

**The impact of asymmetric warfare on the
methods of response by healthcare providers
working in conflict:
Approaching a new model of intervention**

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Declaration

I hereby declare that, the contents and organization of this thesis constitute my own original work and does not compromise in any way the rights of third parties, including those relating to the security of personal data.

Flavio Salio

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** Thesis submitted in fulfillment of the requirements for the degree of Doctor of Global Health, Humanitarian Aid and Disaster Medicine.*

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List of publications related to the thesis

Author(s)	Title of publication	Journal
Flavio Salio and Altaf Musani	Providing health care in conflict settings: a call for papers	Bulletin of the World Health Organization 2019;97:310 http://dx.doi.org/10.2471/BLT.19.232769
Salio F, Pirisi A, Bruni E, Court M, Peleg K, Reaiche S, Redmond A, Weinstein E, Hubloue I, Della Corte F, Ragazzoni L.	Provision of trauma care in asymmetric warfare: a conceptual framework to support the decision to implement frontline care services	BMC Conflict & Health Confl Health 16, 55 (2022). https://doi.org/10.1186/s13031-022-00490-w
Salio F, Pirisi A, Bruni E, Ciottone G, Court M, Peleg K, Reaiche S, Redmond A, Weinstein E, Hubloue I, Della Corte F, Ragazzoni L.	Applying the Haddon Matrix to frontline care Preparedness and Response in asymmetric warfare	Prehospital and Disaster Medicine Prehospital and Disaster Medicine, 37(5), 577-583. doi:10.1017/S1049023X22001066

Additional publications

Author(s)	Title of publication	Journal
Flavio Salio contributor and overall coordination of the publication	A guidance document for medical teams responding to health emergencies in armed conflicts and other insecure environments.	Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.
Wolff, E., Shankiti, I., Salio, F., & Von Schreeb, J.	The Response by International Emergency Medical Teams Following the Beirut Harbor Explosion in 2020 – Who Were They, When Did They Arrive, What	Prehospital and Disaster Medicine, 37(4), 529-534. https://doi.org/10.1017/S1049023X22000784

Did They Do, and
Were They Needed?

Helou, M., El-Hussein, M., Aciksari, K., Salio, F., Della Corte, F., Von Schreeb, J., & Ragazzoni, L. Beirut Explosion: The Largest Non-Nuclear Blast in History. *Disaster Medicine and Public Health Preparedness*, 16(5), 2200-2201. <https://doi.org/10.1017/dmp.2021.328>

Skelton P, Salio F, Emiroglu N Emergency preparedness and readiness; anticipating the need for rehabilitation *Bulletin of the World Health Organization*, 03 Oct 2022, 100(11):744-746
PMCID: PMC9589385

Sacchetto, D., Raviolo, M., Lovesio, S., Salio, F., Hubloue, I., & Ragazzoni, L. Italian Field Hospital Experience in Mozambique: Report of Ordinary Activities in an Extraordinary Context. *Disaster Medicine and Public Health Preparedness*, 37(4), 553-557. <https://doi.org/10.1017/S1049023X22000772>

Acronyms

CBRN: Chemical, Biological, Radiological, Nuclear Threats

CCC: Combat Casualty Care

EMT: Emergency Medical Team

FDG: Focus Group Discussion

HAZMAT: Hazardous Material

HCW: Health Care Worker

HR: Human Resources

IHL: International Humanitarian Law

IHRL: International Human Rights Law

NGOs: Non-Governmental Organizations

OCHA: Office for Coordination of Humanitarian Affairs

PFC: Prolonged Field Care

PHCs: Primary Healthcare Centers

POI: Point of Injury

SALT triage: Sort, Assess, Life-saving interventions, Treatment and/or Transport triage

SD: Standard deviation

START: Simple Triage and Rapid Treatment

TCCC: Tactical Combat Casualty Care

TSP: Trauma Stabilization Point

WHO: World Health Organization

Preface

People living in conflict-affected areas incur physical and psychological trauma. They are also vulnerable to disease outbreaks and disruptions in the supply of food and water, medicines and health services. High-quality, accessible medical care is very difficult to provide in such settings. The Geneva Conventions hold warring parties accountable for the provision of care to civilians and combatants. However, these parties may not be willing or able to provide medical assistance to conflict-affected populations. Recent major conflicts, such as in Mosul, Iraq and Al Raqqa, Syrian Arab Republic, have moved health and humanitarian assistance closer to the frontline and challenged the risk-averse approach of traditional responders.

Accountability to affected populations, as defined by the Inter-Agency Standing Committee [\[1\]](#), requires humanitarian responders to provide quality assistance in a timely manner while upholding best practices. Medical ethics and international humanitarian law also bind health practitioners to an operational and accountability framework. When warring parties fail to provide care and assistance to civilians, there is still an imperative to save lives and reduce suffering.

The recent experiences of humanitarian responders show that operational guidance on the provision of trauma care in conflict settings is needed. These experiences also constitute valuable lessons, from which best practices can be identified and future responses improved. An assessment of response in Mosul found that the “WHO-coordinated efforts helped address critical needs in the provision of trauma care for wounded civilians and saved lives.” [\[2, 3\]](#) However, the referral pathway used in this response created a complex system of care that could not be used by all humanitarian actors because of proximity to the frontlines and to military personnel. WHO recognized the operational, technical and ethical dilemmas

of the response, trying to balance battlefield care and medical ethics with the humanitarian principles of neutrality, impartiality, humanity and independence [4].

WHO emphasized its role as a provider of last resort, and called for partners to work closer to the frontlines. The debate generated by the referral pathway shows that research is needed on issues of quality of, and access to, timely trauma care, on prevention of attacks on health-care workers, transport, patients and facilities, as well as on outbreak prevention and response.

Most research on trauma care in conflict settings has been done in the context of symmetric warfare, when humanitarian agencies have equal access to all warring parties and the wounded, and where the military is the main provider of care. This research led to changes in care provision at the frontline, where the risk of functional impairment is usually highest.

Rapid evacuation from the location of injury to the care facility is needed to save lives and reduce disabilities. Despite hard-won experience gathered by many military, United Nations, nongovernmental, civilian and humanitarian actors, there is very limited research on health-care provision and civilian protection in asymmetric warfare, where humanitarian agencies have no access to one or more warring party.

1. Introduction

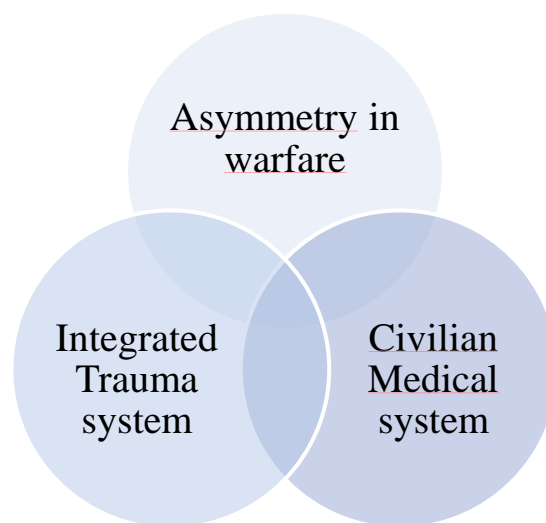
Conflicts and war have evolved considerably over recent decades. This includes the “asymmetrical” nature of conflicts, with non-state actors, armed opposition groups and armed groups participating who are not signatories to International Humanitarian Law and who challenge the very principles underpinning humanitarian action. Humanitarian space has shrunk considerably as a result; healthcare workers are now being targeted frequently and hospitals are attacked with disconcerting frequency. This has changed the modalities of delivering medical assistance and humanitarian aid [5].

Today we also see an increasing number of conflicts fought with heavy weapons in densely populated urban areas, resulting in larger numbers of civilian casualties and larger numbers of trauma patients. This brings with it a set of unique challenges as large numbers of complicated trauma cases require immediate interventions by skilled providers. Since time is critical in order to save lives, this requires the provision of trauma care close to the areas of fighting, with the inherent problems of protecting the aid providers. Because of the proximity to the areas of combat, a certain degree of armed protection for those providers may be necessary in certain contexts, for example by co-locating with armed forces. Such proximity has traditionally been a no-go area for civilian and humanitarian actors, resulting in victims of armed conflict being deprived of lifesaving care with a resulting loss of life.

Additionally, civilian medical systems and personnel are not trained on how to operate clinically in semi-permissive and non-permissive environments. There is no recognized standard for civilian medical professionals engaged in conflict settings targeting the operational skill sets necessary to manage multiple challenges, threats, and adaptation to resource-poor medical settings [6].

The correlation between the asymmetry in warfare, the implementation of an integrated trauma system and its application in the management of civilian casualties represents the foundation of this research.

Figure 1. Correlation between asymmetry in warfare, integrated trauma system and civilian medical system.



1.1 Asymmetric warfare

The early years of the 21st century seem to have become dominated by asymmetric warfare.

In broad terms asymmetric warfare is defined as warfare that involves attacking an adversary's weaknesses with unexpected or innovative means while avoiding his strengths.

The asymmetry in warfare includes increasing trends of siege tactics, urban warfare, proxy wars, the use of more advanced weapons (and correspondingly complex injury patterns) and increased likelihood of CBRN attacks [7].

The anticipated trend, as historical evidence suggests, is showing all conflicts to be increasingly more barbaric together with the continued weaponization of many new technologies. International humanitarian law (IHL) in all types of armed conflict - whether international or non-international - imposes obligations on the warring parties to use their best efforts to collect and care for the wounded and sick. This means either that the parties to armed conflicts perform these medical activities themselves, traditionally through their military medical corps, or, where they are unable or unwilling to do so, to permit others, such as the local civilian administration or impartial humanitarian organizations to assist them. In practice, the civilian administration is often unable to provide assistance in conflict settings, leaving victims – especially civilians - without access to adequate care.

Below and illustration and comparison between the scope of applications and boundaries of IHL, Human Rights and Medical Ethics Laws and Applications.	International Humanitarian Law IHL	International Human Rights Law IHRL	Medical Ethics
Scope of application	<ul style="list-style-type: none"> - International armed conflict - Non-international armed conflict 	<ul style="list-style-type: none"> - International armed conflict - Non-international armed conflict - Other emergencies - Peacetime 	<ul style="list-style-type: none"> - International armed conflict - Non-international armed conflict - Other insecure environments - Other Emergencies - Peacetime

Beneficiaries	- Wounded and sick - Medical personnel	- Wounded and sick - Medical personnel	- Wounded and sick - Medical personnel
Bound by the Law	- States - Armed groups - Individuals ¹	- States	- Medical personnel

Ref. A guidance document for medical teams responding to health emergencies in armed conflicts and other insecure environments. Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.

While states are accountable to other states in the United Nations system in terms of international law and to their own citizens (at least in democratically-governed countries) in terms of domestic law and values, violent non-state actors seem subject to no laws [8]. In addition, political and military analysts have pointed out that non-state group’s purpose is to incite a military response from the enemy state in the areas they control aiming to provoke death of civilians living in targeted areas. In this regard, it is important to acknowledge the need to recognize that not all civilians are non-combatants as some might take a direct or indirect role in the fighting. In summary, asymmetric war expands the range of permissible civilian targets without each side incurring charges of terrorism or disproportionate harm [9, 10].

Considering all the above, do these elements affect the responsibility of the parties to the conflict, under the Geneva Conventions and its Additional Protocols, to provide care to wounded and sick soldiers as well as to civilians?

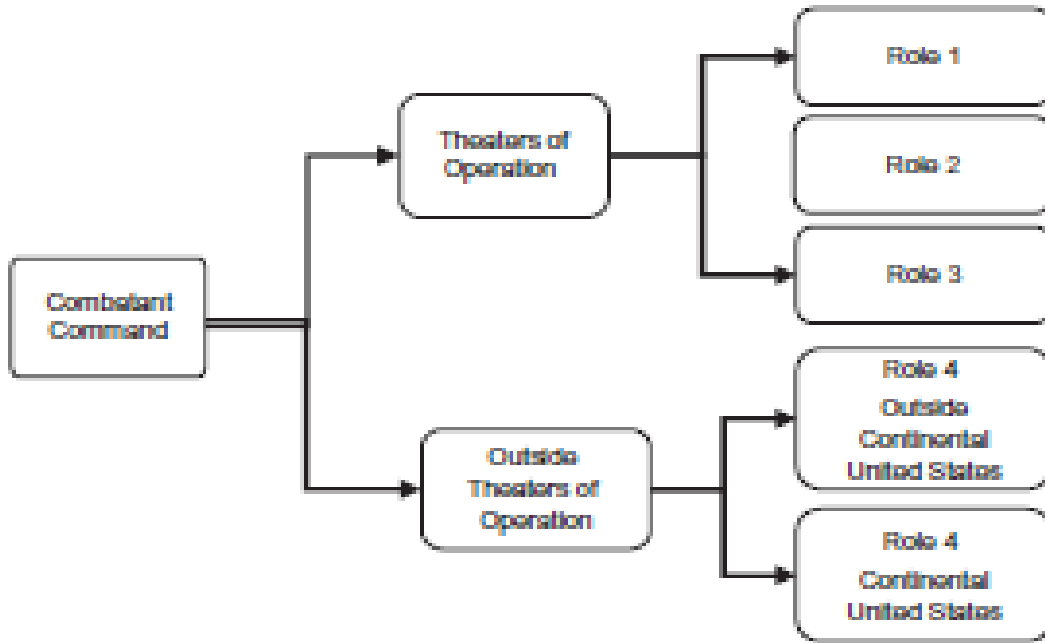
¹ In certain circumstances, also individual civilians may be directly bound by international humanitarian law. For instance, civilians must respect wounded and sick people (cf. Article 18(2) GCI)

1.2 Integrated trauma system

Military research has found that approximately 25% of persons who die as a result of explosive or gunshot wounds have potentially survivable wounds [11]. Many improvements in the clinical outcomes of injured soldiers have come mainly from analyzing the way in which trauma care is executed on the frontline and possibility to improve efficiency. Of relevance, the principles of combat casualty care (CCC) that should be considered in three phases from point of injury, during transport to the hospital, and hospital-based treatment. More recently, prolonged field care (PFC) has emerged as reality of providing medical care to military forces in remote and austere locations far from medical support and the casualty evacuation chain.

