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## **Systematic Review**

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Corresponding author: Hannah Wild; Email: hbwild@uw.edu

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# Civilian Sheltering Guidelines for Explosive Weapons in Populated Areas: A Scoping Review

Alexandra Christine Hansen MPA<sup>1</sup>, Elsara Badri MPH<sup>1</sup>, Mohamad Almalla MPH<sup>2</sup>, Aparna Cheran MHA<sup>1</sup>, Wael ElRayes PhD<sup>3</sup>, Taylor Jacoby MPH<sup>4</sup>, David Mockler BA<sup>5</sup>, Bonface Massah MPhil<sup>6</sup>, Adam L. Kushner MD<sup>7</sup>, Jack Denny PhD<sup>8</sup> and Hannah B. Wild MD<sup>1,9</sup>

<sup>1</sup>Explosive Weapons Trauma Care Collective (EXTRACCT), International Blast Injury Research Network, University of Southampton, Southampton, UK; <sup>2</sup>World Food Programme Country Office South Sudan, Jebel Kujur Office, Juba, South Sudan; <sup>3</sup>Department of Health Services Research and Administration. Center for Global Health and Development, University of Nebraska Medical Center, Omaha, NE, USA; <sup>4</sup>Trinity College Dublin, School of Medicine, Dublin 2, Ireland; <sup>5</sup>The Library of Trinity College, The University of Dublin, College Green, Dublin 2, Ireland; <sup>6</sup>Malawi Human Rights Commission, Lilongwe, Malawi; <sup>7</sup>Surgeons Overseas, New York, NY, USA; <sup>8</sup>School of Engineering, University of Southampton, University Road, Southampton SO17, 1BJ, UK and <sup>9</sup>Department of Surgery, University of Washington, Seattle, WA, USA

## Abstract

**Objectives:** The use of explosive weapons in populated areas (EWIPA) has a disproportionate impact on civilians. Many humanitarian organizations utilize varying sheltering guidelines to recommend safe positions for civilians affected by explosive threats. It is not known whether these recommendations are standardized or derived from evidence. This study aimed to identify existing recommendations and potential gaps in literature relevant to sheltering guidelines for civilians during explosive events.

**Methods:** A scoping review was conducted of the literature including indexed databases and grey literature to identify reports that described sheltering guidelines for civilians during explosive events. Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) methodology was followed.

**Results:** The search identified 3582 peer-reviewed records. After title/abstract and full text screening, only 2 peer-reviewed reports remained eligible. These were combined with 13 gray literature reports obtained from humanitarian organizations and internet searches. The peer-reviewed reports included mine and unexploded ordnance guidelines, not guidelines for EWIPA or aerial bombardments. There is a substantial knowledge gap and heterogeneity in existing sheltering guidelines from explosive events, particularly those appropriate for protection from EWIPA.

**Conclusions:** Findings from this scoping review demonstrate a need for the creation and standardization of evidence-based civilian sheltering guidelines to mitigate the threat of explosive weapons to civilians in conflict.

The use of explosive weapons in populated areas (EWIPA) inflicts disproportionate harm on civilians. Action on Armed Violence (AOAV) reported 47 476 casualties caused by explosive weapons globally in 2023. <sup>1</sup> In populated areas, 90% of recorded casualties were civilians.<sup>1</sup> Compared to 2022, in 2023, civilian deaths from EWIPA increased by 130%, predominantly due to the conflict in Gaza, alongside escalation of conflict in Sudan and Myanmar, among others.<sup>1</sup> Airstrikes conducted by the Israeli Defense Forces killed 14 000 civilians in just under 2 months, 40% of which were children.<sup>2</sup> EWIPA has also been responsible for civilian devastation in the Ukraine War, causing over 7500 civilian deaths from February 2022-June 2023.<sup>3</sup> In 2023, the ongoing conflict in Sudan also witnessed over 1200 civilian casualties due to explosive weapons.<sup>4</sup>

In 2022, a political declaration was introduced by Ireland and endorsed by 83 countries entitled The Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences of Arising from the Use of Explosive Weapons in Populated Areas. This declaration aimed to raise awareness of the negative humanitarian effects of EWIPA and set "new international standards for protecting civilians from the use of bombs, rockets, artillery and other explosive weapons in populated areas during situations of armed conflict."<sup>5</sup> The main function of the declaration was to serve as a high-level policy standard and tool for long-term prevention, with ongoing proceedings to identify pathways to implementation. Despite the declaration, EWIPA-related injuries and deaths increased from 31 273 in 2022 to 47 476 in 2023, showing that practical protection strategies are also needed.<sup>1</sup>

