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Strengthening the emergency health response to children wounded by explosive weapons in conflict

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ABSTRACT

The 2022 war in Ukraine has highlighted the unacceptable consequences wrought on civilians and health infrastructure by conflict. Children are among the most vulnerable of those affected and constitute an increasing percentage of non-combatants injured in conflicts globally. A disproportionate number of these injuries are caused by blast mechanisms from munitions including 'conventional' landmines and indiscriminate explosive weapons such as barrel bombs and improvised explosive devices. In 21st century conflict, children are no longer only accidental casualties of war, but are increasingly targeted by parties through acts such as bombing of school buses and playgrounds, conscription as child soldiers, and use as human shields. In the present viewpoint article, we review the state of pediatric blast injury studies, synthesizing current understandings of injury epidemiology and identifying gaps in research to advance the field towards a concrete agenda to improve care for this vulnerable population.

INTRODUCTION

The word 'casualty' is derived from the Latin word *casus,* meaning 'chance'. Yet in the context of 21st century warfare, it is inaccurate to state that the harm wrought on children by explosive weapons is accidental. As the 2022 war in Ukraine continues to devastate civilian populations, children are placed directly in the path of harm and have been used as human shields in multiple regions of the country.[1] Consistent with trends in modern warfare, casualty patterns demonstrate dense use of explosive weapons in populated areas.[2] Combined with the bombings of schools, orphanages, children's hospitals and maternity wards, children bear a disproportionate toll of morbidity and mortality in conflict.[3] By 2017, an estimated three-quarters of conflict-related injuries among children were caused by explosive weapons, which in Syria caused nearly 14 000 child deaths between 2011 and 2016 alone.[4 5] Explosive weapon-related injuries may occur unintentionally while playing or working in contaminated areas, but there is too little intentionality given to where explosive weapons are planted and detonated.

Children are routinely targeted with explosive weapons in modern armed conflict.[6 7] Some of these tactics are new, while others are longstanding. Since the Soviet-Afghan war in the 1980s when toy-like PFM-1 or 'butterfly' mines that trigger at as little as 5 kg of pressure were dropped in vast quantities over Afghanistan, the functional design of explosive weapons have appealed to children's innate curiosity.[8] Cluster munitions (eg, ball-shaped BLU-63 bomblet used in Western Sahara) and submunitions (eg, M77 grenades for the M270 multiple launch rocket system with ribbons tied to their tops strewn over Lebanon) have maimed children in dozens of conflict-affected and postconflict nation states.[9–11] The Islamic State of Iraq and Syria (ISIS) boobytrapped civilian homes during the 2016 Mosul offensive, and subsequent retreat from Raqqa used teddy bears, toy trucks, and playing cards as detonators.[12] Children are casualties and intentional victims of war.

In addition to types of munitions to which children are particularly susceptible, areas frequented by children are increasingly targeted by indiscriminate bombings, including neighborhoods, elementary schools, playgrounds, and health facilities.[13–15] Additionally, children conscripted as soldiers are injured while manufacturing improvised explosive devices (IEDs), or when forced to plant them to allow adult fighters to evade the fire of coalition snipers.[16 17] In the cruelest cases, children themselves are used as suicide bombers, a practice of the Taliban that has proliferated under extremist organizations in settings, such as Nigeria and Iraq, where fighters were documented to have told one 6-year old boy that his vest would 'shower flowers and food when he pushed the plunger'.[18–22] The most vulnerable are the most frequently exploited, with a

disproportionate effect on the children of impoverished families, orphaned children, and children with disabilities. Children from the latter group have been forcibly deployed as suicide bombers by ISIS as an alternative to the fatwa (ruling on a point of Islamic law) authorizing their death.[19]

The human toll of such atrocities devastates individuals, families, communities, and the fabric of societies, with far-reaching physical, psychosocial, educational, economic, and vocational consequences that cannot be addressed by any single discipline. Deconfliction efforts should continue to be pursued at the political level. Measures restricting the use of explosive weapons and enforcing protections for conflict-affected children should continue to be promoted by human rights advocates. Risk education/injury prevention activities by local and non-governmental organizations (NGO) should be supported. In parallel, as long as children are wounded by explosive weapons, medical professionals must take steps to ensure that the emergency health response to their injuries is prepared to mitigate unnecessary morbidity, mortality, and functional disability among child victims of war.