The care of wounded military service personnel is based on an integrated trauma system. When Combat Support Hospitals were introduced they were frequently criticized for being too large and cumbersome to meet the needs of the agile troops, and were often far behind the advancing ground forces [12]. The application of the CCC principles and reduced the time from point of wounding to the medical facility has dramatically decreased death rates on the battlefield and, at the same, has created a complex system of levels of care (Figure 2) previously referred to as echelons based on differences in capability and not quality of care [13].

Figure 2. Battlefield trauma system



Ref. Jud Janak, Zsolt Stockinger, MC, USN, Edward Mazuchowski, USAF, MC, Russ Kotwal, MC, USA (Ret.), Jonathan Sosnov, USAF, MC, Harold Montgomery, NREMT, USA (Ret.), Frank Butler, MC, USN (Ret.), Stacy Shackelford, USAF, MC, Jennifer Gurney, MC, USA, Mary Spott, Louis Finelli, MC, USA, David J Smith, MC, USN (Ret.), Military Preventable Death Conceptual Framework: A Systematic Approach for Reducing Battlefield Mortality, *Military Medicine*, Volume 183, Issue suppl_2, September-October 2018, Pages 15–23, <https://doi.org/10.1093/milmed/usy149>

Findings from military research have shown improved survival associated with investments on out-of-hospital phase of care and more advanced en route care capability.

Lessons learned in hostile environments have guided many developments in trauma care in particular in high-income countries with improved casualty outcomes and a lower mortality rate. In this regard, it is important to remark that these two results represent an objective shared by the civilian and military trauma doctrine.

Thus, can lessons from war and military research be a foundation to help reduce mortality and morbidity among civilians injured in conflict settings?

1.3 Trauma pathway and frontline care

The management of civilian casualties in intrastate/asymmetric conflict in Iraq, the retaking of the cities of Mosul and Tel Afar from ISIS by the Iraqi Government forces with allies, generates controversies in particular related to the application of military standards of trauma care in much closer proximity to the frontline.

Key Issues

- The ‘alleged’ breach of **International Humanitarian Law (IHL)** by trauma partners during the Mosul offensive (2016-17)
- Management of ‘risk appetite’ of medical organizations to provide front line high quality medical care
- Phenomenon of **urban warfare** resulting in high levels of civilian casualties and subsequently a public health imperative to save lives
- Ensuring the application of emergency **medical teams standards** by national and international actors



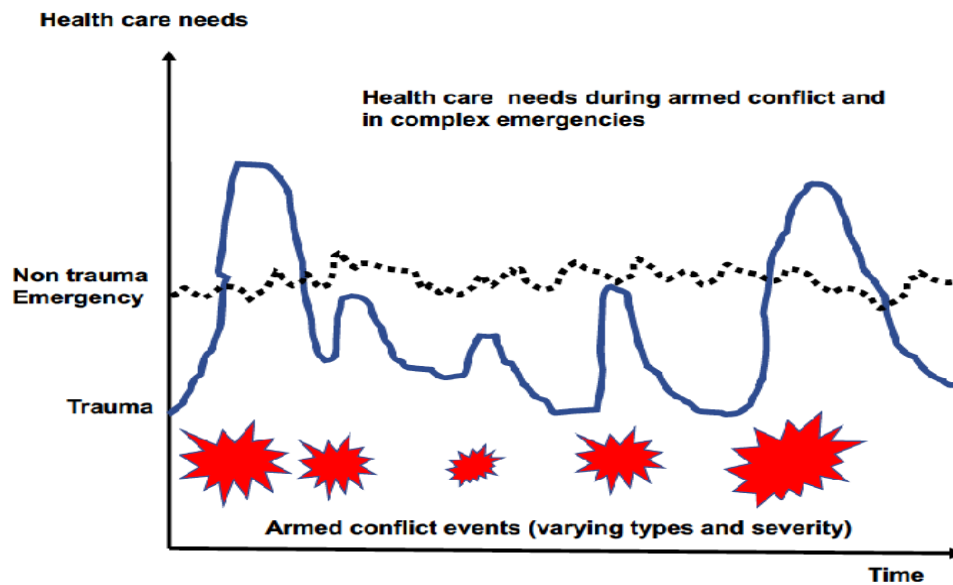
Trauma stabilization points located near the front line and field hospitals positioned within an hours drive saved thousands of lives

In general, the pattern of presentations to health facilities in such settings varies depending upon the transport time of patients. For trauma and other emergency conditions, transfer time is critical, and will not only depend on the distance from the conflict but also on the availability of transport, the security situation, number of check points and road conditions.

The numbers of injured presenting at any one time in armed conflicts will be sporadic,

coming in waves, and dependent on the conflict intensity which in turn can change access to the facility and provoke population movement (Figure 3).

Figure 3. Health care needs during armed conflict and complex emergencies



Ref. A guidance document for medical teams responding to health emergencies in armed conflicts and other insecure environments. Geneva: World Health Organization; 2021. License: CC BY-NC-SA 3.0 IGO.

The development of an echelon-based trauma care, defined as the stratification of the tiers in which medical support is organized, and referral pathway system (Annex II) was designed to address the medical complications derived from the offensive especially among the civilian population. Several assumptions were made including the consideration related to the application of a “trauma bypass” system, meaning critically injured should not be taken to Primary Healthcare Centers (PHCs) but rather direct from the stabilization point to the forward receiving/field hospitals [14]; estimates of ambulance transfer times required as the trauma system comes into effect including the possible inter-ambulance transfers; for severely

injured patients, care providers will need to be paramedic level or above during transport - as general guiding principle, the level of care provided during transport must aim to be at least equal to that at the point of referral and must prepare the patient for admission to the receiving service; as the frontlines advance, often along roads badly damaged or destroyed combined with increasingly long transfer times [15].

The medical planning presented health staff with several major challenges and was associated with controversy all of which have implications for future decisions. Additionally, it has challenged existing humanitarian principles and some humanitarian organization's modus operandi.

Recent intrastate conflicts have proven difficult for the humanitarian community, often unprepared, to safely gain access to vulnerable populations and the way to operationalize principles varied greatly between humanitarian actors. The form of substitution has been seen as a fundamental element to the protection of the victims and the medical personnel in situations where humanitarian principles have been compromised [16]. Therefore, a legitimate de-coupling or a compromise in relation to the respect and application of the principles, should be the result of exceptional circumstances and a specific context, and not a choice made by bias or agenda.

Figure 4. The four main principles underpinning humanitarian action

Humanity	Neutrality	Impartiality	Independence
Human suffering must be addressed wherever it is found. The purpose of humanitarian action is to protect life and health and ensure respect for human beings.	Humanitarian actors must not take sides in hostilities or engage in controversies of a political, racial, religious or ideological nature.	Humanitarian action must be carried out on the basis of need alone, giving priority to the most urgent cases of distress and making no distinctions on the basis of nationality, race, gender, religious belief, class or political opinions.	Humanitarian action must be autonomous from the political, economic, military or other objectives that any actor may hold with regard to areas where humanitarian action is being implemented.

Ref. OCHA

http://www.unocha.org/sites/dms/Documents/OOM_humanitarianprinciples_eng_June12.pdf

To what extent can we apply military knowledge and experience to humanitarian action?

Are humanitarian principles indivisible or does an implied hierarchy exist, creating a need to compromise one to achieve another?

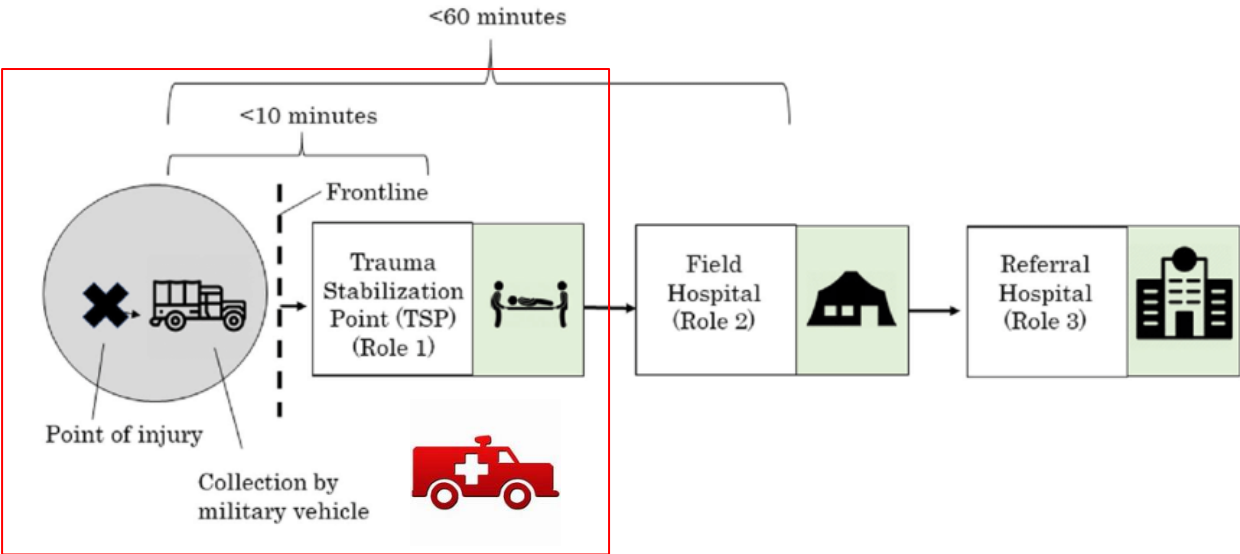
Steps have been taken to clarify the importance for medical teams and humanitarian organizations on how to maintain the core principles of humanity and impartiality as the overarching driver of the response, addressing suffering wherever it is found in a non-discriminatory manner, strictly based on needs, with priority only allowed for medically more urgent cases, as required by core humanitarian principles and medical ethics also found in IHL; and still remain guided by the other humanitarian principles of neutrality, and independence in delivering the response [17].

All the above generate the need to explore a model of intervention in such contexts that ensures a balanced technical and principled approach. This topic is at the forefront of healthcare debate and very limited evidence-based research is available since it has never

been explored from the technical and humanitarian standpoint.

The essential component of this model for improved trauma capability is the rapid stabilization of the injured and their timely evacuation through a tiered system of care.

Figure 5. Trauma care pathway with highlighted focus area of the study



Modified from Garber, Kent & Kushner, Adam & Wren, Sherry & Wise, Paul & Spiegel, Paul. (2020). Applying trauma systems concepts to humanitarian battlefield care: A qualitative analysis of the Mosul trauma pathway. *Conflict and Health*. 14. 10.1186/s13031-019-0249-2.

2. Rationale and methodology

2.1 Significance

Recent conflicts have presented new and different challenges to an effective trauma response and call for the updating of old paradigms including the type and level of trauma services to be provided and the systems for referrals. The experience of civilians providing advanced trauma care in a conflict marks a new era that has seen new providers and strategies contribute towards more lives being saved. Considering that truly austere circumstances do exist, not only in many armed conflicts around the world but also in daily practice in low-income countries, and can push even the most organized health-care systems to the limits, innovative solutions can strengthen the resilience of these systems through better preparedness and structured planning.

Taking into consideration the implications of asymmetric and urban warfare on the provision of medical care to civilians, by transitioning from an approach solely driven by military medical doctrine and incorporating civilian medical practices, the model has the potential to play an important part in improvements in prehospital operational environment and contribute to decrease both mortality and morbidity in conflict settings.

This research, inspired by the call for standardization and the potential benefits and application of the model in the future, has addressed the question: how can lessons from the implementation of trauma care close to the frontlines contribute to generate a model for the provision of trauma care in asymmetric conflict such as Iraq?

