, as key elements of the method. Relevant peritraumatic factors are considered, such as: incident type (I), exposure level (E), trauma duration (D), and perceived threat level (T). Each of these peritraumatic risk factors can be given a role in assessment of possible PTSD development. A way to assess the factors is to assign a numerical value for each of them, considering the trauma burden for prioritizing the most affected for follow-up. An aggregated score can be established based on the IEDT assessments, which then reflects the potential for developing PTSD conditions. A practical example on how such a scoring system could be designed is given in the paper.

Keywords: Rapid Triage method, mass violence events, posttraumatic stress disorder, risk factors, risk mitigation

1. Introduction

Following mass violence events, such as terrorist attacks and mass shootings, potentially perceived as life-threatening to those exposed, there is a significant risk of developing mental illness or disorders. In emergency response following such events, a type of rapid triage method may be applied for effective prioritization and management of the individuals exposed and potentially traumatized for appropriate treatment (see e.g., Burkle Jr., 2002). For existing methods, Showstark and Lovejoy (2019) point to *the simple triage and rapid treatment* (START) system; *the sort, assess, lifesaving interventions, treatment and/or transport* (SALT) system; and *the move, assess, sort, and send* (MASS) system. Reference can also be made to ABCDE approach (see Bruinink et al., 2024). For the analysis scope and risk exposure, numbers can vary from a few to several thousand individuals depending on the situation. With respect to the treatment, current methods predominantly focus on physical trauma and lifesaving, while mental aspects normally are addressed in alter stages of follow up. This allowing for PTSD conditions to develop.

PTSD is a psychiatric disorder that may occur in individuals having experienced or witnessed an upsetting traumatic event or a series of events. It influences the central nervous system and how the mind processes experiences. The mental reaction triggers also physical reactions that might occur long after the actual event (van der Kolk, 2021). Such a diagnosis is associated with symptoms lasting for more than a month, causing significant distress or problems in the individual's daily functioning (American Psychiatric Association, 2022). Typical symptoms being (ibid.):

a) Intrusive thoughts such as disturbing memories; distressing dreams; or flashbacks.
b) Trying to avoid reminders of the event.
c) Alterations in cognition and mood, for example, inability to remember important aspects of the traumatic event, negative thoughts and feelings.
d) Behavior alterations, such as arousal and changed reactivity.

Many individuals develop symptoms within three months of the trauma, but symptoms may appear later and often persist for over time. Further, PTSD is often associated with conditions such as depression, substance use, and memory problems. Although the majority do not develop long-term conditions, early intervention is crucial in reducing the individual and societal burden of PTSD and related disorders (Breslau, 2009).

The U.S. National Center for PTSD (USA) estimates that about one-third of those who witness a mass shooting develop acute stress disorder, and as many as 28% develop PTSD (Novotney, 2018). For example, after the September 11 attacks in 2001, 29% showed persistent PTSD symptoms (Bonanno et al., 2010). More than a third of the survivors of the Utøya terror attack on 22 July 2011 still reported PTSD symptoms more than 8 years after the event (Dyb et al., 2021). Numbers suggest an occurrence around 30%, where a rapid triage method potentially could lower this number to the benefit of individuals at risk and society.

Early posttraumatic intervention after disasters, with focus is on safety, stability and coping, through e.g., psychological first aid, have shown promising results (Ozer & Weiss, 2004). It also limits the need for stressful debriefing approaches, which can exacerbate symptoms by reinforcing traumatic memories (Norris et al., 2002a), and also reduces the need for long-term cognitive behavioral therapy.

The aim of the paper is to discuss relevant risk factors for such a method, and also to consider how these can be weighted in the method. As an initial step in designing a rapid triage method or extending existing methods for screening of PTSD potential, various factors that influence the development of PTSD after mass violence events are considered.