Sheltering guidelines, or recommendations relating to individuals' posture and positioning related to infrastructure during an explosive incident, are an important injury prevention strategy for civilians affected by EWIPA.<sup>6</sup> Various sheltering guidelines are utilized by many humanitarian actors, such as the humanitarian mine action (HMA) sector. Such guidelines are often not (a) standardized between nongovernmental organizations (NGOs), local governments, health workers, and other entities, and (b) based on empiric evidence. Variation can create confusion and uncertainty, while a lack of evidenced guidelines can be ineffective or even harmful for the intended beneficiaries. For example, the social media platform X has been a hub of shared confusion and advice among civilians. Discussions by Palestinian users on X have suggested which floor of a building is the safest to take refuge on, and how and where to construct shelters, although the origins and effectiveness of these recommendations are unsubstantiated.<sup>7</sup> Currently, the available sheltering recommendations for civilians affected by EWIPA are limited, unverified for effectiveness, and inconsistent across different sectors and platforms. A scoping review was undertaken with the objective to identify and highlight the full extent of this gap of available literature relevant to sheltering guidelines for civilians facing explosive threats.

## **Methods**

To survey the extent of existing EWIPA-relevant sheltering guidelines, a review was performed of published peer-reviewed literature as well as non-peer-reviewed gray literature from NGOs, United Nations (UN) reports, and policy documents. The protocol developed can be found in Supplement 2.

#### Search Strategy and Information Sources

Search strings were developed using structured index terms and database-specific language designed to capture all records describing sheltering recommendations for civilians during explosive events (Supplement 3). Reference lists of records meeting eligibility criteria as identified through this search strategy were also screened to identify additional potentially relevant results. Bibliographic databases, indexing systems, and organizational websites were searched, including PubMed/MEDLINE, Embase (Elsevier), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Global Index Medicus, Center for Agriculture and Biosciences International (CABI) Global Health, Cochrane Library (Wiley), Web of Science Core Collection, Google Scholar, Human Rights Watch, United Nations Human Rights Council, and the International Committee of the Red Cross.

#### **Eligibility Criteria**

Inclusion and exclusion criteria were defined to determine eligibility. Eligible studies were those that (i) described recommendations for civilians to shelter during explosive events or (ii) contained data (e.g., blast loading experiments, injury reports, and analyses of explosive events) that provide evidence for the consequences of positioning at the time of an explosive event on injury outcomes. Due to the limited availability of open data on this topic, populations from all contexts were eligible including military and civilian populations (though military populations differ due to the use of protective body armor), high and low resource contexts, urban and rural settings, and conflict and non-conflict settings. All study designs were eligible. Records in all languages were eligible for inclusion.

To maintain relevance to modern armed conflict, date restrictions were applied limiting eligible records to those published on or after January 1, 2000. This timeframe was selected to roughly correspond with the US wars in Iraq and Afghanistan, with Operation Enduring Freedom beginning in 2001, consistent with prior reports.<sup>8</sup> Records that described the development of blast-resistant building designs or bomb threat response drills without recommendations or evidence on the protective positioning of individuals were excluded, as they provide recommendations from an administrative perspective, rather than for civilian self-protection. Reports describing occupational safety for explosive ordnance disposal personnel were also excluded due to the lack of applicability for civilians practicing self-protection. Finally, records without full-text availability were excluded.

#### **Data Selection**

Records identified through the above search strategy were compiled in EndNote, <sup>9</sup> with duplicative records being eliminated. The remaining non-duplicative records were imported into the systematic review software Covidence.<sup>10</sup> Using Covidence, 2 independent reviewers screened titles and abstracts for relevance to eligibility criteria, with a senior author arbitrating discrepant opinions. The full text reports of records determined to be eligible for inclusion in the analysis were then retrieved and screened for relevance to eligibility criteria.

#### Data Items, Extraction, and Management

A standardized extraction form was developed to ensure uniformity of data extraction. This form was developed using a modified Conducting Systematic Reviews and Meta-Analyses of Observational Studies of Etiology (COSMOS-E) strategy.<sup>11</sup> A series of information was extracted from reports included in the analysis if presented, including bibliographic information, author, country, study design and methods, responsible actors, study setting, study population, study topic (e.g., sheltering in place, physical positions taken during explosive events, recommended structures to shelter in), and recommendations given to civilians regarding sheltering during explosive events (Table 1). Injury details and outcomes were also recorded if applicable.