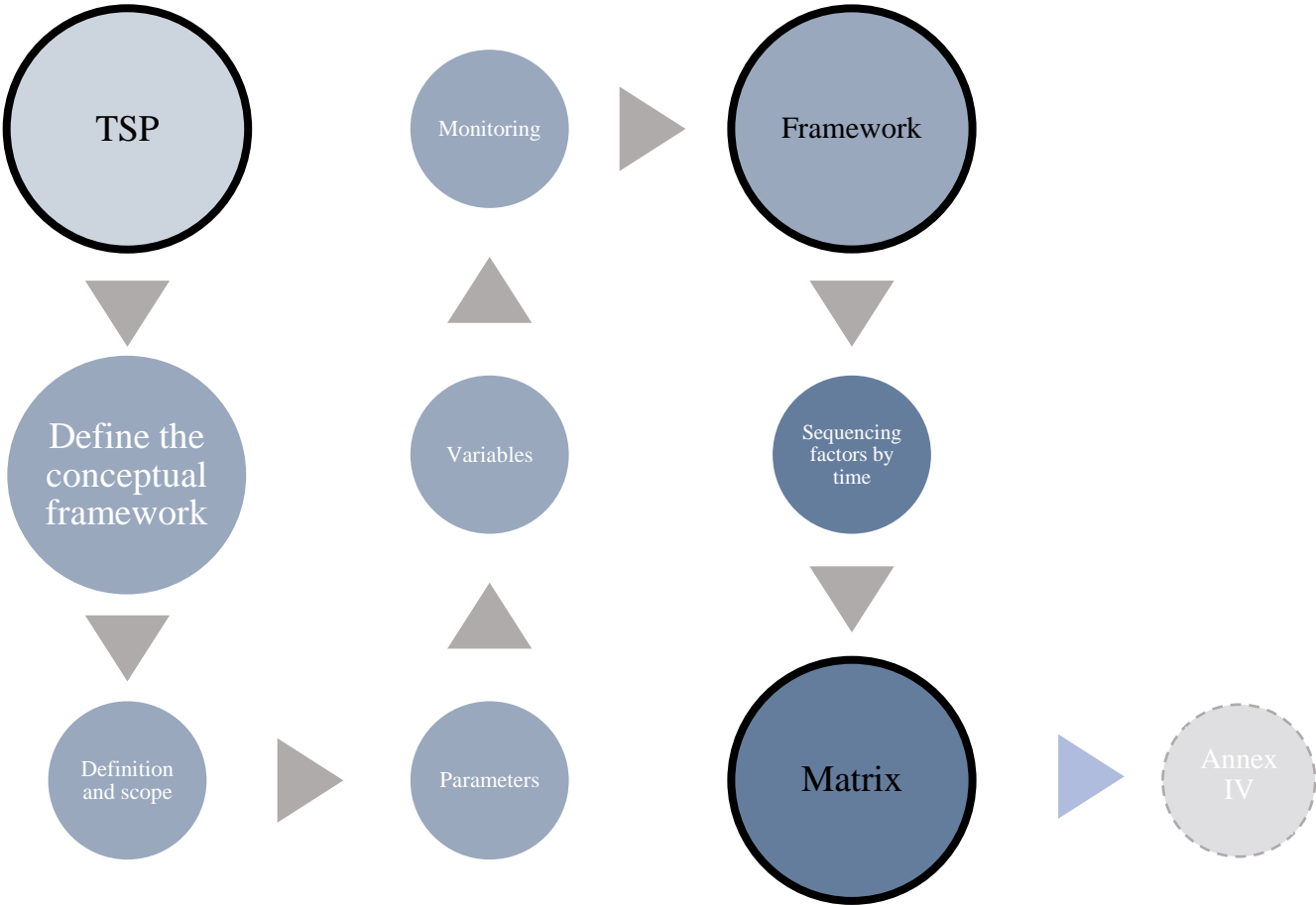
Hereafter the methodology is presented including the process followed to overcome the limitations derived from limited availability of literature, documents, military and civilian data, all influenced by context and challenges of war as well as the new approach.

2.2 Methodology

There is very limited research on health-care provision and civilian protection in asymmetric warfare. Lack of a solid amount of literature and the innovative nature of the topic encouraged the use of more inductive approaches and semi-structured interviews involving subject-matter experts.

The approach taken considered three phases as per Figure 6; research design and methods are presented in the description of each phase.

Figure 6. The approach (phases)



Step 1: Trauma Stabilization Point (review)

To support the development of the model, it is important to have a thorough understanding of the available academic literature and resources available. This ensures the standards are rooted in the best currently available evidence and align with existing standards or practices put forward by other best practice organizations.

Considering the circumstances and the period when the research was initiated, a narrative review was selected as method to broadly summarizing and describing all relevant concepts present in the literature, being well suited to answer broad questions, or multi-faceted questions with limited existing knowledge. Subsequently, a grey literature search was performed using natural language searches of Google and millionshort.com. Finally, a review of relevant documents from civil society and humanitarian organizations was conducted.

Keywords were selected in two areas: setting (Conflict OR Asymmetric Warfare) and intervention (trauma stabilization point). The outcome of the three steps' search resulted in only few documents addressing the broader response to the Mosul battlefield, none addressing the specificity of the provision of trauma care close to the frontline. Nevertheless, the potential contribution of the TSP has been described contingent to the presence of a system of care meeting the following requirements:

1. adequate transport;
2. transfer to a receiving facility able to provide more-advanced care;
3. capability to maintain care en route.

A summary of the findings and recommendations relevant to the research objective is presented in the Table 1.

Table 1. Findings and recommendations linked with the new model.

Finding (s)	Recommendation
<p>Although initial plans called for field hospitals to treat non-trauma medical emergencies, in practice some facilities did not initially consider this care to be part of their mandate.</p>	<p>Standardize emergency non-trauma care, including OBGYN services, in future planning, including explicitly defining these types of services in TORs with contracted providers.</p>
<p>Standard operating procedures (SOPs) may have differed among TSPs, field hospitals and providers, or in some cases were non-existent.</p> <p>The 72-hour policy to discharge patients may have exacerbated post-operative complications.</p>	<p>Ensure standardized SOPs are created and require implementing partners to follow them.</p> <p>a. Stronger efforts should be made to include professional societies and international organizations to develop clinical protocols and standards for civilian care on the battlefield.</p> <p>b. Develop flexible procedures that allow complex patients to stay in field hospitals longer if adequate referral is not available and avoid strict time limits.</p>
<p>WHO added dozens of civilian ambulances to the combat theatre, but ambulances generally lacked en route care.</p>	<p>Support ambulances with trained personnel and appropriate resources to the extent possible to allow en route care, as well as stronger and more sophisticated communications systems to ensure patients reach the intended point of care.</p>
<p>Static field hospitals limited their trauma utility as the battlefield moved onwards.</p>	<p>Future consideration as to the feasibility and cost of mobile field hospitals needs to occur.</p>
<p>Data were insufficient to make conclusions regarding quality of care at field hospitals.</p>	<p>Track critical processes and outcomes using clinically appropriate indicators (e.g. injury severity scores, mortality and complication rates) to improve quality of care.</p>
<p>WHO searched for and found partners, all of whom had never undertaken such work in conflict settings, after “traditional” partners declined.</p>	<p>Whenever, possible, organizations with strong experience in conflict and war trauma should be mobilized.</p> <p>a. Strong pre-deployment training including components on international humanitarian law and humanitarian principles as well as contextually appropriate medical procedures.</p> <p>b. Clear understanding of high-risk environment, particularly for those working in TSPs, needs to be undertaken pre-deployment.</p> <p>c. Post-deployment psychosocial support needs to be made available.</p>

Local leadership (Ninewah DoH) played a critical role in providing leadership and operational guidance, as well as access to Iraqi military counterparts.	National and district leadership should be prioritized together with capable local partners with strong networks in any future response.
Field coordination at the TSP level was outsourced due to security reasons and fell largely to a single individual working for one of the implementing partners.	WHO should support field coordination more strongly with additional personnel and resources as well as more sophisticated tracking mechanism from TSPs to field hospitals and onward after hospital discharge.
Proximity to armed actors is not inherently a compromise.	The basic tenets of civil-military coordination provide a framework for mutual respect of mandates and coordination, but this framework also relies on distinction.
Participation of non-traditional medical actors.	Adapt to operational challenges, especially in counterterrorism, urban warfare and asymmetrical negotiation contexts.
Acknowledge the role that security played in the response.	Internalizing the reality that issues other than principles and potential future consequences play a role in the decision-making, hindering assertive and timely action and innovative problem solving.
Medical ethics seem to preserve a rudimentary form of impartiality to ensure the protection and equal treatment of all patients, irrespective of identity or affiliation.	This may serve as an acceptable minimum standard for operating in sub-optimal conditions to save lives. Thus, reinforcing the implementation of medical ethics might be a more productive route with non-traditional medical actors.
WHO and its partners together with Ninewah DoH attempted to plan for sustainability in terms of training Iraqi medical personnel as well as hand over and usage of facilities and equipment, but there were numerous challenges.	Further consideration needs to occur regarding: creating new hospital structures versus rehabilitating damaged structures; siting of facilities; capacity building efforts; and longevity of funding for human resources and functioning of facilities.
The system requires planning ahead of time.	An assessment of the tactical circumstances must be made and an analysis of the physical limitations and human resources must be carried out before the plan is implemented.
There is often confusion as to what is practical in different contexts.	Access and security of medical staff remain the greatest barriers to bringing treatment to the wounded.

NB: despite the review didn't bring significant elements related to the new model, access to the WHO Trauma Working Group documents and the work conducted in parallel for the definition of a guidance document for medical teams working in conflict settings and unsecured environments, involving hundreds of contributing groups, individuals, organizations, academics, governments, NGOs/Civil Society Organizations and militaries and [published](#) in 2021, significantly supported this research. All these elements reinforced the choice of selecting the Delphi technique as method since experts can draw on various sources of information to make their judgments.

Step 2: Framework

Considering the complexity of the research topic, the novel approach, the fact that knowledge was uncertain and incomplete, this step focused on the process to decide when to provide frontline trauma care services in form of TSP.

For the purpose of this research and based on the lack of consensus on when to establish TSP in asymmetric warfare, it was decided to adopt the Delphi technique (type 4) as described by Häder [18].

Delphi techniques are used internationally to investigate a wide variety of issues. The aim is to develop an expert-based judgment about an epistemic question using an iterative process. This is based on the assumption that a group of experts and the multitude of associated perspectives will produce a more valid result than a judgment given by an individual expert, even if this expert is the best in his or her field.

The definition of the conceptual framework was guided by specific questions as presented below.

Conceptual Framework

What is a Trauma Stabilization Point?

Which is the TSP’s role?

Which are the characteristics that help to define the TSP and facilitate its establishment?

Which are the external factors that should be taken into consideration in the planning and setting up of the TSP?

What elements would you consider as part of the TSP’s monitoring and quality improvement?

The details of the Delphi process are presented in Chapter 3.

Step 3: Haddon Matrix

Effective preparedness and response require tools to better understand and prioritize emergency readiness and response needs, as well as to facilitate solutions. Of relevance to this research, we extended the use of the Haddon matrix to provide a solid understanding of activities to be performed before, during and after the implementation of TSP.

Figure 7. The Haddon matrix

	Host	Vector & Vehicle	Physical environment	Social environment
Pre-event				
Event				
Post-event				

The phases of an event are depicted on the matrix as a continuum beginning before the event (pre-event), the event itself (event phase), and sequelae of the event (post-event phase). These are the phases at which change would have its effect. Each cell of the matrix represents a

distinct locus for identifying strategies to prevent, respond to, or mitigate injuries. Once the Haddon matrix has been filled, the cells present pre-event, event, and post-event task-oriented items that can be prioritized and/or assigned to appropriate personnel.

The process to use the Haddon matrix followed a number of steps as presented below.

The process to use the Haddon matrix

1. *The problem*: ideally community needs assessment data should be used to determine the problem in need of intervention (see Step 1)
2. Define the dimension *columns*
3. Define the dimension *rows*
4. Define *value criteria* (*feasibility, effectiveness and gap oriented*)
5. *Brainstorm* contributing factors and potential interventions by phases
6. Organize data to permit *categorization* based on similar patterns or characteristics
7. *Fill in* cells formed by columns and rows
8. *Assess* each intervention against value criteria
9. Make decisions about best options (*consensus*)

Notes: group brainstorming was useful to generate ideas about interventions in each of the cells. Participants from different disciplines bring different perspectives to the problem and to solutions, enriching the overall pool of ideas. By applying the principles of brainstorming in which all ideas are recorded without critical comment before discussion, the process can provide a variety of options. A glossary was agreed as reference to align terminology and related definitions [19].

The details of the process followed and outcome are presented in Chapter 4.

3. Provision of trauma care in asymmetric warfare: a conceptual framework to support the decision to implement frontline care services

This session is based on the article published by Salio F, Pirisi A, Bruni E, Court M, Peleg K, Reaiche S, Redmond A, Weinstein E, Hubloue I, Della Corte F, Ragazzoni L. Provision of trauma care in asymmetric warfare: a conceptual framework to support the decision to implement frontline care services. *Confl Health* 16, 55 (2022).

<https://doi.org/10.1186/s13031-022-00490-w>

3.1 Rationale of the study

The emerging trends of asymmetric and urban warfare open a needed debate that was predicted to occur once intrastate, non-international armed conflicts began to dominate over interstate or cross-borders wars during the post-Cold War era which have today all but disappeared [20 21]. Asymmetric conflict brought tension between humanity and the demand of military operations and, when respect by one-part fades, mutual disrespect for the adversary and the law of armed conflict increases [22]. While emphasizing the role of each party in providing frontline care to the wounded, it is argued that asymmetry in war expand the range of permissible civilian targets without each side incurring charges of terrorism or disproportionate harm [23].

Military research and the analysis of the way in which trauma care is executed on the frontline have significantly contributed to improvements in the clinical outcomes of injured soldiers and redefined the trauma paradigm towards improving efficiency. By moving medical capabilities as close as possible to the point of injury (POI), better tactical pre-hospital care and reducing the time from POI to the casualty arriving at a medical facility, death rates on the battlefield have decreased significantly [24 25].

The extent to which civilian and military trauma care and innovation have been of mutually reinforcing benefit is reflected in the successful adoption of systems and processes into the civilian trauma settings. However, most research on trauma care in conflict settings has been done in the context of symmetric warfare [26]. Nowadays, this is challenged by external factors such as nonlinear battlefields, the principle of distinction and the rising need for civilian actors to provide and adjust treatment capacity to the acute increase in demand and to sustain its functionality for prolonged periods [27]. Considering the above and the direct correlation between proximity and effectiveness of medical aid operations, the concept of the Trauma Stabilization Point (TSP) is introduced.

The TSP is proposed as the first site of care staffed by trained medical personnel. Its primary function is to provide far-forward emergency resuscitation and stabilization and must be capable of functioning in resource-constrained environments [28].

There is no consensus on the process to decide when and how to provide frontline trauma care services in the context of asymmetric warfare. The time is right to bring varied experiences and experts together to agree on a commonly accepted framework to support this process and better allow future dissemination of best practices.

3.2 Aim of the study

This study aims to describe the development of a conceptual framework to support the decision to implement frontline care services by using expert consensus process. This framework serves as a necessary first step to foster critical debate for health care decision-making to facilitate the decision on how to implement tactical pre-hospital care in complicated and demanding intrastate conflicts.