The objective of the method is to perform a rapid screening of those exposed, and a way forward is then to collect relevant data, including a characterization of the situation. It is then relevant to collect on-site data through perform gentle interviews of those at risk, allowing for subjective reporting of e.g., emotional and physiological distress experienced during and immediately after the traumatic event (peri-traumatic). Collection of experiences from before (pre-traumatic) or after the event is also considered for the method. The aim is to establish a set of questions covering a selection of influencing factors, as basis for assessing the mental trauma burden, so that follow-up can be prioritized.

2. Risk influencing factors

There is a broad set of factors potentially relevant to a triage method aimed at PTSD. Characteristics and experiences before, during and after traumatic event may influence the risk of developing a mental disorder (Kuh et al., 2003). Below, the potential influence of pre-, peri- and posttraumatic factors, and also factors for prevention and treatment of mental disorders, are considered.

2.1. *Pre-traumatic risk factors*

'Pre-traumatic' refers to the contribution of experiences before the event, where for example earlier mental health problems increase the risk of PTSD and depression (Neria et al., 2008; Norris et al., 2002; Ozer & Weiss, 2004). Other risk factors include low socioeconomic status, minority background, poor social support, and neuroticism (Galea et al., 2005; Norris et al., 2002; Ozer & Weiss, 2004). Previous traumatic experiences also increase the risk of posttraumatic mental disorders (Neria et al., 2008; Ozer & Weiss, 2004). Gender, loss of loved ones, ethnicity, and sociodemographic variables are also significantly related to the development of PTSD (Bugge et al., 2017). Experience show also that women and younger people seem to be at higher risk of PTSD and depression, while men are more prone to substance use (Galea et al., 2005; Neria et al., 2008; Ozer & Weiss, 2004; van der Velden, Kleber, 2009). Younger people are more vulnerable due to undeveloped coping mechanisms, while middle-aged people face increased risk due to stressors such as parenting and career (ibid). Older people may be protected by life experiences but are more prone to depression by physical or social challenges (Breslau, 2009; Galea et al., 2005; Goldmann & Galea, 2014; Norris et al., 2002; Ozer & Weiss, 2004).

2.2. *Peri-traumatic risk factors*

The degree of exposure is a strong predictive factor for mental illness after disasters. Both direct and indirect exposure could influence the risk of developing PTSD (Galea et al., 2005; Ozer & Weiss, 2004; Vlahov et al., 2006). The level of exposure shows a correlation with prediction of PTSD conditions, often explained through a dose-

response relationship (see e.g. Bowman & Yehuda, 2004). Exposure can be measured through factors such as type, duration, deaths, intentionally inflicted damage, and proximity to the disaster. High exposure increases the risk because of the sensing of a life-threatening situation for oneselves or loved ones (Bugge et al., 2017; Norris et al., 2009; Novotney, 2018). Persistence and severity of the exposure are factors increasing the likelihood of PTSD development (Ozer& Weiss, 2004; Goldmann & Galea, 2014). Literature also highlights the relevance of considering exposure and PTSD risk linked to crisis management and mental health services are allocated after mass shootings (Norris et al., 2002).

2.3. *Post-traumatic risk factors*

For factors linked to the situation in the period after the event, there are obvious stressors such as job and property loss, marital problems, and health problems that could influence PTSD development and duration (Brewin et al., 2000; Ozer & Weiss, 2004). Reduced social support or loss of networks also increases the risk of PTSD and depression, while high perceived support provides better resilience after disasters (Bonanno et al., 2009; Norris et al., 2002; Ozer et al., 2003; Ozer & Weiss, 2004). These factors show how both stressors and social support play a crucial role in shaping mental health outcomes following traumatic events.

3. Categorization of risk influencing factors

The review above indicates a potential to perform a successful screening through assessment of peri-traumatic risk factors only. Although also pre- and post-traumatic factors can play a role in PTSD development, they are challenging to assess immediately after the event and might require a different type of inquiry and would be more appropriate to follow up in earlier or later stages. Thus, an initial focus is on selecting the relevant peri-traumatic factors for the method. Ideally these are objective, and the questions should not be retraumatizing, by that worsening the situation.