In the present viewpoint article, we synthesize what is known regarding injury epidemiology and considerations specific to the clinical care of pediatric populations, focusing primarily on gaps and opportunities for strengthening the care of child victims of explosive weapons (table 1). No formal scoping or systematic review of this topic was undertaken because two recent systematic reviews have been conducted and because this was not our primary objective.[23 24] Instead, we have synthesized the evidence base around children injured by explosive weapons using the findings of these reviews, which we have supplemented with focused literature queries as well as our perspectives as clinicians and researchers with experience in injury prevention, pediatric trauma care in austere settings, and humanitarian response. On the basis of this synthesis, we propose a coordinated agenda to advance the care of children injured by explosive weapons.

INJURY EPIDEMIOLOGY

In the absence of standardized, cooperative trauma registries among humanitarian actors in conflict settings, the constraints of accessible and published data limit the current understanding of the epidemiology of pediatric blast injury. Much of what is known comes from Department of Defense Trauma Registry and UK Ministry of Defence Joint Theatre Trauma Registry data that detail the experience of military medical personnel caring for child victims of the wars in Afghanistan and Iraq at facilities such as Camp Bastion, where 25% of all civilian patients admitted for blast injury between 2002 and 2010 were under the age of 15 years.[25–27] Because these characteristics have been described relatively well in previous reports, we limit our discussion to a brief review.[23]

The proportion of conflict-related injury caused by blast mechanisms is higher among children than adults.[24] A recent systematic review of child victims of 21st century armed conflicts demonstrated that nearly 60% of conflict-related injuries in children were attributable to blast mechanisms, compared with approximately 25% in adults, a finding consistent with prior reports from Afghanistan and Iraq.[24] In certain settings this proportion may be even higher, such as in Syria where approximately 80% of child victims of war between 2011 and 2017 were caused by blast injury, predominantly from barrel bombs and airstrikes.[5]

Compared with adults, children are more likely to be handling and playing with explosives at the time of detonation (43% compared with 18% in Nepal).[28] For similar reasons, child blast victims often result in mass casualty situations due to multiple children playing together or congregated in the same area.[29 30] For example, 63% of incidents involving children included multiple victims among landmine-injured patients in Iran.[31] Similar to trends observed among military personnel, 21st century armed conflict has been characterized by an increasing incidence of injuries from IEDs, which inflict devastating, multisystem injuries associated with multiple amputations and nearly fourfold higher mortality than 'conventional' antipersonnel mines.[32] However, unlike military personnel, children are unprotected by body armor and present with higher injury severity as a result.[27 33]

With respect to anatomic injury patterns in blast-injured children, reports are highly variable.[23 27 33–37] Injury patterns differ by age, with head injury reported to be more prevalent in infants (<3 years) in whom surface area and proportion of body weight are skewed towards the head. Injury patterns in older children resemble those reported for adults. While some reports describe a higher incidence of lower extremity injury due to children's shorter stature, others describe a higher rate of upper extremity injury due to children's predisposition to handle and play with explosives—an activity that leads to higher rate of craniofacial and ocular injuries, with bilateral blindness in up to 20% of wounded children.[31] The above-cited systematic review demonstrated overall similar wounding patterns with no statistically significant differences observed in the incidence of head or extremity injuries; however, non-uniform reporting of injury precluded stratification by age group for pooled analyses.[24] The pliability of children's bones permits greater distribution of energy into soft tissue and viscera, which often causes severe injury to internal organs.[38] When interpreting available data on injury patterns survivorship bias is significant, as many children with head and thoracoabdominal blast wounds will not survive to reach a health facility in humanitarian contexts owing to ad hoc modes of prehospital transport, lack of organized trauma systems, and delays to definitive care.[39–41]

Reported mortality rates among blast-injured children vary widely even within the same conflict and time period from approximately 5% to 25%, and as high as

Table 1 Key issues in pediatric blast injury: epidemiology, clinical considerations, recommendations to mitigate the impact of explosive weapons on children