3.3 Methods

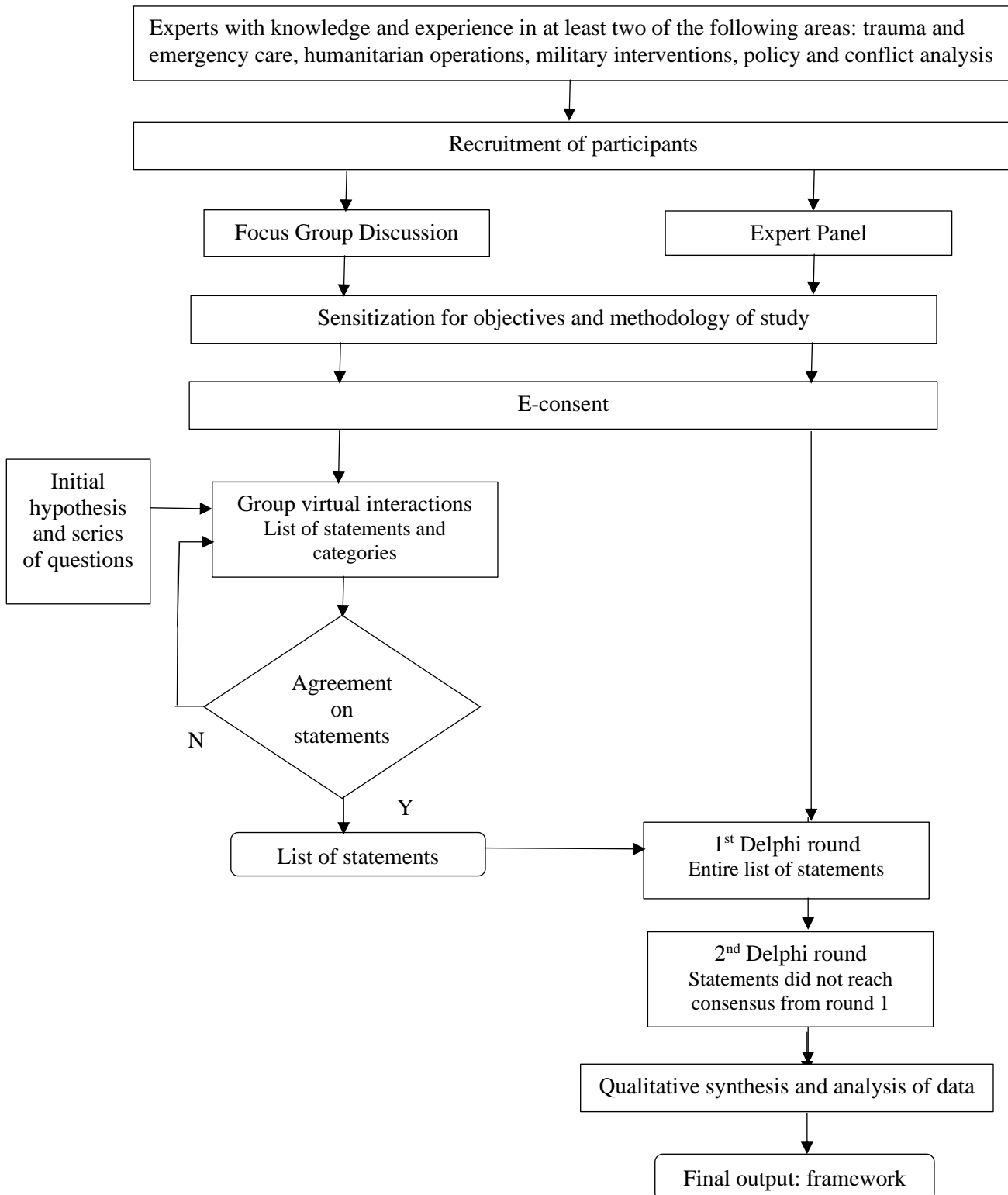
Study design

The Delphi method has been selected to make effective use of informed intuitive judgement and derives from personal expectations from individuals rather than predictions from well-established theory. A convergence of opinion has been observed in the majority of cases where the Delphi approach has been used. It provides anonymity for respondents, the possibility to review and assess the comments and feedback provided by the other Delphi panelists, a controlled feedback process, and the suitability of a variety of statistical analysis techniques to interpret the data [29]. A three-step Delphi method was used to establish consensus and, considering the limited evidence, available in the literature, a focus group discussion was set up to develop the list of statements to be submitted to the group of experts.

Panel Selection

The criteria used to guide the selection of the Focus Group Discussion (FGD) and Delphi experts included consideration of individuals who were highly trained and competent within their specialized area of knowledge and expertise who might potentially utilize the outcomes of the study. Therefore, experts were chosen based on sector expertise and experience in trauma and emergency care, humanitarian operations, military interventions, policy and conflict analysis with a willingness to revise their initial or previous judgments for the purpose of reaching or attaining consensus. Twenty-eight experts out of the thirty-two contacted provided consent and agreed to participate while ten experts formed part of the FGD.

Figure 8. Methodology in the Delphi consensus study



Focus Group Discussions

A brief document containing a clear explanation of the objective of the study and specific instructions for member participation was circulated by email to all ten members of the FGD. All the members were familiar with the TSP concept as were involved or exposed to it during its first iteration in Iraq and Syria.

No research is available pertaining to the necessary process to facilitate the decision to implement the TSP. Thus, during the first virtual meeting the panel has worked on a list of elements to consider for the establishment of the TSP. The elements were grouped into categories followed by the development of a list of 21 statements agreed during the second panel meeting. FDG members were encouraged to discuss the statements until agreement was reached. The draft document containing the list of statements divided in 5 categories was circulated by email to all 10 members of the FDG for confirmation while the opportunity to provide additional comments and recommendations was given and feedback recorded.

Delphi Round 1

A brief document containing a clear explanation of the objective of the study and specific instructions for member participation was circulated by email to all twenty-eight panel members. Experts who agreed to partake in the study were sent an email invitation to create a username and password on the Stat59 online platform (Stat59 Services Ltd, Edmonton, AB, Canada) where the surveys were managed. Seven-point linear numeric scales were used, and each expert was requested to assign a point value ranging from 1 (strongly disagree) to 7 (strongly agree) beside each statement. Experts were also given the opportunity to provide comments and suggest additional items that may not have been included when developing the initial list of statements.

Consensus was defined as at $SD \leq 1.0$ [30]. Statements meeting consensus were removed from the next round, while those not meeting consensus were re-proposed to the panelists for round

2.

Delphi Round 2

The list of statements that did not reach consensus from round 1 was proposed for an additional round to all 28 members. In round 2, the experts used the same voting method as described for round 1. However, feedback in the form of a statistical representation of the group scores and comments was provided in way to reduce the range of responses while preserving the anonymity of each participant. Final responses were analyzed as described for round 1 while calculation on the % of agreement (agree/strongly agree) among the group was verified as well.

Data Analysis

Data analysis was performed using Stat59. As there are no rigidly defined published standards of how to measure consensus and ranking for Delphi studies, for this study, the criteria for consensus was set a-priori as a standard deviation of less than or equal to 1.0 [31]. Statements that reached consensus were then ranked by their mean scores. Standard deviation and mean were chosen over intra-quartile range for four reasons. Firstly, Seven-point unanchored linear numeric scales are considered by many authors to be robust to the assumption of normality [32]. Secondly, for numbers of experts near 30, the underlying sampling distribution of the responses should be near normal as per the central limit theorem [33]. Thirdly, as the overall measurement of dispersion is to ensure consensus, standard deviation is more sensitive to outliers. Fourthly, as only those statements reaching consensus (with a narrow standard deviation of less than or equal to 1) it is unlikely that there will be a significant difference between mean and median in these cases. And, finally, as the Delphi studies represent a type of hybrid between qualitative and quantitative studies, it is unlikely that choice of parametric or non-parametric studies is unlikely to make a mean.

Additionally, eighty percent (80%) of participants agreeing/strongly agreeing was considered as another appropriate measure of content validity and consensus as per previous Delphi studies [34]. Comments and recommendations provided by the FGD and during round 1 were used to analyze the findings of the study.

3.4 Results

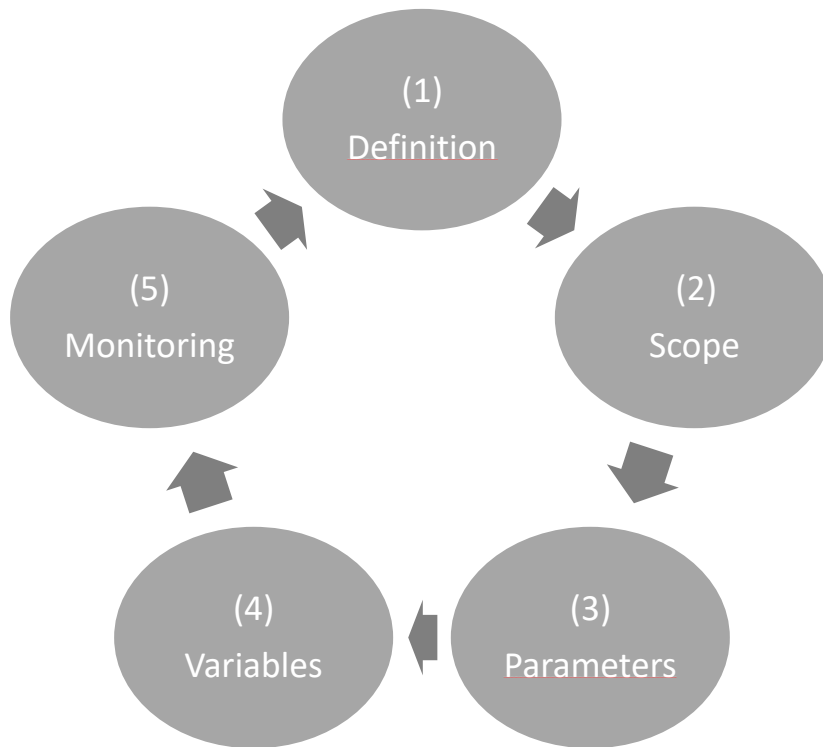
All the twenty-eight (28) experts invited to participate in this Delphi study completed both round 1 and round 2. The experts had at least two of the criteria for inclusion in the study with the majority having sector expertise and experience in trauma and emergency care and humanitarian operations or military interventions. Broader agreement on the proposed 5 categories as key elements of the proposed conceptual framework.

Focus Group Discussions

This exercise built on the consensus of the need for the TSP approach helped to identify the five main categories forming part of a conceptual framework that contribute and support the decision to implement or not the TSP.

The five main categories include the definition, scope, parameter, or characteristic that helps to define or classify the TSP, variable or external factor that should be taken into consideration in the planning and set up of the TSP, its monitoring and quality improvement. Lastly, 21 statements were developed to provide elements to support the decision-making process.

Figure 9. Conceptual Framework



Delphi Round 1

After round 1 voting was completed, 12 of 21 statements reached consensus. Looking to the results by group, the category “definition” had 2 of 4 statements reached agreement, the category “scope” 1 of 4, the category “parameter” 3 of 4, the category “variable” 2 of 5 while the category “Monitoring/Quality improvement” 4 of 4. Additionally, 24 comments were recorded many of which at operational and tactical level suggesting practices derived from personal experience and measures oriented toward concrete resources and requirements needed. 9 Statements with higher variation than 1 were re-proposed to the panelists for round 2.

[Table 1](#) List of statements that did meet consensus after round 1

Delphi Round 2

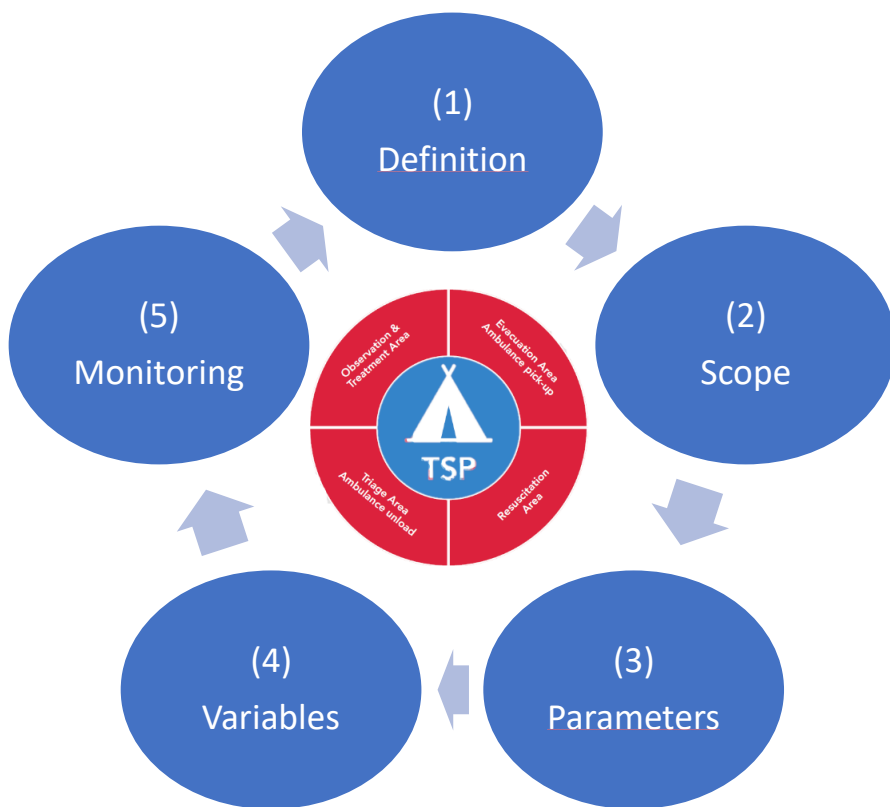
After round 2 voting was completed, panel members reached consensus on 1 statement under the category “definition”. Despite a SD slightly above 1, the statement under the category “parameter” such as “Proximity - The TSP should be positioned as closely and safely as possible to the point of injury (POI)” was included under the final approved list having met 89% agreement. The same approach was used for the statement under the category “variable”: “Access – TSP staff should have the ability to safely enter the affected area and provide medical services” having met 82% agreement. A total of 6 statements did not reach consensus.