Two relevant objective factors to consider for the method, are the physical conditions at site, such as the severity of exposure, and the level of intentional harm inflicted. Post-mass shootings evaluations, such as the Utøya and the 9/11 attacks, described physical injuries as one of the most consistent correlations with PTSD (Brewin et al., 2000; Galea et al., 2005; Bugge et al., 2017, Dyb et al., 2014; Neria et al., 2011; Norris et al., 2002). Exposure is measured through the number and intensity, type of disaster, duration, deaths, and proximity to the 'epicenter'. Greater or more intense exposure carries a higher risk as the development of PTSD often is described as a dose-response relationship (Brewin et al., 2000; Breslau, 2009; Wilson, 2014; Wilson, 2014; Stuber et al., 2006; Neria et al., 2008; Norris et al., 2002; Ozer et al., 2003). Based on the review of existing literature, the following four peri-traumatic risk factors should be considered for the assessment of PTSD potential:

i. Incident (event) type
ii. Exposure degree
iii. Duration of traumatization exposure
iv. Perceived Threat level

These four factors can be abbreviated as 'IEDT' and represents potential main elements of the proposed rapid triage method. The key is that it should be possible for healthcare professionals to assess these factors immediately after a traumatic event. A preliminary way is to assign a numerical value to each factor, where the total score will indicate trauma burden, with a higher sum representing a greater risk of PTSD. The scientific foundation for the scoring can be challenged, but it is a starting point towards a method focusing on influencing factors.

3.1. *Type of Incident (I)*

The type or character of the event plays a role in whether it has a potential to be perceived as traumatic for those exposed in some way. More grotesque or violent event are associated with a higher risk of PTSD development. It's assumed that human-made disasters involving mass violence is associated to a higher PTSD risk compared with technological ones and natural disasters.

Focus for the design of the method is on mass violence events and expose to these, i.e., type I3 based on the categorization in Table 1. Further, this table also show a proposed ranking or scoring system for the 'burden' related to each of the types. The burden value reflects then the intentional aspect leading to the event. Table 1 also shows a proposed scoring of this category.

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3.2. *Type of Exposure (E)*

The level of exposure can be linked to proximity and intensity, and also the voluntariness of being at site and the ability to control the situation. For an assessment of exposure, there are some

conceptual candidates that would be natural to consider for a rapid triage method. One is related to the term 'blocked in a confined area', which is sometimes used to describe situations where a person is unable to leave the scene unimpeded, such as being trapped in a building, or a dead-end street. While, 'indirectly exposed' refers to situations where the one exposed is not close enough to the incident to be considered a direct part of the ongoing activity but is within the same installation or building. 'Blocked' on the other hand, describes a situation where the survivor is physically prevented from leaving the scene, for example by being taken hostage. 'Directly exposed' refers to situations where the survivor is so close to the incident that minor changes in circumstances could have led to a fatal outcome. 'Intentional injury/death' refers to deliberately inflicted injury or fatality.

Type	*Description of incident type (I)*	*Burden values*
I1	Natural disasters such as extreme weather, volcanic eruptions, earthquakes, landslides and avalanches, floods, etc.	2
I2	Human-made technological disasters such as chemical spills, nuclear accidents, or industrial accidents including workplace accidents occurring during normal operation, transportation, and travel accidents.	4
I3	Human-made violent incidents such as unprovoked violence, mass violence such as terrorism, mass shootings, suicide bombings, car bombings, mass vehicular attacks and war.	6

Table 1. Risk influencing factor I: Type of incident

These variations reflect 7 types of exposure, influencing risk related to PTSD development. Table 2 gives an overview and also shows a suggestion for categorization and burden values that could be used to express the degree of exposure and potential stress, and risk, associated to this. For event of type I1 and I2, exposure is linked to the degree of blocking, while injuries will not be inflicted or attempted intentionally or deliberately, but rather unintentional and 'not deliberate'. Similar tables can be prepared for types I1 and I2, but they are not included here, as the point is mainly to suggest risk influencing factors as an initial scheme for weighting these as an initial step in designing a rapid triage method.