Domain	Key issue	Recommendations
Injury epidemiology	► A higher proportion of conflict-related injury is caused by blast mechanisms in children than adults. ► Children are more likely to be handling/playing with explosives at time of detonation.	Strengthen injury prevention: build ties between medical personnel and explosive ordnance risk education programming (eg, UNICEF's International Mine Risk Education Working Group).
	Gaps in data collection limits understanding of epidemiology of explosive weapon-related injury in children.	Establish a uniform minimum dataset among actors caring for children with explosive weapon-related injuries.
	Specific patient subsets have disproportionately high mortality, including children <5 years, and those with burns or traumatic brain injury.	Target research efforts on high-mortality subsets to generate clinical care guidelines and quality improvement toolkits.
Clinical considerations	Although guidelines on the care of children with explosive weapon-related injuries exist, pediatric knowledge is still limited among most medical personnel in conflict settings (including age-specific normal physiological ranges for vital signs, equipment sizing, and medication dosing).	► Promote the integration of pediatric modules into standardized trauma training programs. ► Disseminate references such as the Pediatric Blast Injury Field Manual as well as pediatric vital sign charts, triage (eg, Broselow) tapes; ensure sustainability provision of pediatric equipment in conflict-affected settings.
	Several anatomic and physiological differences exist in children that warrant special consideration during acute trauma resuscitation (eg, narrower airways, less functional residual capacity, less adipose reserves).	► Provide padding on backboard to prevent airway occlusion. ► Ensure frequent reassessment of endotracheal tube positioning given propensity for displacement. ► Avoid cricothyroidotomy in children <12 years of age. ► Prioritize external warming and hyperthermia prevention. ► Ensure adequate source of dextrose to prevent hypoglycemia.
	The long-term sequelae of explosive weapon-related injury are profound, requiring a broad range of rehabilitation services from physiotherapy to mental health and vocational services.	Improve coordination between acute trauma care and disability services, strengthen referral pathways to rehabilitation services.
Policy and advocacy	Wide variation exists in the types and quality of assistance available to child victims of blast injury.	Support the implementation of United Nations International Mine Action Standard 13.10[72] on Victim Assistance.
	Few research and advocacy initiatives focus specifically on the impact of explosive weapons on children.	Support the work of Save the Children's Pediatric Blast Injury Partnership; expand collaborations with local mine action authorities and national ministries of health in heavily affected countries.
	Inadequate legislation and policy exists to protect children from the impact of explosive weapons.	Support: 1. International Network on Explosive Weapons Political Declaration on the use of Explosive Weapons in Populated Areas.[65] 2. International Campaign to Ban Landmines treaty promulgation, disarmament, and clearance efforts. 3. Human Rights Watch efforts to pass legislation banning the use of incendiary weapons.

UNICEF, United Nations Children's Fund.

almost 50% within specific subpopulations, such as children with war-related burns.[26 27 42] Numerous factors may contribute to mortality figures that do not tell the entire story. These include survivorship bias, with up to 85% of critically injured children estimated to die in the prehospital setting who are therefore not captured in hospital-based registries, and varying definitions of mortality (ie, in-hospital death, 30-day mortality, death in the operating room, or postoperative recovery unit); consenquently, these figures are difficult to interpret.[31 43]

A lack of information regarding outcomes postdischarge from military or NGO treatment facilities also limits the utility of these data.

Nonetheless, certain subgroups of children are consistently demonstrated to have disproportionately high mortality on the order of 30%, or approximately five times greater than that of overall patient samples. Specifically, these groups include: (i) the youngest patients (age <5 years); (ii) children with burns; and (iii) children with traumatic brain injury (TBI).[26 44–50] Nearly 90% of child deaths caused by blast injury were caused by head injury according to reports from Camp Bastion in Afghanistan, while both TBIs and burns had a nearly five times higher case fatality rate than all other injuries.[27 47] At present, the quality of data is inadequate to determine factors underlying the increased mortality rates in these subpopulations. Systematic data on outcomes other than mortality are essentially non-existent. Little is known about complications or short-term and long-term disability, community participation, or return to school or work following hospital discharge, although ramifications are qualitatively understood to be profound.[51 52]

CLINICAL CONSIDERATIONS

Although important distinctions in the care of conflict-related blast injuries among children do exist in comparison to adults, it is also important that these distinctions not be overstated. Acutely, the fundamental principles of timely prehospital care, ABCDE (airway, breathing, circulation, disability, exposure) approach to the primary survey, damage control resuscitation, and operative management are shared.[38] Comprehensive guides to the care of blast-injured children in austere settings exist.[53–55] We therefore limit our discussion to a review of salient considerations regarding pediatric physiology and implications for trauma management. We advocate for the promulgation of these materials as standard resources for emergency trauma care providers, all of whom may be called on to care for children in conflict settings.