[Table 2](#) List of statements that did meet consensus after round 2

[Table 3](#) List of statements that did not meet consensus

[Table 4](#) Additional comments provided by the experts group

Figure 10. Proposed conceptual framework



Definition	√
The Trauma Stabilization Point (TSP) is the first site of care staffed by trained medical personnel	
TSP must be capable of functioning in resource-constrained environments	
The primary function of the TSP is to provide far-forward resuscitation and initial stabilization in the form of airway, hemorrhage and fracture control	
Scope	
The TSP has an important triage role, rapidly transferring the more serious injuries to a higher level of care and identifying minor injuries	
Parameter	
Proximity – The TSP should be positioned as closely and safely as possible to the point of injury (POI).	
Mobility and/or Flexibility – The TSP should ensure an agile system to move and/or expand medical services based on the changing needs	
Transport – Adequate transport and transfer to a receiving facility that has the capability to provide more advanced care should be available	
Safety – The TSP should be an environment of care that is safe for patients and health care personnel with risk management plans that are context and area-specific	
Variable	
Chain of referral – There should be a level of integration across the chain of care with continuity from POI to definitive treatment and rehabilitation	
Conflict dynamics – Combat strategies, intensity, and geographical location may influence clinical presentations at TSP	
Access – TSP staff should have the ability to safely enter the affected area and provide medical services	
Monitoring/Quality Improvement	
Indicators and metrics which monitor areas where TSP can make a difference in patient outcomes or staff safety should be developed	
Time per patient spent at the TSP should be carefully monitored although its interpretation is dependent on several factors.	
Transport time to a higher level of care should be carefully monitored although its interpretation is dependent on several factors.	
Mechanism of injury and anatomic injury patterns are important criteria in monitoring and predicting workload and should be tracked.	

NB: the process can be stopped at each step if the requirements are not agreed or met.

3.5 Discussion

This study describes the development of a consensus-based framework to support the decision to implement frontline care services. This framework presents five main categories identified as interconnected components that facilitate the decision to implement or not the TSP. Under each component, several elements have been identified as being able to guide the decision to utilize such capability in high-risk security and resource constrained settings. The TSP has the potential to prevent death and disability, careful analysis of the findings of the study per category is presented.

Definition - The application of military standards of trauma care closed to the frontline has challenged existing humanitarian principles and some humanitarian organization's modus operandi [35]. The use of a TSP is not considered appropriate for all conflict settings in particular where fighting is sporadic or frontlines are poorly defined. This is in contrast to the vision of the military medical community challenged by the nonlinear battlefields of Iraq, Afghanistan and the Arabian Peninsula, calling for a revision of the doctrine, training and the concept of the Role 1 care (tactical combat casualty care) [36].

Scope - The implementation of the TSP model during the Gaza trauma response has been shown to save lives and decrease the burden on already overwhelmed referral hospitals. It is envisaged that tools and lessons learnt can be adapted and applied to countries that are experiencing conflict and civil unrest in the region [37 38]. The scope of the TSPs was set around two main roles: the triage, treatment and discharge of patients with minor injuries and the triage, stabilization and referral of critical patients with life-threatening or limb-threatening injuries. A similar approach (First Aid Post) was applied in Afghanistan recognizing a more variable pattern of injuries and lengthy delay from injury to hospital

treatment for civilians [39]. The perspective from the panel members was prudence in relation to the scope of the TSP and the risk of a broader (and inappropriate) spectrum of procedures performed at the site. This suggests the need to invest in a wider awareness and clarification of the scope of the TSP, with consideration of recent available guidance from the World Health Organization [40].

Parameters - The approach applied in both combat and civilian emergency medical systems (EMS) considers the proximity to, the provision of lifesaving interventions at the site of illness or POI and reducing time to definitive medical care. Recognizing dissimilarity between combat and civilian trauma care, similar factors appear to affect the implementation of the TSP such as resource limitations, extreme environments, varying evacuation time and transportation platforms [40, 41]. Safety of patients and health care personnel is a paramount and risk management plans must be context and area-specific [42]. TSPs would ideally be located within the “platinum 10 minutes” of the POI or within 20 minutes considering the contextual constraints [28, 40]. However, others will argue that evidence for operational decisions based only on the Golden Hour of Trauma is weak and time to treatment should not be over-emphasized [43]. A short transport time is still worth pursuing, best achieved through robust evacuation resources and processes. All these factors should be taken into account when planning the trauma care pathway, including the location of the TSPs, a trauma by-pass system and the fact that in many situations aeromedical evacuation for civilians is not an option [44 45].

Variables - The scope and level of interaction between civilian and military forces and other armed actors is always context-dependent involving the adoption of relevant measures to minimize the risk to civilians and the analysis of how to operate effectively. However, regardless of the situation, the type and scale of threats to civilians must be identified,

including who is vulnerable and why, to establish the basis for intervention. Existing medical capacity and capability and their implications for trauma system organization must be identified [46, 47]. Variation in the responses of the panel members and strong emphasis on humanitarian principles suggest the need for continue debate on this important variable.

Monitoring – There was group consensus regarding the need for a monitoring and a quality improvement system. TSP and hospital data help to periodically assess the adequacy of the chain of casualty care, the efficiency of first-aid measures and the evacuation system itself. Hospital mortality decreases as evacuation time increases; thus rapid evacuation is of vital importance [48]. Therefore, time per patient spent at the TSP and transport time to higher level of care should be carefully monitored although their interpretation is dependent on several factors (sample of medical record provided in Annex III). For example, prehospital professionals are generally expected to keep trauma scene-time stabilization under 10 minutes and report fatality rates during transportation. Similarly, although recognizing the quality of emergency and trauma care in resource-constrained settings is understudied, potential improvements could be made by analyzing and periodically reassessing the existing transport patterns and targeting cost-effective outreach of trauma care [49].

Several considerations have been made by the group of experts towards the importance of defining the TSP functionality. Of relevance, the definition of the minimum requirements in terms of skills, staff, equipment and resources needed as well as a curriculum for civilian medical systems and personnel to operate clinically in semi-permissive and non-permissive environments.

3.6 Strengths and Limitations

A multidisciplinary panel of physicians, nurses, paramedics, humanitarian and military experts, and policy makers from over 17 countries came to a consensus on this conceptual framework. The rigorous Delphi technique enabled statements to be honed and its anonymity reduced the effects of dominant individuals; often a concern within group-based processes that collect and synthesize information. However, the process may have benefited from a face-to-face meeting at its end phase to allow experts to exchange important information and clarify their reasons for disagreements. Particularly, it seems that the different profiles and experiences of the experts played a key role in the deviation observed in some statements due to their professional position/vision of the problem. A possible face-to-face meeting was not included in the proposed methodology and authors decided to respect the anonymity agreed at the beginning of the process.

3.7 Conclusions

Using consensus-based evidence, this study presents a conceptual 5-step framework to support the decision to implement or not the TSP. Recognizing lack of empirical data on the benefit of such intervention, the proposed framework and categories add a structure to the decision-making process. Following the steps from 1 to 5 will allow for better definition of role, extent, and scale of such intervention. A very important step to support emergency and trauma care planning and implementation efforts. Additional research and debate are required to clearly define the scope, its functionality and the integration of such approach in asymmetric and urban warfare for the benefit of populations in conflict.

4. Applying the Haddon Matrix to frontline care Preparedness and Response in asymmetric warfare

This session is based on the article published by Salio F, Pirisi A, Ciottone GR, Echeverri LM, Peleg K, Redmond AD, Weinstein ES, Hubloue I, Della Corte F, Ragazzoni L. Applying the Haddon Matrix to Frontline Care Preparedness and Response in Asymmetric Warfare. *Prehosp Disaster Med.* 2022 Oct;37(5):577-583. doi: 10.1017/S1049023X22001066. Epub 2022 Jul 25. PMID: 35875999; PMCID: PMC9470527.

4.1 Rationale of the study

Asymmetry in warfare is not a new phenomenon. However, in the post 9/11 era the asymmetry between state and non-state actors, and the reaction to asymmetric threats have implications on the provision of medical assistance, in particular trauma care, in conflict zones. The assumption of reciprocity as an ethical imperative and motivation for respecting the law is often unrealistic. Instead, strategies to cause greater loss of human life represent a crude reality. These include the use of prohibited modalities and selection of civilian targets to replace military ones posing major pragmatic and ethical challenges to prepare for and respond to the needs of the affected population [\[50\]](#).

Military research focusing on the understanding of overall severity of injuries and other non-medical factors contributing to survival and long-term recovery has resulted in improvement in the clinical outcomes of injured soldiers throughout the battlefield trauma system [\[51\]](#).

Reducing the time from point of injury to arrival at a medical facility dramatically decreased death rates of battlefield casualties. At the same time, this has created a complex system of levels of care previously referred to as echelons based on differences in capability and not quality of care [\[52\]](#).

Attempts to define and evaluate the application of a similar model involving civilians, recognizing the significant shift in the provision of medical care in such contexts from humanitarian organizations, have been registered. Although comparative analyses between systems should be performed, situations of armed conflict or other emergencies in insecure environments are extremely context-specific and require constant analysis and adjustment based on realities on the ground and tactical circumstances [51, 40].

Rapid evacuation from the point of injury (POI) and establishing far-forward emergency resuscitation and stabilization capabilities, are both needed to save lives and reduce disabilities [53]. However, limitations derived from the lack of a prehospital trauma care system exist in many low- and middle-income countries and are associated with the growing number of hybrid threats. Increasing the availability of medical transport and trained healthcare providers as well as preparing for the most likely scenarios with contingency plans in the event conditions deteriorate should be pursued [54].

Recognizing the challenges of moving life-saving interventions closer to the POI and the implications to civilians of today's asymmetric warfare, it can be argued that the initial part of the trauma care system is being neglected [55]. Investments in far-forward emergency resuscitation and stabilization can contribute to saving lives and increase the resilience of health systems. Efforts to improve preparedness measures and system competencies should be prioritized, utilizing different scenarios that ensure accountability and prompt actions.

Although the Trauma Stabilization Point (TSP) has already been described as the first site of care staffed by trained medical personnel, further research is required to better define its scope and operationalization [28]. In line with this, we propose the use of the Haddon Matrix which has been used for more than two decades by injury prevention professionals to evaluate

contributing factors, design response strategies and promote safety.

The matrix provides a conceptual framework that helps to examine problems systematically, breaking them down into smaller components to propose actions, proving to be an effective planning tool. It can help health leaders and planners in their decision making process, analysis of threats and risk factors, identification of priority actions, allocation of resources and after-action review [56]. Therefore, the benefits of its application and use have been extended beyond injury prevention to better understand different public health issues and support public health emergency preparedness.

4.2 Aim of the study

The aim of this study is to propose the use of the Haddon matrix to determine a set of strategies to better understand and prioritize activities to prepare for and set-up frontline care in form of TSP.

4.3 Methods

Study design

An expert consensus methodology was used to achieve the research aim. This includes a qualitative research method and data collection technique in the form of focused group discussion. To obtain a thorough understanding on the current trend of modern armed conflicts, a search was conducted on the Global Terrorism Database (GTD), the Armed conflict location and Event Data project and Uppsala conflict Data Program. Additionally, review of the existing documentation and data from the implementation of the TSP in the context of the Mosul's battlefield was performed.

In order to gain an understanding of relevant technical and operational considerations related to the TSP, a small subject matter experts' group was convened. It was tasked with 1) the review and discussion related to the problem, its magnitude and the agreement on the need of such intervention; 2) the creation of a list of main actions to perform before, during and after the implementation of the TSP; 3) the validation of the content of the Haddon matrix.

The recorded discussions and notes were then transcribed. Two rounds of discussion occurred aimed at narrowing down an initial list into tangible activities. This iterative process continued until the conversations reached saturation and consensus was obtained.

The Haddon Matrix

The Haddon matrix is comprised of three (3) rows representing the phases of an injury namely pre-event, event and post-event and four (4) columns representing the contributing and influencing factors (host, agent/vehicle, physical environment, social environment). The host column refers to the person at risk of injury. The agent refers to the energy that is transmitted to the host through a vehicle or vector. Physical environment refers to the characteristics of the setting where the event takes place. Social environment refers to the law and social norms associated with the location of the event. The terminology used for the factors of the matrix can be modified based on the context of its application [\[57\]](#).

Considering the majority of the unwanted events occur sequentially or in phases, each row presents opportunity for prevention or control. The identification of contributing and influencing factors guide the definition of strategies to be adopted in each phase.

Expert Group

The criteria used to guide the selection of the expert group consider individuals representing different disciplines essential to the successful creation of the Haddon matrix. Highly trained and competent within their specialized area of knowledge and expertise, the ten (10) experts out of the twelve (12) initially invited have expertise and experience in trauma and emergency care, humanitarian operations, military interventions, policy and conflict analysis ([Table 1](#)).

Invitation to contribute to the expert group was circulated by email to all ten (10) members including a brief document with the explanation of the objective of the study and instructions for participation. Although the Haddon matrix model wasn't known to all of them, the advantages of the expert panel composition were the knowledge and experience in conflict setting as well as familiarity with the TSP concept.

During the first virtual meeting, the moderator introduced the Haddon matrix, the findings of the search, purpose of the study and background on the TSP. Based on the brainstorming method, the list of contributing and influencing factors was created on the basis of three main aspects: medical response staff, frontline care requirements and characteristics of asymmetric warfare that affects the response, in relation to the three phases (pre-event, event and post-event). The event phase spanned the activation and set up of the TSP through to its deactivation and/or relocation due to possible changing in the pattern of presentations, conflict dynamic and intensity which can provoke significant population movement [[40](#), [37](#)].