Type	*Description of exposure type (E)*	*Burden values*
E1	Indirectly exposed, present, but at a distance from the crime scene itself, but not blocked from getting away.	1
E1.1	Indirectly exposed, blocked in a limited area around, but at a distance from the crime scene itself, such as the same installation, building, assembly or stadium.	2
E2.1	Directly exposed, blocked and witnessing others suffering deliberate injury/death.	6
E2.2	Directly exposed, blocked, and threatened with intentional injury/death.	8
E3.1	Directly exposed, blocked and attempted inflicted intentional injury/death.	10
E3.2	Directly exposed, blocked, and inflicted intentional non-critical injury.	14
E3.3	Directly exposed, blocked, and inflicted intentional serious injury.	16

Table 2. Factor E. Degree of Exposure.

3.3. *Duration of exposure or involvement (D)*

Existing literature on the topic supports the argumentation that the duration of the exposure in the event being potentially traumatic influences the likelihood of developing PTSD, where longer duration increases the burden. The exposure time is here interpreted as the time during which the one exposed is 'blocked in a confined area' related to the incident scene, for example trapped in a room or building, up to the point where an escape is made, i.e., getting to perceived safe location or the event is somehow ended. No specific period for this is found in literature, to indicate reasonable periods for the method and assessments. However, some inference is possible from known cases where PTSD conditions are observed in later stages. Based on these, a scheme as presented in Table 3 is proposed.

3.4. *Perceived threat level (T)*

In addition to objective factors, subjective elements should also be considered, such as the individual's perception of risk. Even with a low exposure score, a person may have the impression of a life-threatening event, for himself or close ones. When assessing perceived threat level, a potential challenge is that it might not be fruitful to ask the person to relive or describe their experiences

immediately after the event, as this might have an effect on the potential for PTSD development and could have a harmful effect.
For the categorization and assessment of burden, a scheme as presented in Table 4 is proposed as a starting point.

Type	*Description of exposure duration (D)*	*Burden values*
D1	1 - 6 hours.	2
D2	6 - 12 hours.	4
D3	More than 12 hours.	6

Table 3. Factor D. Duration of exposure.

Type	*Description of perceived threat level (T)*	*Burden values*
T1	Severe threat: A threat to the person's health and safety that is not perceived as life-threatening.	2
T2	Threat to others: Significant threat to the health and safety of others exposed.	4
T3	Life-threatening threat: A significant threat for own life perceived.	10

Table 4. Factor T. Threat level.

Regarding situations where a survivor experience threatened death of family members or a close friend, it might be argued that the stress level and perceived risk, could be on level with a T3 type. It can also be argued that type T3 would be suitable for survivors with exposure levels of E3.2 and E3.3.

4. Discussion

Based on the four identified influencing factors and categorizations, it should be possible to develop a rapid triage method tailored to assessing PTSD risk. A preliminary framework outlining the core elements and structure of such a method is presented in the four tables in the previous section (see Table 1 to Table 4). Additionally, a detailed questionnaire designed to collect the relevant input is provided in Appendix A. Although there are still some missing pieces and need for thorough review and testing before concluding on the foundation, a rapid triage method built on such a foundation can be used to prioritize survivors for psychological follow-up with limited resources. It can be used in the event of major terrorist incidents or mass shootings (type I3), for example where survivors are gathered in a safe location during/after the event.
An approach where input for the risk assessment is collected using a questionnaire, where standard questions are asked to the survivors, together with an assessment of any injuries, can be fully completed by emergency personnel or police in a situation without support from medical or psychological professionals. For example, say the incident type is known (I3), and the degree of exposure and duration are observable factors, the risk of misclassification should be low. The start time of the incident is usually known at the time of interview, ad should be possible to establish, however, survivors' individual experience of when the danger started and ended may vary. It might also change over time, based on dialogue with others in the same situation. The one collecting the answers, will nevertheless be able to collect some input on whether the person investigated had a feel of being at risk somehow.
For the aggregation of scores, there are different alternatives, and it's not obvious how to do this. It can also be discussed who to do the collection and at what time.
The total trauma burden score suggests a priority for further follow-up. This score is a representation of the potential for PTSD development, also some margins should be incorporated as there are usually high complexity and high uncertainty, and also pre-traumatic and post-traumatic factors that could influence the risk.