Familiarity with normal physiological ranges for vital signs by age is required. Standardized pediatric vital sign charts and pediatric triage (eg, Broselow) tapes and mobile applications providing reference to age-specific sizes of essential equipment, such as laryngoscopes, endotracheal tubes, and intravenous catheters, should be available. Blast injury manuals contain appendices with these data, as well as: appropriate dosages for resuscitation and maintenance fluids and guidance on their local manufacture; dosing for essential medications; pediatric Glasgow coma scale for the assessment of neurological injury and TBI; modified Lund and Browder chart for estimation of total body surface area in burn patients; and initial pediatric ventilator settings for contexts in which access to mechanical ventilation exists.[53–55]

Several key physiological differences exist in children which require special attention. Children's airways are more cephalad, narrow, and anterior, with tissue laxity that, in combination with passive flexion caused by their prominent occiput and large head, predispose them to airway occlusion. This can be addressed by padding the child's torso to create a more neutral neck position prior to securing a definitive airway. Endotracheal intubation in children is complicated due to airway anatomy and because children have less functional residual capacity and are prone to more rapid desaturation following preoxygenation. Additionally, children can have a more pronounced vagal response to laryngoscopy and induction agents during rapid sequence intubation, leading to bradycardia without the capacity to compensate with increased stroke volume as adults do. This can be averted by premedication with atropine. Given the shorter length of the trachea, malposition and displacement of ETTs is common and can be caused by even small movements during transport, requiring frequent reassessment to ensure the airway is adequately secured. Due to their laryngotracheal anatomy, establishing a surgical airway also differs in children aged <12 years, in whom surgical cricothyroidotomy is not advised due to the risk of laryngeal trauma. In this age group, percutaneous transtracheal ventilation via needle cricothyroidotomy can be used for rescue oxygenation; however, this may be (a) challenging to achieve in younger children due to laxity of the airway as well as risk of puncturing through the posterior wall of the small trachea causing esophageal injury, and (b) does not provide adequate ventilation, leading to hypercarbic respiratory acidosis which can be particularly deleterious in patients with TBI. These considerations have led to the recommendation of tracheostomy if within provider comfort level and if appropriate to context/resource availability, acknowledging the risk of subglottic stenosis if suboptimally placed. In one cohort of Syrian war victims, nearly all patients with second-degree or third-degree facial burns underwent tracheostomy to obtain a definitive airway.[56]

Children have a smaller total circulating blood volume with decreased ability to modulate their stroke volume in response to hypovolemia; therefore, they are dependent on heart rate to maintain cardiac output in hypovolemic shock and are able to compensate with tachycardia until approaching hemodynamic collapse. Children are predisposed to hypothermia owing to less subcutaneous adipose tissue as well as higher body surface area-to-weight ratio, necessitating the use of passive and active warming measures including warming of all fluids prior to administration. Children also have relatively minimal stores of glycogen and are at higher risk of hypoglycemia, requiring dextrose-containing or glucose-containing enteral or intravenous fluids. Peripheral intravenous access may be challenging to obtain in children, especially those with burns, requiring alternative modes such as enteral and intraosseous access. Multidrug-resistant pathogens among explosive weapons-injured children appear to be prevalent in certain conflicts, which may have implications for postoperative complications and outcomes.[57] In addition to trauma stabilization, in the experience of the authors, many children arrive at a

health facility alone and require the support of translators and social workers to identify a family member or other companion during their care.

Beyond these basic physiological considerations, most issues are a matter of nuance. Certain medications and anesthetic agents carry different risk profiles in children (eg, the increased risk of propofol-related infusion syndrome with prolonged use is thought to be more common in children than in adults).[58] Debate also exists over certain operative approaches. For example, splenic salvage has been advocated due to the increased risk of overwhelming postsplenectomy infection in children, especially those with limited access to healthcare and inconsistent immunization rates; yet this risk must be balanced against the risk of hemorrhage in settings with minimal capacity for close hemodynamic monitoring and blood transfusion. Although transverse laparotomy incisions are commonly employed for children under the age of 2 years in an elective setting, a midline laparotomy incision is recommended in the setting of conflict-related injury given the advantage of access for vascular control from the supraceliac aorta to the iliac arteries. Further discussion regarding practice guidelines in nuanced clinical scenarios is outside the scope of this review. Without minimizing the importance of pediatric-specific considerations and acknowledging the reality that most practitioners called on to care for blast-injured children will not be certified in a pediatric subspecialty, a basic understanding of these fundamental principles should be adequate to stabilize critically injured children.