The list of contributing and influencing factors was reviewed, items merged and recorded in the Haddon matrix. Final confirmation from the expert group was received at the end of the second virtual meeting and by email from all the experts.

4.4 Results

The review of the trend of modern armed conflicts demonstrated a significant increase in non-state conflicts (Figure 10) and fatalities (Figure 11) in the last decade. Modern conflicts take civilians lives and increasingly incidents of attacks on health are reported and documented [58]. However estimating and reporting the number of civilian casualties is increasingly challenged by organizational, political, strategic and tactical hurdles [55,59].

Figure 11. Non-state conflicts, 1989-2020

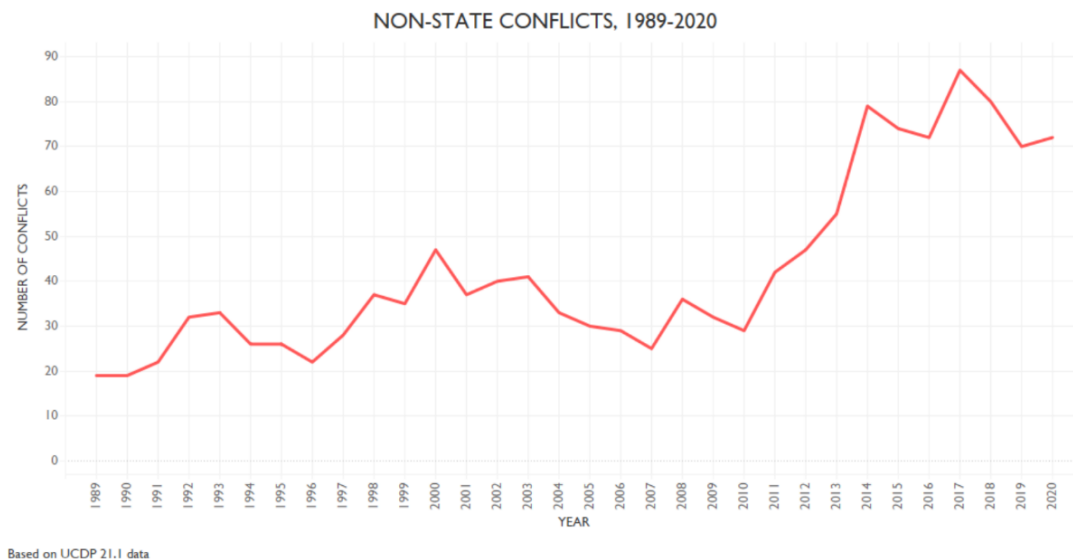
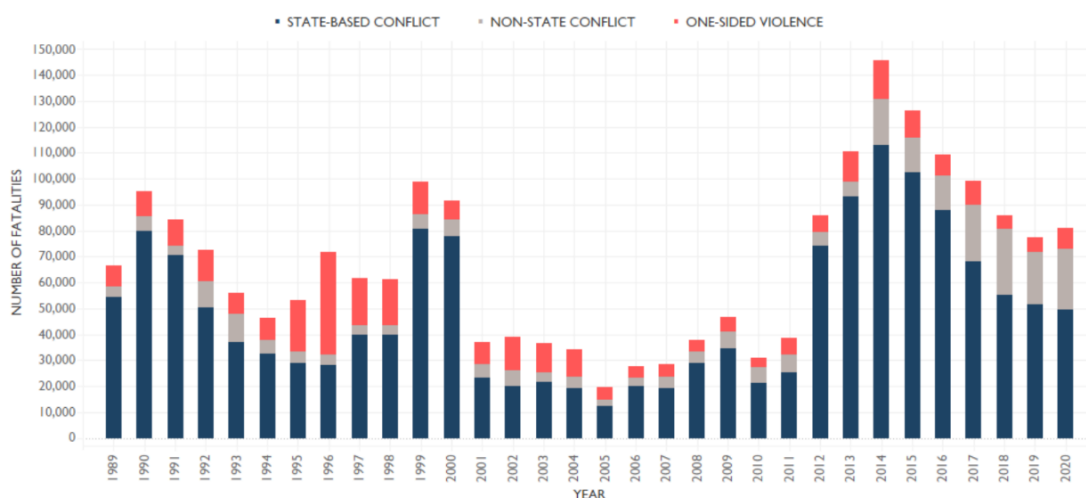


Figure 12. Fatalities by type of violence, 1989-2020

FATALITIES BY TYPE OF VIOLENCE (EXCLUDING RWANDA 1994), 1989-2020

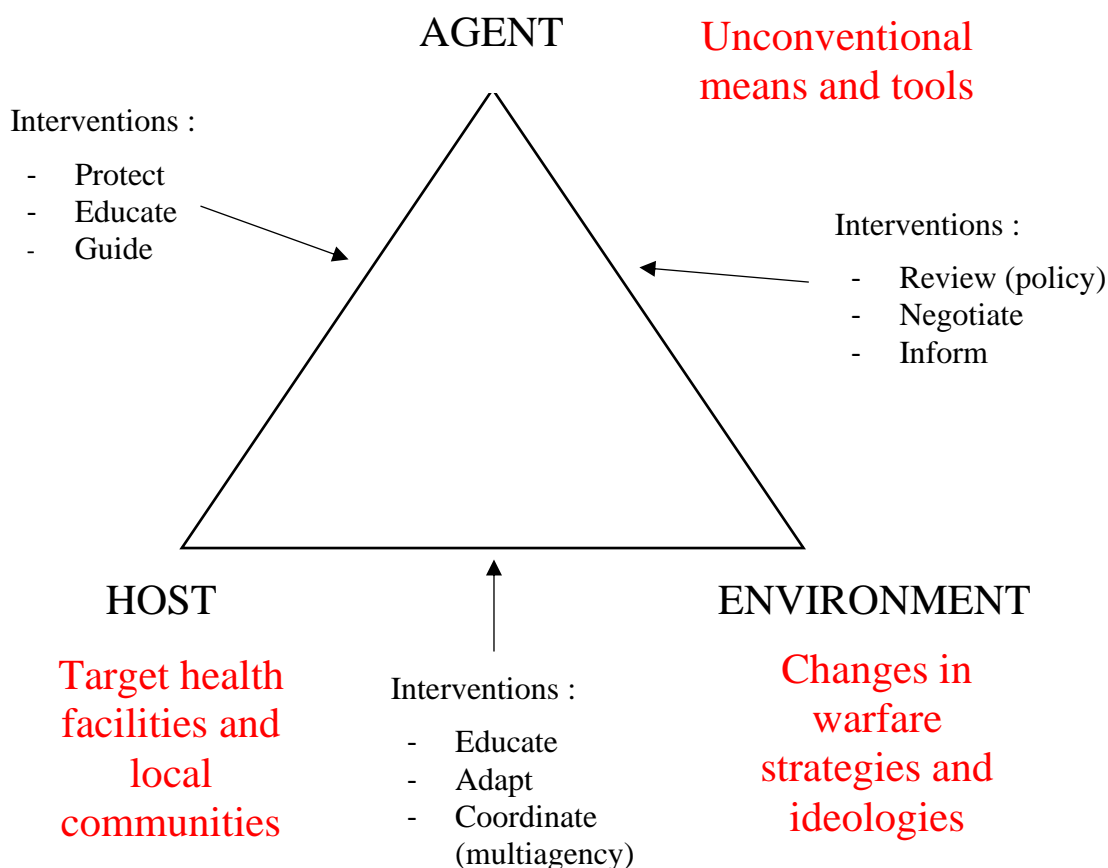


Based on UCDP 21.1 data



The outcome of the initial review and first task assigned to the expert group are reflected in the epidemiological triangle (Figure 12). It shows the correlation between each of the factors in conjunction with macro level characteristics associated with asymmetric warfare and interventions required to prevent or mitigate the effects of war related actions.

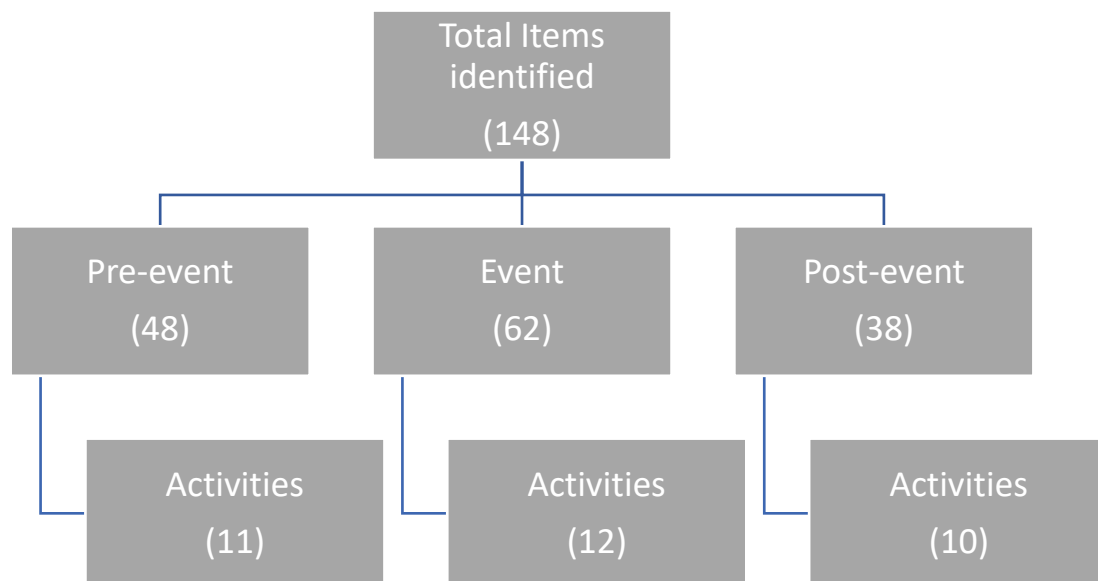
Figure 13. Epidemiological triangle



Expert Group - The Haddon Matrix

A list of one hundred forty-eight (148) elements was initially created to cover the cycle from pre- to post- event. Elements were subsequently categorized based on similar patterns or characteristics and assigned to their related boxes within the matrix.

Figure 14. Process for Haddon matrix items and activities identification



The first phase includes elements that need to be contemplated prior to the event’s occurrence, the preparedness and level of readiness required to maximize a speedy and effective response.

The event’s phase considers those factors and actions that should be taken in order to minimize impact and adverse outcome. The final phase includes actions that should be carried out to minimize mortality and morbidity related to the event. This includes the variation of intensity and possible multiple relocations of the TSP.

[Table 2](#) presents the result of the expert group consultations which describes the overview of TSP Preparedness and Operational Readiness within a Haddon matrix framework. A number

(ten) of opportunities or potentially modifiable factors have been highlighted as priorities due to their possible positive impact on the successful implementation of the TSP.

This is the result of a broader agreement within the expert group on the content of the matrix. Additionally, it proved to be useful as an analytical framework in support of the identification of main activities to be prioritized for the implementation of frontline care in the context of asymmetric warfare.

The richness of the discussion, and the knowledge and expertise of the expert panel has facilitated the analysis of the outputs of the Haddon matrix. This in conjunction with the number of comments provided during the sessions and through email exchanges, inspired the use of the reverse matrix approach. [Table 3](#) presents the application of this approach to the pre-event phase (identified by the group as the most critical) and more precisely the activities and procedures necessary for the preparation and activation of the TSP. As per previous attempts, it revealed gaps in knowledge and evidence providing possible areas for future research [\[60\]](#).

4.5 Discussion

Using an expert consensus methodology, this study describes the creation of a new framework to enhance frontline care preparedness and response in asymmetric warfare. By applying the Haddon matrix, this framework will facilitate the understanding of the main strategies to adopt and the key activities to perform before, during and after the implementation of TSPs in conflict settings.

The model allows its users to better understand the multidimensional nature and

interdisciplinary perspectives of this form of medical intervention. This includes disciplines such as engineering, law, medical and behavioural sciences to assist in the preparedness, operational readiness and response of such far-forward medical capability.

In the following discussion, main strategies are elaborated that consider the identified opportunities in the context of the possibility of implementation.

Pre-event

Training and drills - significant importance is being given to training and drills to increase confidence and the willingness to respond among health professionals along with familiarity of relevant hazards. However, current existing guidelines on tactical combat casualty care (TCCC) do require adaptation to the scope of practice and the needs of the civilian medical and operational environments. Emphasis remains on the ability to provide far-forward emergency resuscitation and stabilization in remote and resource-limited settings [61]. The risk of a broader (and inappropriate) spectrum of procedures performed at the site should be considered together with its scope. For example, evidences suggest the need for more research on impact of haemorrhage control training for first responders on patients outcomes [62]. Another example, although contested but supported by growing evidences, the far forward provision of whole blood especially when facing transport times and other logistical constraints [63].

Increasing attacks targeting civilians, along with the use of non-conventional means and the threats they pose to the health system, suggest the need for new approaches and investments to adequately equip frontline healthcare providers [64]. Efforts must be undertaken to not only revise the curriculum, but also to adapt it to the context and available resources.

Medical intelligence – for the purpose of this study, medical intelligence is defined as a

critical capability to monitor and evaluate risks to health and frontline healthcare personnel. It aims to mitigate risks regardless of how low the probability is. This includes threat detection and identification, information on the operational context and its characteristics. The ability to conduct and analyse information from various risk assessments, a system for monitoring and quality improvement actions should be included as core elements for medical planning and operations [65, 66]. Clear distinction should be made between military and civilian intelligence systems, including their objectives and roles in conflict settings.

Infrastructure and equipment – located near areas where casualties are likely to occur.