4.1. *Example of use*

Using the proposed model for collection of data and suggested aggregation as a basis for analysis, it is possible to test the validity of the model on an overall level. A case from a mass violence event in Norway, the so-called 'Utøya event' is used in this paper to exemplify and discussion around the use of the method. Experiences from the event are presented in Dyb et al., (2014), where peritraumatic effects are identified for 325 out of the 490 Utøya survivors, where a total of 146 of the survivors is reported to have been shot at.
Based on information available from the event, an assessment of mental trauma burden could be assessed, as presented in Table 5. This model could have given an input to prioritization of the survivors with respect to PTSD treatment and follow-up. In terms of trauma burden, the

following priority groups (1 to 5) can be used as a starting point for follow-up.

1. priority – survivors severely injured Shot at, attempted killed						
Cases	*Type*	I3	E3.3	D1	T3	*Total*
23	*Burden*	6	16	2	10	34
2. priority – survivors moderately injured Shot at, attempted killed						
Cases	*Type*	I3	E3.2	D1	T3	*Total*
37	*Burden*	6	14	2	10	32
3. priority – survivors uninjured Shot at, attempted killed						
Cases	*Type*	I3	E2.1	D1	T3	*Total*
86	*Burden*	6	10	2	10	28
4. priority – survivors uninjured Saw someone get injured/killed						
Cases	*Type*	I3	E2.1	D1	T3	*Total*
61	*Burden*	6	6	2	10	24
5. priority – survivors uninjured Saw/heard the terrorist, heard screams/gunshots etc.						
Cases	*Type*	I3	E2.1	D1	T3	*Total*
118	*Burden*	6	2	2	10	20

Table 5. Analysis of trauma burden and prioritization of survivors of the Utøya terror attack, based on interviews conducted 4–5 months after the incident with 325 out of 490 invited participants.

4.2. *Burden values and degree of traumatization*

There are different alternatives for assessing mental trauma burden. One is using 1,2,3, etc., another is using a logarithmic scale. In the proposed model for analysis, it is taken into consideration that survivors of the Utøya event having physical injuries and peritraumatic exposure had a higher levels of posttraumatic stress reaction. Moderately injured survivors had particularly higher levels compared to uninjured people (Bugge et al., 2017). This is solved by increasing the value by 4 from uninjured to moderately injured, and 2 from moderately to severely injured. The current model for analysis sums up the factors, but other approaches such as multiplying the values can also be considered and discussed, and also alternatives to taking the sum or product may be appropriate. As per now, the proposed system already has some limitations, e.g., that a person with I3, E1, D1, T1 does not meet the PTSD criteria in ICD-11 (ICD-11, 2023) or DSM-5 (VA/DoD (2017), while I3, E3.3, D3, T3 do and should be prioritized. A total burden value below 20 indicates a low risk of PTSD but should then also consider pre- and pro-traumatic factors.

5. Concluding remarks

An important focus of this paper is to initiate work on the core building blocks for a rapid triage method, based on risk influencing factors pointed to in the literature. Per now the method can be characterized as immature, as there is a way before the appropriate factors, scoring and structure can be established. It should be carefully tested in practice, where then a sound foundation gradually will be established, enabling a better analysis of the risk factors influencing PTSD development. By assigning a numerical value to the peritraumatic burdens each survivor is exposed to, the method could be useful beyond emergency response, as a mapping of mental conditions relevant for learning in a long-term.

The current design of the method is assumed a use from health and emergency personnel. The aim is a rapid preliminary sorting of survivors to prioritize follow-up in large-scale events. Such a method could be integrated into national contingency plans for disaster management, and also has potential for international use, especially in collaboration with humanitarian organizations working in conflict and disaster areas.

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APPENDIX A - PTSD potential analysis scheme

Scheme for screening of PTSD potential following mass violence events

The original follows the survivor. The copy is retained by the registrar/healthcare professional.