Given implications for long-term functional disability particularly in settings with limited access to adequate-quality prosthetics, thoughtful management of orthopedic injuries is critical in children.[59] The creation of functional amputation stumps has major quality of life implications for children following traumatic amputation. Decision-making around residual limb length in children is complicated by the need to preserve viable physis for continued bone growth, and to balance limb length preservation with maintaining adequate soft tissue padding.[59 60] Due to continued bone growth and complications such as terminal osseous overgrowth, in comparison to adults children require a higher number of average lifetime procedures (eg, surgical revisions) and prosthetic modifications in settings where little infrastructure for such services exists.[61]

The equally devastating long-term psychosocial, educational, and vocational disabilities for children are outside the purview of this review.[62–64] Linkages between emergency healthcare personnel involved in the acute phase of resuscitation and stabilization of children with blast injuries, and health personnel with expertise in physiotherapy and rehabilitation, prosthetic and orthotics, and mental health should be positioned to address the less-visible, but no less important, consequences of blast injury.

MOVING BEYOND ACKNOWLEDGING THE PROBLEM

These injuries should not occur, but they do. Broader efforts from political and advocacy standpoints include work driven by the International Network on Explosive Weapons and International Campaign to Ban Landmines.[65 66] Explosive ordnance risk education activities are supported by a range of actors including the United Nations Children's Fund (UNICEF) among other organizations within the mine action sector.[67] These are critical to reducing the number of children harmed by explosive weapons. For the injured, medical personnel must focus efforts to improve the emergency health response. Although trauma systems are often ad hoc or non-existent in the settings where these injuries are most frequent, numerous opportunities nonetheless exist to strengthen the planning and organization of care for the injured.[41 68]

Recent experiences in the Middle East led to a relative proliferation of literature on injury epidemiology, which has been reviewed above. A basic understanding exists regarding the types of injuries suffered by children, as well as differences that should be considered in their care compared with adult patients. Researchers in this domain should now pivot their efforts towards known gaps and focus on synergizing existing resources for medical personnel caring for children in conflict settings with other trauma systems-strengthening initiatives relevant to these environments. We outline below steps that can be taken to improve the planning and organization of trauma care for child victims of explosive weapons.

Develop, translate, and disseminate pragmatic references for local medical personnel caring for child victims of explosive weapons

Numerous resources exist to guide practitioners in the clinical care of pediatric trauma patients with explosive weapon-related injuries. First is the *Pediatric Blast Injury Field Manual*, a publication supported by the Imperial College London's Center for Blast Injury Studies and Save the Children.[55] The manual is a direct response to a request from medical personnel in Syria caring for children with conflict-related injuries for a pragmatic clinical guide. The manual is currently translated into five languages: English, French, Arabic, Dari, and Pashto. It is structured to 'follow' the child from point of injury to point of discharge covering each phase of care, including psychosocial and rehabilitation considerations. Its appendices contain charts for appropriate dosing of medication and sizing of equipment for children. While some materials written for surgeons functioning within a military treatment facility are not likely to be appropriate in a more resource-constrained system, *Pediatric Surgery and Medicine for Hostile Environments* provides in-depth material on the medical and operative management of pediatric blast injury.[53] Local emergency medical practitioners caring for child victims of blast injury can be supported through the dissemination, translation, and promulgation of such pragmatic resources, as well as ensuring availability of standard references, such as

pediatric triage tapes and mobile applications for medication dosage and equipment sizing.

Promote the integration of pediatric modules into standardized emergency care training programs

Numerous initiatives have been developed to strengthen and standardize trauma training in low-resource and conflict-affected settings, such as the WHO Emergency and Trauma Care Training Course, The International Committee of the Red Cross Blast Trauma Care course, and trauma surgery courses adapted for low-resource and conflict-affected settings by organizations including the International Association for Trauma Surgery and Intensive Care. Pediatric modules should be integrated into these and other courses promoted for such contexts. A judiciously selected curriculum of key considerations in the care of blast-injured children may significantly improve the care rendered by providers in these settings. Short training packages can significantly enhance capability and confidence for deployed medical staff.[69] Given the adverse psychological consequences poor outcomes of children have on all involved in their care as well as on organizational effectiveness and morale, it is particularly important to provide medical personnel who may be called on to treat children wounded by explosive weapons with the tools for optimal preparedness.