#### Risk of Bias (Quality) Assessment

Due to limited available data on the review topic, no reports were excluded from consideration based on assessment of data quality or potential bias. Qualitative assessment of study quality was conducted using a modified Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (Table 1).<sup>12</sup>

### Strategy for Data Synthesis

Results were reported in accordance with PRISMA-ScR guidelines (Supplement 1). A significant amount of heterogeneity in study design, data reporting, study topic, and outcomes presented was anticipated. This precluded any ability to synthesize results for pooled analysis. Data was therefore synthesized qualitatively in narrative text, graphical figures, and tables.

## Table 1. Included information summary table

Author(s)	Year	Title	Source	Country	Content	Evidence	GRADE Certainty					
Peer Reviewed Reports												
Durham et al.	2005	Effective mine risk education in war-zone areasa shared responsibility	Health Promotion International	Laos	An empirical study on mine risk education (for landmines and UXOs) during the monitoring and evaluation process of a mine risk education program in Laos using defined "risk factors". It was found that civilian ignorance is likely not the sole factor in mine accidents, and suggests that new approaches that consider economic, social, and political factors in mine risk as well.	An observational study using ordnance injury data, program staff observations, anecdotal evidence, and civilian mine risk and safety awareness data to examine the risk factors associated with civilian explosive ordnance casualties in Laos.	Low					
Surrency et al.	2007	Key factors for civilian injuries and deaths from exploding landmines and ordnance	Injury Prevention	Afghanistan	The study aim is to identify risk factors for death or injury from landmines and ordnance so programs can target preventative actions for the identified risk factors.	A quantitative study using hospital and community surveillance to examine the details of 571 landmine and ordnance casualties between 1996 and 1998 in Kabul City, Afghanistan.	Low					
Direct Ha	ndover Gre	y Literature										
NGO 1	2023	Safer Practices During Shelling or Shooting and around Explosive Devices	Direct Handover	Not specified	An infographic aimed at civilians that describes simple self-protection methods during active shelling or shooting. Also includes a warning to stay away from and report unexploded ordnance post- conflict.	Not specified	N/A					
NGO 1	Undated	"Don't bring things into your home which could take your life"	Direct Handover	Myanmar	An infographic with the purpose of warning civilians of the risk and potential negative impact of unexploded ordnances.	Not specified	N/A					
NGO 1	Undated	"Safe position" slide	Direct Handover	Myanmar	A slide demonstrating a safety position in the case of an explosive event.	Not specified	N/A					
NGO 1	Undated	"How to behave in case of shelling on the street"	Direct Handover	Ukraine	An infographic informing civilians how to shelter from shelling on the street.	Not specified	N/A					
NGO 1	Undated	"How to behave in case of shelling in public transport or car"	Direct Handover	Ukraine	An infographic informing civilians how to shelter from shelling in public transport or a car.	Not specified	N/A					
NGO 1	Undated	"How to behave in case of shelling in the basement"	Direct Handover	Ukraine	An infographic informing civilians how to shelter from shelling in a basement.	Not specified	N/A					
NGO 2	2020	Humanitarian Mine Action and COVID–19: An Operational Feasibility Study	Direct Handover	Myanmar	A study undertaken by MAG Myanmar to assess the feasibility of delivering mine action operations during COVID–19 in Myanmar. This report includes information collected from 520 communities and aims to inform both mine action and other community outreach stakeholders.	Operational feasibility survey in Myanmar to determine the feasibility of carrying out mine action services during COVID–19 challenges.	Low					
NGO 2	2021	Small Arms and Light Weapons Risk Education (SALW RE)	Direct Handover	Not specified (case example is Mali)	A generic guide to a presentation given to civilians on small arms and light weapons risk education.	Not specified	N/A					