The registrar registers the time and incident location and checks whether the survivor is physically injured.		*Yes (x)*	*No (x)*	*Proceed to*
A	Is the survivor visibly injured? If not, ask: Are you physically injured?			Question B
				Registrar records **Details,** then Part 2, question No. 1
B	Is healthcare personnel available?			**Healthcare personnel** record **Details,** then Part 1, question No. H1
				Registrar records **Details,** then Part 1, question No. H1

Details

	DD.MM.YY	TT.MM	Mobile No.:		Born DD.MM.YY:			
Time:			First name:				M	F
Incident location:			Last name:		Gender:			

Part 1 (E). Questions and assessments to be conducted by healthcare personnel/registrar

No.	*Questions and assessments for determining the degree of exposure (E) with injury*	*Yes (x)*	*No (x)*	*Type (E)*	*Burden value*	*Proceed to*
H1	Were you injured in connection with evacuation/escape?					Part 2, question no. 1
						Question No. H2
H2	Has the patient been inflicted with intentional non-critical injury?			E3.2	14	Question No. H3
				E1	2	Question No. H3
H3	Has the patient been inflicted with intentional critical injury?			E3.3	16	Part 3, question No. 1
				E1	2	Part 3, question No. 1

Part 2 (E). Questions and assessments to be conducted by the registrar/healthcare personnel

No.	*Questions for determining degree of exposure (E) without inflicted injury*	*Yes (x)*	*No (x)*	*Type (E)*	*Burden value*	*Proceed to*
1	Were you able to move out of the area of the violent incident(s) without being blocked?			E1	1	Question No. 2
				E1.1	2	Question No. 2
2	Did you see anyone get injured or killed during the incident?			E2.1	6	Question No. 3
				E1	1	Question No. 3
3	Were you personally threatened with being injured or killed?			E2.2	8	Question No. 4
				E1	1	Question No. 4
4	Were you personally subjected to an attempted injured or killing?			E3.1	10	Part 3, question No. 1
				E1	1	Part 3, question No. 1
	Record the highest type of exposure **E** and burden value from Part 1 or 2:					Transferred to type **E** in Part 5.

Part 3 (D). Questions and assessments to be conducted by the registrar/healthcare personnel

No.	*Questions to determine the duration (D) of the exposure/felt at risk*	*Yes (x)*	*No (x)*	*Type (E)*	*Burden value*	*Proceed to*
1	Were you in danger for more than 6 hours?			D1	2	Question No. 2
						Part 4, question No. 1
2	Were you in danger for more than 6 -12 hours?			D2	4	Question No. 3
						Part 4, question No. 1
3	Were you in danger for more than 12 hours?			D3	6	Part 4, question No. 1
	Record the highest type exposure duration **D** and burden value:					Transferred to type **D** in Part 5.

Del 4 (T). Questions and assessments to be conducted by the registrar/healthcare personnel

No.	*Questions for determination of perceived degree of threat (T)*	*Yes (x)*	*No (x)*	*Type (E)*	*Burden value*	*Proceed to*
1	Did you experience the incident as the most severe threat to your own safety and risk of physical harm so far?			T1	2	Question No. 2
						Question No. 2
2	Were you concerned about others who were present and directly exposed in the incident?*			T2	4	Question No. 3
						Question No. 3
3	Did you think during the incident "now I'm dying," or see your life in passé, or experience that your thoughts went to your loved ones?			T3	10	Part 5, Summary
						Part 5, Summary
	Record the highest type exposure duration **T** and burden value:					Transferred to type **T** in Part 5.

*Select type T3 if the survivor experienced a threatened death of family member(s) or a close friend. ** Select Type T3 for survivors with exposure level E3.2 and E3.3 from Part 1.

Part 5. Summary - Calculated trauma burden

Type	I 3	E	D	T	*Total Burden value*
Burden value	6				

At burden value from 20 and up, the survivor is at risk zone of developing PTSD. ICD-11 and DSM-5 require a threat level of T3 by definition to make a diagnosis of PTSD.