Establish a standardized and cooperative registry for conflict-related injuries among children with uniform metadata, definitions, and data elements

Although previously published reports have presented data on injury patterns, resource utilization, and outcomes of children with explosive weapon-related and other conflict-related injuries, the utility of these data is limited by non-uniform reporting.[24] No agreement exists with respect to the definition of which patients are 'pediatric', with inconsistency even between the same authors publishing from the same time period and conflict. Non-standardized age ranges, injury severity scoring systems, and key data elements that support epidemiological and quality improvement efforts hinder planning and organization of the emergency health response.[24 70] Uniform reporting among actors responsible for the planning, organization, and provision of care to children injured in conflict is a precondition for assessment of system-wide performance and quality improvement initiatives. This should take the form of a standardized and cooperative minimum data registry shared with appropriate safeguards and protections of patient security. Consensus should be established on a standard definition of 'pediatric' (eg, age <18 years, in accordance with the United Nations Paris Principles on Children Associated with Armed Groups).[71] While detailed considerations regarding the barriers and facilitators to development of such a registry are beyond the scope of this review, this cross-cutting domain must remain a priority for humanitarian health practitioners in tandem with efforts to strengthen the care of children injured by explosive weapons.[24 40 43]

Generate clinical care guidelines and quality improvement toolkits for high-mortality subpopulations including conflict-related burns, TBI, and age <5 years

Within the limitations of existing data, several subpopulations of blast-injured children have been consistently observed to have disproportionately high mortality, up to 40% in certain cohorts. These include children with TBI, burns, and those <5 years of age. The quality of available data is insufficient to gain further insight into the factors driving high mortality in these vulnerable groups. Attempts to understand why these injuries carry such high mortality rates would be a valuable area for further research and would be a first step towards identifying targeted interventions, clinical practice guidelines, and quality improvement toolkits with the potential to mitigate excess mortality.

Improve coordination between trauma care and disability services and facilitate stakeholder mapping to strengthen referral pathways to rehabilitation services

The long-term functional and psychosocial sequelae of blast injury are profound and can present particular challenges for children in remote areas. Holistic rehabilitation is critical to avert preventable morbidity that may undermine survival gains made in the acute phase of management through loss of quality of life. Additionally, child survivors living with disability require a broad range of rehabilitation services to optimize functional outcomes, particularly in communities without accessible infrastructure. Such needs include physiotherapy for contracture mitigation, speech therapy for craniofacial injuries, amputee services, vocational rehabilitation, and mental health services.[64] Emergency health personnel can contribute to the long-term outcomes of children injured by explosive weapons by having a detailed awareness of rehabilitative resources to facilitate long-term care. Mapping of resources for physiotherapy, prosthetic fitting and maintenance, mental health, psychosocial rehabilitation, adaptive education, and vocational services should be performed in relation to trauma care facilities to improve the understanding of available services. On the basis of such infrastructure mapping, trauma care providers should be able to identify referral pathways to connect children with appropriate rehabilitation services as soon as possible and with care extending across their lifetimes. In this domain, the United Nation's recently passed International Mine Action Standards on Victim Assistance (IMAS 13.10) sets an important precedent.[72]

CONCLUSION

The harm wrought by explosive weapons on children in war is unacceptable. From policymakers at the level of deconfliction, legislation, and advocacy to practitioners providing frontline care and long-term rehabilitation, all

have a responsibility to mitigate the reverberating effects of explosive weapon-related injuries on this vulnerable population. The work of groups such as the International Network on Explosive Weapons, International Campaign to Ban Landmines, and UNICEF among others within the mine action sector on advocacy, policy, injury prevention, and explosive ordnance risk education should be provided full support. Against the backdrop of ongoing efforts to minimize the number affected, children are wounded every day by explosive weapons in conflicts globally including Ukraine, Syria, Yemen, and the Sahara-Sahel. The medical community must renew its attention to improving the care of blast-injured children to minimize profound long-term sequelae and suffering.

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