Increasing survival among civilian victims of explosive weapons:
Linking humanitarian mine action and trauma care in low-resource settings

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In the current state, greater than 1 in 3 casualties of explosive ordnance (EO) die of their injuries.
The Question

What affordable, effective and feasible interventions could increase survival among civilian casualties of explosive ordnance (EO) to 1 in 10 and be supported by mine action services in low-resource settings?
The Partnership:
Synergy with Mine Action Area of Responsibility

**Goal 4: Leverage new partnerships**

Utilize academic research capacity and expertise in injury prevention and trauma care in low-resource settings to maximize impact of UNMAS field operations and advocacy efforts.
The Partnership:
Synergy with Policy Frameworks and Advocacy Initiatives

Oslo Action Plan
(as adopted at the final plenary meeting on 29 November 2019)

Action #36 Provide effective and efficient first aid to casualties in mine-affected communities, as well as other medical emergency services, and ongoing medical care.

Integrated emergency, critical and operative care for universal health coverage and protection from health emergencies

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Victim Assistance in Mine Action

Support for the Political Declaration on Strengthening the Protection of Civilians from the use of Explosive Weapons in Populated Areas
How can the emergency health response to civilian casualties of explosive weapons be adapted to 21st-century conflict?
Saving Lives in Conflict: Reducing Avertable Mortality

BASELINE, EXCESS, AND AVERTABLE MORTALITY

- Baseline Mortality
- Excess Mortality
- Avertable Mortality
- Averted Mortality

*Lives saved

Checchi F. Inferring the impact of humanitarian responses on population mortality: methodological problems and proposals. Conflict and Health. 2023
Reducing Avertable Mortality

1. Bring care forward to the patient

2. Bring the patient to care more quickly

3. Bring better care to the patient

*Lives saved*
The Rationale: Military Approach to Revolutionizing Casualty Care

FIGURE 1-4 Military preventable deaths in the prehospital setting.

**The Rationale:**
Military Approach to Revolutionizing Casualty Care

1. **Bring care forward to the patient**
   - Tactical Combat Casualty Care (TCCC)
   - Role 2 Forward Surgical Teams

2. **Bring the patient to care more quickly**
   - Evacuation out-of-theater to Role 3 facilities

3. **Bring better care to the patient**
   - Advances in control of junctional hemorrhage and hemostatic agents, tranexamic acid
   - Use of whole blood

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**Death on the battlefield (2001–2011): Implications for the future of combat casualty care**

Brian J. Eastridge, MD, Robert L. Mabry, MD, Peter Seguin, MD, Joyce Cantrell, MD, Terrill Tops, MD, Paul Uribe, MD, Olga Mallett, Tamara Zubko, Lynne Oetjen-Gerdes, Todd E. Rasmussen, MD, Frank K. Butler, MD, Russell S. Kotwal, MD, John B. Holcomb, MD, Charles Wade, PhD, Howard Champion, MD, Mimi Lawnick, Leon Moores, MD, and Lorne H. Blackbourne, MD

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**Figure 2.** Survivability pre-MTF casualties.

**Figure 4.** Injury/physiologic focus PS acute mortality (n = 976).

Adapting a Military Approach to Casualty Care for Low-Resource Settings

Unlike the military:
- Limited prehospital transport
- Limited resources
- Limited or absent evacuation
The Framework:
Chain of Civilian Casualty Care (CCCC)

**CHAIN OF CIVILIAN CASUALTY CARE**

- **Layperson First Responder Training**
  First aid training for bystanders (e.g., community members, commercial drivers, police)

- **Layperson Transport Systems**
  Organized networks of community-led transport via private vehicle, motorcycle, bicycle, donkey

- **Prehospital Trauma Training**
  Intermediate trauma care training for medics and prehospital personnel

- **Facility-Based Trauma Training**
  Advanced trauma care training for physicians, surgeons, health officers, nurses, and hospital personnel

- **Prehospital Notification**
  Designated pathways to alert health facilities of incoming casualties via phone or radio

- **Trauma Team Organization and Activation**
  Structured trauma teams with pre-designated roles and mechanisms for activation to prepare to receive incoming casualties

- **Data Collection and Quality Improvement**
CCCC: Methodology

1. **Identify** evidence-based trauma care interventions that reduce injury-related mortality in low-resource settings relevant to mine action
2. **Evaluate** barriers and facilitators to implementation through key informant interviews with sector experts
3. **Model** the potential cumulative mortality reduction of the combined interventions
4. **Create** an integrated chain of post-blast care from point of injury to definitive treatment at health facility
**CCCC Methodology:**
Systematic Review

**What trauma interventions work in low-resource settings?**

1. **Identify** evidence-based trauma care interventions that reduce injury-related mortality in low-resource settings relevant to mine action.

CCCC Methodology: Systematic Review

What trauma interventions work in low-resource settings?
2. Evaluate barriers and facilitators to implementation through key informant interviews with sector experts

“What opportunities and barriers exist to implement these interventions?”

“This is pushing at an open door at the moment…”
CCCC Methodology: Key Informant Interviews

**Layperson First Response**
- Engagement of communities by mine action medics
- Leverage existing community initiatives
- Insufficient understanding of community-specific needs

**Prehospital**
- Engagement and training by mine action medics
- Mapping of prehospital routes/facilities
- Remote locations with prolonged prehospital transport times

**Health Facility**
- Partnerships and coordination of health capacity mapping
- Integration with Ministries of Health/local health authorities
- Lack of human and material resources

What opportunities and barriers exist to implement these interventions?
CCCC Methodology: Modeling

By how much can these interventions reduce mortality?

3. Estimate the potential cumulative mortality reduction of the combined interventions

A 68% mortality reduction potential would bring deaths from 1 in 3 to 1 in 10

Legend
- Interquartile Range
- Median mortality reduction
CCCC Methodology:
Modeling

By how much can these interventions reduce mortality?

- Layperson Transport Systems: 21%
- Layperson First Responder Training: 60%
- Prehospital Trauma Training: 36%
- Prehospital Notification: 11%
- Trauma Team Organization and Activation: 22%
- Facility-Based Trauma Training: 48%

Mortality reduction estimate % (95% Uncertainty interval)
Research and Implementation Gaps

- Clinical controversies
  - Tourniquet Application
  - Spinal immobilization
- Resource harmonization
- Cost efficacy
- Monitoring and evaluation strategies
- Translation of advances in high-resource casualty care to low-resource settings
The Framework:
Chain of Civilian Casualty Care (CCCC)

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Data Collection and Quality Improvement
CCCC Phase 1:
Implementation Strategy and Next Steps

Layperson First Responder Training
First aid training for bystanders (e.g., community members, commercial drivers, police)

The mine action sector can partner with WHO’s Community First Aid Responders Training (CFAR) and American College of Surgeons’ Stop the Bleed to deliver Layperson First Responder Training in affected communities.

This programming can be delivered through EORE community liaisons and mine action medics in a train-the-trainer model.
Key Message No. 2:

In line with Action 36 in the Oslo Action Plan, the mine action sector can partner with trauma care providers to greatly reduce the mortality rate of EOD victims by:

2. Strengthening the local capacity for trauma response:
   • Train EORE community liaisons, deminers, and medics to train layperson first responders
   • Act as implementing partners for WHO CFAR and Stop the Bleed trainings
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