#### Table 1. (Continued)

Author(s) Year	Title	Source	Country	Content	Evidence	GRADE Certainty						
NGO 2 Undat	ed "How to sta safe?"	ay Direct Handover	Not specified	An information sheet describing practices civilians can use to stay safe in areas with potential mine or ordnance contamination.	Not specified	N/A						
Author(s)	Year	Title	Country	Content	Evidence	GRADE Certainty						
Internet Searchable Grey Literature												
European Union (Dovidka.info) <sup>1</sup>	2022	"Handbook: In the combat area"	Ukraine	An online handbook and series of accompanying instructional vide aimed at Ukrainian civilians. The section described is the "Shelter portion of the handbook.	Not eos specified e "	N/A						
Nefesh B'Nefesh <sup>2</sup>	Undated	National Emergency Preparation	Israel	An online article aimed to inform civilians in Israel on sheltering recommendations in the event of various national emergencies including rocket or missile attac and earthquakes.	Not specified of :ks	N/A						
United States Occupational Safety and Health 0Administration	Undated	ETool : Evacuation plans and procedures - emergency action plan - shelter-in-place	United States	s An online eTool describing shelter- place protocols.	-in- Not specified	N/A						
Women's Volunta Defence Organization ("Ole valmis!" app) <sup>4</sup>	ry Undated	"Explosion"	Estonia	An information page on the app "C Valmis!" that describes summar safety guidelines for civilians in events of emergencies, including section on "explosions."	Dle Not specified ized the g a	N/A						

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<sup>1</sup>In the combat area. Dovidka.info. Accessed March 9, 2025. https://dovidka.info/en/in-the-combat-area/

<sup>2</sup>Mackler B. National Emergency Preparation. Nefesh B'Nefesh. July 26, 2021. Accessed March 9, 2025. https://www.nbn.org.il/life-in-israel/emergency-resources-life-in-israel-2/nationalemergency-preparation/

<sup>3</sup>eTool : Evacuation Plans and Procedures | Occupational Safety and Health Administration. Accessed March 9, 2025. https://www.osha.gov/etools/evacuation-plans-procedures <sup>4</sup>Explosion. Code of conduct for crisis situations. Accessed March 9, 2025. https://www.olevalmis.ee/en/guidelines/explosion

## Results

#### Search Results

The preliminary search identified 3582 peer-reviewed records. Nine relevant items of gray literature were shared with the research team directly from 2 international NGOs, and 4 additional relevant gray literature reports were identified on NGO, intergovernmental, and governmental websites (Figure 1). After title and abstract screening, 3240 were excluded, leaving 45 reports: 32 peer-reviewed reports, and 13 grey literature reports. During full text review, 30 peer-reviewed reports were excluded: 27 reports did not describe the outcomes of interest, and 3 reports had an irrelevant study setting. All 13 grey literature reports were included in the study. Two peer-reviewed reports met the eligibility criteria but described mine and unexploded ordnance guidelines, not guidelines for EWIPA conditions.

## Full-Text Review Exclusion Characteristics

Of the reports that did not meet eligibility at the full-text review stage, there were 2 primary categories of subject matter. Thirteen of the 30 excluded full text reports examined general emergency or disaster preparedness recommendations for government or medical professionals, but did not describe protective positioning. Fourteen of the 30 excluded full text reports were examining blastresistant shelter construction or building design only. These subjects both represent primarily recommendations for preparation in pre-EWIPA conditions.

## **Geographic Distribution**

Included peer-reviewed reports presented guidance for civilians in Laos and Afghanistan. The first analyzed a mine risk education program in Laos, using risk factors to examine civilian safety before and after the program. The second report examined landmine and ordnance casualties in Afghanistan and their various circumstances, with the goal of identifying a variety of risk factors to inform targeted prevention. Included gray literature identified was targeted at civilians in Europe, the Middle East and North Africa, Asia, the Americas, or multiple regions (Figure 2).

#### Study Settings

Of the included reports (for both the peer-reviewed reports and the intended audience of the gray literature) 85% were countries in current or post-conflict settings (Figure 2). The remaining 2 reports, both gray literature, describe preventative sheltering recommendations for hypothetical EWIPA events in Estonia and the US.



Figure 1. PRISMA-ScR diagram.

## Data Elements Reported

As predicted, data presented by the included reports were nonuniform. Demographic data was only presented by 1 of the 2 peerreviewed reports. As the majority of included reports were gray literature, 60% of the included reports did not describe any elements of a study being performed or evaluated.

## Limitations

This study has several limitations. Classified research commissioned by security and defense actors could not be included in analysis, emphasizing the need for research that can translate into civilian benefit. Date restrictions may have led to exclusion of potentially relevant research outputs following previous major



Figure 2. Geographic distribution of included reports.

conflicts; however, these restrictions were applied to ensure that identified literature was relevant to modern, increasingly urbanized conflicts, as observed with EWIPA. The 2 peer-reviewed reports included were given a GRADE rating of "low," as they were observational studies. Finally, the extremely limited nature of available data on the topic of interest restricted the conclusions that could be derived. This finding highlights a critical evidence gap.