Principles should include considerations for areas providing passive security, inside buildings or in field settings, with the possibility to expand capacity if casualty load increases. There should be clear access to evacuation routes and evacuation assets. To note, evacuation policy and procedures must be established beforehand and amended as situations evolve, as they may represent a source of friction during the course of operations. The care provided can be impacted by several operational constraints and nonmedical factors. For example, weather and environmental factors and their related heat and cold injuries can be some of the first threats to be encountered. Medical equipment and consumables should be in line with the provider scope of practice and adequate for the procedures that are expected to be performed and number of patients expected [67]. Properly equipping and training has been suggested as a new approach to enhancing the military medical system [68]. Recognizing differences in the delivery of trauma care in the military and civilian sectors as well as some similarities in the management of trauma patients, it is fair to assume that the adoption of this approach could be extended to the civilian frontline medical system.

Event

Command structure and activation – When setting up a TSP, referral lines and communication channels among the different levels of care need to be well identified and disseminated among those who participate in the operation. Uncertainty affects strategic location decisions with possible impact on tactical and operational decisions, and ultimately on patient outcomes. The friction between current operations and the need to improve capabilities need to be balanced by the ability to maintain a perpetual state of team readiness. There is a greater call for more standardization and necessary guidance to support team deploying into isolated and challenging environments, with limited resources and self-reliance to optimize patient survival [69]. Additional considerations include particular attention on crisis risk communication, the speed of notification and rotation of personnel.

Execute and reassess – The importance of having trained providers with experience and expertise relevant to their assigned roles and a wide range of professionals who directly support the clinical mission is highlighted in multiple studies [70]. Optimal trauma care and patient outcomes require provision of lifesaving interventions at POI to increase chance of survival and coordination with other facility-based services. The pattern of presentations includes patients with acute, complex, penetrating polytrauma, and multiple injuries from high-energy transfer fragments, such as ordnance, bullets and blasts wounds. The work environment is characterized by higher workload, hostile surroundings, and limited resources [71]. Thus, constant reassessment of the variables, or external factors that should be taken into consideration in the set-up of the TSP, should be performed and threat-based interventions prioritized.

Post-event

Comfort in role flexibility and Psychological support – the importance of comfort in role flexibility should be considered across the three phases. It is defined by the institutional ability to instill workers self-efficacy in the roles they will perform, their engagement and value to accomplish the assigned mission [72]. General recommendations for staff exposed to a potentially traumatic event include the immediate provision of psychological first aid and assessment by a mental health professional within one to three months from the incident to determine whether further follow-up care is required. To note, pre-deployment programmes and research are ongoing to build psychological resilience of military and emergency medical personnel before possible exposure to traumatic events [73]. Although there isn't enough evidence to support these efforts, future research is needed. This should be aligned with outcomes from the data related to psychological evaluation and services provided to staff post-deployment. Additionally, it is important to empower the community and invest in training on the provision of basic care. This can have a potential to increase resilience and save lives as most of the injured will first be treated by bystanders. The cost will be far less than what modern armed conflict may generate.

After action review and evaluation – How does one define mission success from a medical standpoint? The definition of a monitoring and quality improvement system helps the TSP and the entire trauma care system to periodically assess the adequacy of the chain of casualty care, the efficiency of frontline measures and the evacuation system itself. Relocation of the TSP should follow pre-defined indicators. The model can be used to verify the effectiveness of the intervention, improve frontline medical response and advocate for investments in this area. Countries exposed to the risk of conflicts and violence could combine such an approach with efforts to strengthen existing structural limitations derived from the lack of a prehospital

trauma care system [74].

4.6 Strengths and limitations

A multidisciplinary expert panel of clinicians, nurses, paramedics, humanitarian and military experts, and policy makers have contributed to this study. This multidisciplinary approach is essential due to the complex nature of the subject. However, face-to-face interaction and socialization would have facilitated a greater contribution and collaboration resulting in faster completion of the study. The use of the reverse Haddon matrix revealed gaps in evidence and helped identify research questions. Its use should be carefully analyzed and evaluated further. An analysis of the ethical implications for healthcare professional providing such kind of services in austere and non-permissive environment is not being included in the scope of the study.

4.7 Conclusions

Modern warfare has challenged the way in which far-forward medical assistance is provided in such settings. This study presented a new framework to enhance frontline care preparedness and response using the Haddon matrix. The Haddon matrix provides a user-friendly way to systematically describe the key factors that affect the delivery of frontline trauma care. As an effective planning tool, it facilitates the identification of strategies to support the preparedness and operational readiness of frontline healthcare workers in a more efficient manner. In the follow-up study, it will be appropriate to address, among other things; differences between injuries to soldiers on the battlefield and civilians injured where they live; the training and requirements for field management in these two different areas, and incorporating distance from hospitals, nature of injuries. Since the existing approach and tools

are insufficient for modern warfare, additional research is needed. Of particular importance is the revision of a curriculum that fits the civilian medical system and facilitates its adaptation to the context and available resources.

5. Conclusions

This research focused on a new and innovative model to address the provision of far-forward trauma and emergency care in form of TSP in the context of modern warfare where the provision of medical assistance is severely impacted by the changing dynamics.

The model challenges conventional ideas about the provision of care to all injured by armed forces, often unable or unwilling to do so, while civilian system capacity is often inadequate or unprepared to provide assistance either, leaving victims of the conflict without care.

The research shown lack of pre-existing literature due to the complex nature of the subject and the novel approach. Using consensus-based evidence, the outcome of the research provides structure to a complex issue, a process and a practical approach that can be applied by frontline care workers, medical planners and all those involved in emergency preparedness and response in conflict settings.

The TSP can play a critical role in ensuring access to medical care on frontlines to civilians exposed to life-threatening injuries and other medical complications. However, additional research and debate are required to clearly define the scope and the integration of such model in today's emergency response to conflict settings. In this regard, such kind of intervention should be considered at policy level and included as part of the wider readiness assessment of capacities based on priority risk(s).

The new framework to enhance frontline care preparedness and response does include a set of medical strategies to be considered emphasizing the need for a multi-disciplinary approach to

be adopted. Further research is needed to address important elements highlighted in the matrix while investing in an evidence-based approach to support the need for an operational guidance.

Yet, this research represents an important step to increase the understanding and future implementation of this new model.

Future Research

This research highlighted the importance of a new model to provide far-forward emergency resuscitation and stabilization that can contribute to saving lives and increase the resilience of health systems. Here below, taking into consideration the outcome of the studies presented, a number of recommendations for future research.

Civilian medical systems and personnel are not trained on how to operate clinically in semi-permissive and non-permissive environments. A gap exists to support this need with recognized approach and training. Thus, the definition of a curriculum that fits the civilian medical system and facilitates its adaptation to the context and available resources is a priority research topic. Initial steps have been taken to extend the research conducted within the PhD programme to tackle this important topic.

An analysis of the ethical implications for healthcare professional providing such kind of services in austere and non-permissive environment is not being included in the scope of this research. As the nature of asymmetric and urban warfare has evolved, so the thinking required to practice ethically minded medicine in insecure environments and conflict zones should be prioritized for more research.

Considering the limitations derived from the lack of a prehospital trauma care system in many low- and middle-income countries and the possible association with the growing number of hybrid threats, it is recommended exploring the application of such model beyond the context of asymmetric and urban warfare.

The framework developed to facilitate the decision to implement or not the TSP presented five main categories and several elements underneath. It is recommended to review those statements that didn't reach consensus and possibly enlarged the number of elements in way to further detail the process for the decision to utilize such capability in high-risk security and resource constrained settings.

This research emphasized the lack of empirical data on the benefit of such intervention, the limited availability of reliable data and systematical review of the provision of frontline care in asymmetric and urban warfare. It is recommended to possibly invest in documenting TSP or similar interventions through case study approach aiming to generate an in-depth understanding of the application of this new model in its real-life context.

Executive Summary

The emerging trends of asymmetric and urban warfare and their impact on the burden of disease and health needs in conflict affected areas are at the forefront of today's healthcare debate.

Recent events have shown the greatest challenge to implementing emergency and trauma care intervention is the inadequacy in the health system in which it is set. Health systems and health care providers are often the first victims challenged by the blending of civilians and combatants and the rising need to provide and adjust treatment capacity for prolonged periods of time.

This research aimed to address the need for a new model for the provision of life-saving emergency and trauma care services in the context of asymmetric warfare. Using consensus-based evidence, it identified two main components as foundation of the model.

First, a conceptual 5-step framework to introduce the concept of the Trauma Stabilization Point (TSP) and support the decision to implement or not such services.

Second, the application of the Haddon matrix to facilitate the understanding of the main strategies to adopt and the key activities to perform before, during and after the implementation of TSPs in conflict settings.

Recognizing lack of empirical data on the benefit of such intervention, the two main components add a needed structure for future standardization, to the decision-making process, and to the identification and future dissemination of best practices. A very important step to support emergency and trauma care planning and implementation efforts for the benefit of populations in conflict.

Samenvatting

De opkomende trend van asymmetrische en stedelijke oorlogsvoering en hun beider impact op de belasting van het gezondheidssysteem in door conflicten getroffen gebieden staan voorop in de hedendaagse gezondheidszorgdebat.

Recente gebeurtenissen hebben aangetoond dat de grootste uitdaging in de implementatie van urgente- en traumazorg ligt in de ontoereikendheid van het gezondheidssysteem. Gezondheidssystemen maar ook zorgverleners worden vaak ook de uitgedaagd in de uitvoering van hun taken door de vermenging van burgers en strijders en de toenemende behoefte om behandelingscapaciteit voor langere perioden beschikbaar te stellen en aan te passen aan de duur van het conflict.

Dit onderzoek heeft tot doel een nieuw model voor het verstrekken van levensreddende interventies en traumazorg in het kader van asymmetrische oorlogsvoering te ontwikkelen. Op basis van “consensus-based-evidence” werden twee belangrijke componenten van dit model geïdentificeerd.

In de eerste plaats werd een 5-staps conceptueel “framework” ontwikkeld teneinde het concept van Trauma Stabilization Point (TSP) te introduceren en hierbij ook de beslissing rond het al of niet implementeren van dergelijke methode te beschrijven.

In tweede instantie werd de “Haddon-matrix” gebruikt teneinde de besluitvorming in de gekozen strategie voor, tijdens en na de implementatie van TSP's in conflictsituaties beter te kunnen begrijpen.

Deze twee belangrijke componenten wijzen op de noodzaak van het ontwikkelen van duidelijke structuur in standaardisatie van het besluitvormingsproces, en in de identificatie en toekomstige verspreiding van “best practices” in het toepassen van urgente traumazorg voor specifieke bevolkingsgroepen in conflictsituaties. Het gebrek aan empirische data over de voordelen van

een dergelijke interventie noodzaakt verder wetenschappelijk onderzoek.

Tables

Provision of trauma care in asymmetric warfare: a conceptual framework to support the decision to implement frontline care services

Table 1. List of statements that did meet consensus after round 1

Statement	Mean	SD	Consensus
DEFINITION: TSP must be capable of functioning in resource-constrained environments.	6.6	0.7	attained
DEFINITION: The primary function of the TSP is to provide far-forward resuscitation and initial stabilization in the form of airway, hemorrhage and fracture control.	6	0.9	attained
SCOPE: The TSP has an important triage role, rapidly transferring the more serious injuries to a higher level of care and identifying minor injuries.	6.5	0.9	attained
PARAMETER: Mobility and/or Flexibility – The TSP should ensure an agile system to move and/or expand medical services based on the changing needs.	6.4	1.0	attained
PARAMETER: Transport – Adequate transport and transfer to a receiving facility that has the capability to provide more advanced care should be available.	6.6	0.6	attained
PARAMETER: Safety – The TSP should be an environment of care that is safe for patients and health care personnel with risk management plans that are context and area-specific.	6.7	0.5	attained

VARIABLE: Chain of referral – There should be a level of integration across the chain of care with continuity from POI to definitive treatment and rehabilitation.	6.6	0.7	attained
VARIABLE: Conflict dynamics – Combat strategies, intensity, and geographical location may influence clinical presentations at TSP.	6.4	0.8	attained
MONITORING/QUALITY IMPROVEMENT: Indicators and metrics which monitor areas where TSP can make a difference in patient outcomes or staff safety should be developed.	6.7	0.5	attained
MONITORING/QUALITY IMPROVEMENT: Time per patient spent at the TSP should be carefully monitored although its interpretation is dependent on several factors.	6.1	0.8	attained
MONITORING/QUALITY IMPROVEMENT: Transport time to a higher level of care should be carefully monitored although its interpretation is dependent on several factors.	6.4	0.7	attained
MONITORING/QUALITY IMPROVEMENT: Mechanism of injury and anatomic injury patterns are important criteria in monitoring and predicting workload and should be tracked.	6.4	1.0	attained

Table 2. List of statements that did meet consensus after round 2

Statement	Mean	SD	Consensus
DEFINITION: The Trauma Stabilization Point (TSP) is the first site of care staffed by trained medical personnel.	6	0.8	attained
PARAMETER: Proximity – The TSP should be positioned as closely and safely as possible to the point of injury (POI).	6.4	1.2	not attained (adjusted - 89% agreement)
VARIABLE: Access – TSP staff should have the ability to safely enter the affected area and provide medical services.	6.2	1.4	not attained (adjusted - 82% agreement)

Table 3. List of statements that did not meet consensus after round 2

Statement	SD	Consensus
DEFINITION: The utility of the TSP should be considered in all conflict settings even where fighting is sporadic or frontlines are poorly defined.	1.6	not attained
SCOPE: The TSP must be prepared to initially manage acute medical conditions in addition to trauma.	1.5	not attained
SCOPE: Uncomplicated minor injuries can be managed at the TSP.	1.9	not attained
SCOPE: Penetrating and blast injuries should (always) be considered for referral to higher level of care.	1.2	not attained
VARIABLE: Civil-military coordination – Interaction with the military and other armed groups must be established. This relationship is dependent on the medical needs and the roles and responsibilities of the military and other armed groups.	1.5	not attained
VARIABLE: Medical expertise – Capacity and capability of the medical staff should vary within the trauma care system in context with the local health care delivery system.	1.1	not attained