## Discussion

In this study, a scoping review was conducted to determine and characterize the gap in available literature on sheltering guidelines for civilians affected by explosive threats. A substantial gap in sheltering guideline recommendations for civilians was found, evidenced by the small percentage of reports that met all inclusion criteria, including only 2 peer-reviewed reports. There was a complete lack of relevant evidence-based findings applicable to EWIPA, as none of the peer-reviewed reports included directly considered the effects of explosions in urban environments such as those that characterize many of the highest-intensity uses of EWIPA.

Examination of the pattern in ineligible records demonstrated a bias towards structural considerations in high-resource and military

environments. Twenty-two of the 30 reports excluded at the full text review described either shelter construction or emergency preparedness recommendations, both of which focus on pre-EWIPA preparedness. While this can expand communities' capacity to cope with EWIPA, it does not protect all vulnerable civilians. Civilians are rarely armored like their military counterparts, and therefore have increased vulnerability to "secondary" type blast injuries caused by fragmentation. Similarly, blast-resilient structures are typically limited to key defense infrastructure, landmark buildings, or valuable assets, such as embassies or luxury hotels. Civilian homes do not feature such protection and are vulnerable to failing windows and localized or even full structural collapse.

There was a significant lack of standardization among the included reports describing sheltering recommendations. This is primarily evidenced by the heterogeneity of the included grey literature reports. None of the included organizational grey literature reports cite empiric evidence from which their guidelines were derived. This highlights the need to undertake empirical studies to recommend and standardize effective sheltering guidelines for civilians. Moreover, without a substantive evidence base on the effectiveness and feasibility of sheltering guidelines, there are additional risks for persons with disabilities who may not directly benefit from or be able to maintain the recommended positions. Universal design, the process of creating programs and services that are usable by everyone without the need for specialization or adaptation, is impossible with the current gap in standardization.<sup>13</sup>

The political declaration on EWIPA contains a list of pledges that present steps to mitigate current and future civilian harm from EWIPA. Notably, they include improving national policies to strengthen the protection of civilians during armed conflict, providing support to EWIPA victims, and assisting the United Nations in collecting data on effects of EWIPA on civilians.<sup>14</sup> The pledges represent a need to improve trauma care for civilians during EWIPA events, while also acknowledging the criticality of injury prevention.<sup>15,16</sup> Diplomacy and policy, such as that of the political declaration on EWIPA, must be paired with practical, uniform, and analytically proven sheltering guidelines to reduce civilian harm in the present and future. Given the range of structural and material factors in typical civilian environments known to increase injury such as glass, fragmentation, and other debris, strategies must be developed to implement these recommendations.<sup>6</sup>

Numerous opportunities exist to strengthen the evidence base for civilian sheltering guidelines. These steps could include: (1) data collection on civilian casualties exposed to explosive injury, including position at time of impact if known; (2) blast modeling experiments and simulations to model and analyze the impact of injury patterns at different positions; (3) a synthesis of this information with qualitative interviews with individuals with disabilities to understand how they can be adapted in an inclusive manner. The large gap in evidence found in this review alongside the increasing threat of explosive weapons for civilians will require a multifaceted, interdisciplinary approach. Several initiatives including the Explosive Weapons Trauma Care Collective and the International Blast Injury Research Network have arisen to address these needs by leveraging a broad range of sectors including stakeholders in humanitarian mine action, emergency health care, and engineering.<sup>17</sup> Further research as outlined above can help mitigate harm for civilians in EWIPA settings.

## Conclusions

Findings from this scoping review confirm a lack of evidence in publicly available literature of relevance to sheltering guidelines from explosive events, particularly those appropriate for protection from the use of EWIPA and civilian populations. This further suggests that current informal recommendations used as individual injury prevention strategies are unsubstantiated by evidence and, therefore, may not be effective. The findings highlight an urgent need to strengthen injury prevention frameworks for civilians impacted by explosive violence in conflicts globally. Future research should seek to enhance injury prevention strategies through multidisciplinary, methodologically rigorous research, the overall coordination and dissemination of sheltering guidelines that are proven and trusted, and the potential for improved sheltering guidelines for individuals with all abilities.

**Supplementary material.** The supplementary material for this article can be found at http://doi.org/10.1017/dmp.2025.117.

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revisions; Adam Kushner: Manuscript revisions; Jack Denny: Supervision, manuscript revisions; Hannah Wild: Conception, supervision, data analysis, data extraction, manuscript revision.

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