Table 4. Additional comments provided by the experts group

Comments
TSP should be ran by both local health authorities and international partners
Trauma Stabilization points should be able to handle acute life-threatening medical emergencies, however there is significant risk of Mission Creep, and the rules/responsibilities should be very clearly defined.
The use of TSPs need a further very good analyze of needs and even more training of staff to work in the area of conflict, war or other situations of violence.
All medical staff at the TSP shall be trained in Advanced Disaster Life support and Tactical Combat Critical Care for medical provider (or equivalent)?
Triage is a crucial component of the medical set-up at the battlefield. SALT Triage must be adapted in such field as it is easier to learn and more efficient than START?
Future humanitarian responses to conflict should consider the responsibilities of the various actors and competition should be avoided between them. Inexperienced personnel should not be permitted to set up and operate TSPs.
Key procedures/interventions for a TSP should be established
Logistic requirements for a TSP should factor into the location of the TSP (ie. availability of water, electricity, access to sterilization, etc)

<p>Minimum requirements for skills, staff, stuff, resources for trauma stabilization points should be defined for humanitarian settings</p>
<p>Trauma stabilization points should have the means to provide life-saving interventions depending on context and level of care conditional to availability of referral options or not</p>
<p>Civilian organizations working with military or armed groups should clearly identify as none-neutral humanitarian organizations (i.e. there should be no confusion in the neutrality of civilian organizations)</p>
<p>TSPs are critical to overcoming the gap in the provisions of emergency life saving medical intervention, but are dependent upon the functional emergency and trauma system.</p>
<p>Increased focus on specialized response measures at the TSP level may have a greater role in future conflicts, however this will require assurance and proof of specialized capacity and capabilities.</p>
<p>Among the indicators to assess the effectiveness of first-aid-trauma posts in asymmetric warfare we should include the ratio civilian/military. The availability of TSPs for civilian casualties should enable the conditions for evacuation of civilians from the point of injury.</p>
<p>More than one TSP is needed when there is more than one line of referral.</p>
<p>TSP should assist and coordinate the already established local pre-hospital and referral system caring for the wounded.</p>

TSP should be included in the referral pathway as part of the real-time coordination of patient transfers.

Alongside well-established system of referral of patients from one level of care to a higher one, it should be mandatory to ensure a reliable supply chain, a list of standardized items (consumables, medicines, equipment) and timely replenishment of goods.

Applying the Haddon Matrix to frontline care Preparedness and Response in asymmetric warfare

Table 1. Expert panel: demographics and basis of expertise

Expert panel	
Gender	N
Male	8
Female	2
Country of Residence/work	N
USA	2
UK	2
Norway	1
Israel	1
Switzerland	1
Italy	1
Colombia	1
Ukraine	1
Current role	N
Professor	3
Physician	1
Trauma Nurse	1
Medical Director	2
Director of Operations	2
Health Cluster Coordinator	1
Years working in the field	N
20+ years	4
15+ years	5
10+ years	1
Expertise	N/10
Trauma and Emergency care	7
Humanitarian operations	7
Military interventions	2
Health Policy	3
Conflict analysis	1

Table 2. Haddon Matrix and TSP Preparedness and Operational Readiness

Phases	Contributing and Influencing Factors			
	Host (Human Factors)	Vector and Vehicle	Physical environment (overall design)	Social environment (social and cultural norms, policies)
Pre event	<p>Training to increase willingness and ability to respond #</p> <p>Training to increase knowledge and familiarity with hazard #</p> <p>Exercise on eligibility criteria and activation #</p> <p>HR selection criteria</p>	<p>Type of agent (human, physical, mechanical, thermal, chemical, biological, radiation)</p> <p>Medical intelligence including the risk analysis #</p>	<p>Pre-event testing of temporary infrastructure and equipment #</p> <p>Scene assessment</p> <p>Supply stockpile #</p>	<p>Guidelines for frontline workers and local communities #</p> <p>Intra and inter-institutional relations</p> <p>Budget (preparedness resource allocation)</p>
Event	<p>Command structure</p> <p>HR Management including remote management system</p> <p>Speed of activation and accountability of HCW #</p> <p>Patient tracking, record and discharge plan #</p>	<p>Structural failure</p> <p>Protective devices</p> <p>Decontamination capability</p>	<p>Site selection, design including holding area</p> <p>Water, sanitation and energy</p> <p>Resupply and cold chain</p>	<p>Public information sharing policy</p> <p>Re-assess variables</p> <p>HCW including ambulance access to the area</p>
Post event	<p>Comfort in role flexibility #</p> <p>Psychological support and long-term follow up</p> <p>Confidentiality</p> <p>Management of patient records</p>	<p>Secondary effects</p>	<p>Resupply</p> <p>Waste management</p>	<p>Revision of the scope of the mission</p> <p>After action report</p> <p>Community-based resilience</p>

Opportunities – potentially modifiable factors

Table 3. Reverse Haddon Matrix (pre-event – activation of the TSP)

Phases	Contributing and Influencing Factors			
	Host (Human Factors)	Vector and Vehicle	Physical environment (overall design)	Social environment (social and cultural norms, policies)
Pre event (Activation of the TSP)	<p>To what extent training increase willingness to respond?</p> <p>Ethical considerations for engaging in frontline trauma care?</p> <p>To what extent risks for frontline workers can be mitigated?</p> <p>Does previous military experience increase the confidence of TSP personnel?</p>	<p>Does medical intelligence reduce risk exposure?</p> <p>How prioritize/tailor CBRN-e and HAZMAT knowledge and training for specific risks?</p>	<p>Which standards should be applied for the definition of the structure and equipment needed?</p> <p>Which is an effective and efficient stockpile strategy?</p>	<p>Which are the barriers to prepare for and train frontline workers?</p> <p>Are current policies adequate for the provision of care in modern warfare?</p> <p>Which are the barriers to engage and maintain effective civil-military cooperation?</p> <p>Cost effectiveness of such intervention?</p>

Annexes

Annex I.

Letter sent to the expert group for participation to the study

Overview

Providing healthcare in armed conflicts has been one of the struggles taunting States and armed groups for centuries. Speedy, organized, and safe provision of healthcare to all combatants or fighters *hors de combat* and the civilian population is one of the pillars upon which mankind has tried to humanize war, reducing its effects on the most vulnerable categories and trying to limit the scope of war to the sole purpose of overpowering the enemy to induce it to surrender. Under these premises, the advent of new methods of speedy recovery and evacuation of the wounded by the most advanced armies have had a great impact on reducing the number of soldiers killed in action.

In the last decade, the introduction of the joint trauma system helped to reduce the time from point of wounding to the arrival of the casualty at a medical facility and consequently dramatically reduced death rates on the battlefield. However, the implementation of this system in an asymmetric conflict as Iraq (Mosul battlefield) involving NGOs opened up a debate that includes issues of impartiality and principled approach, access to care, quality of care and civil-military interaction. Considering all these elements, the need for a model applicable in different contexts that may ensure and optimize the ability to provide essential care required for casualty injuries has emerged.

Research Question/Hypothesis

How can lessons from the implementation of trauma care close to the frontlines contribute to the development and implementation of a new, more efficient and comprehensive model for the provision of trauma care in asymmetric conflict such as Iraq?

Attempts to define and evaluate the model have been registered. However, a framework to better understand and prioritize needs during the emergency cycle such as preparedness including the required level of readiness, response and post response phase to drive subsequent improvements represent a gap. Here, we propose to extend the use of the Haddon matrix — a

conceptual model used in injury prevention to evaluate contributing factors and design response strategies — for this purpose.

Delphi Study

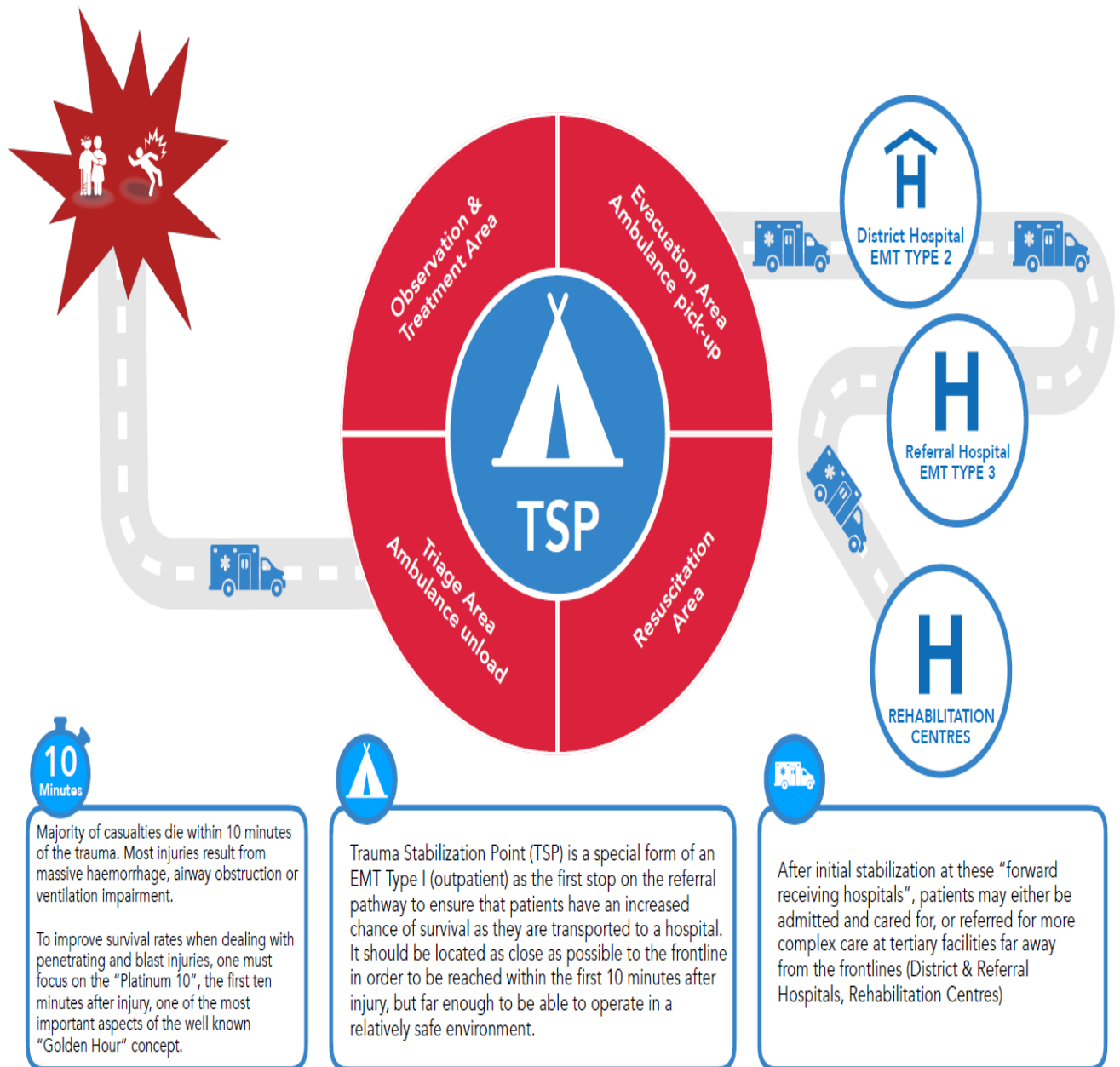
The Delphi method has been selected to make effective use of informed intuitive judgment and derives from personal expectations from individuals rather than predictions from well-established theory. Being an iterative multistage process, the first phase includes a focus group discussion composed by a small group of experts aiming to define parameters and inform the implementation conducted through a series of structured questionnaires (commonly referred to as rounds).

The criteria used to guide the selection of Delphi subjects considers individuals who are highly trained and competent within their specialized area of knowledge and who might potentially utilize the outcomes of the study. Eligible candidates must:

- have somewhat related backgrounds and experiences concerning trauma care, humanitarian operations, military interventions, conflict analysis
- be capable of contributing helpful inputs
- be willing to revise their initial or previous judgments for the purpose of reaching or attaining consensus

Annex II.

Representation of TSP and trauma care pathway



Annex IV.

Continuation of the research towards the definition of a

Curriculum for emergency medical care in non- or semi-permissive environments

Background

Guidance and standards for provision of emergency medical systems in non-permissive and semi-permissive conflict environments are set out in the WHO 'Red Book'. Recent conflicts have proven difficult for the humanitarian community, often unprepared, to safely gain access to vulnerable populations and the way to operationalize principles varied greatly between humanitarian actors. Civilian medical systems and personnel are not trained on how to operate clinically in semi-permissive and non-permissive environments. A gap exists to support this need with recognised approach and training.

Objective

Building a curriculum for civilian medical systems and personnel to operate clinically in semi-permissive and non-permissive environments based on the TSP model.

Methods

The study uses mixed methods approach in stages: revision of relevant peer-reviewed literature, focus group discussion, opinions of experts using Delphi method through a series of carefully designed questionnaires interspersed with information and opinion feedback.

Results

Curriculum for training military medics for conflict scenarios exists as well as for training civilian tactical medics for tactical emergency care provision. However, there is no recognized standard for civilian medical professionals engaged in providing medical care in non- or semi-permissive environments. Existing curricula require adaptation to the scope of practice and the needs of the civilian medical and operational environments. The primary focus does remain the ability to provide far-forward emergency resuscitation and stabilization in line with the scope of intervention required, availability of medical transport and improve system competencies.

Conclusion

Investments in far-forward emergency resuscitation and stabilization can contribute to saving lives and increase the resilience of health systems. Thus, the definition of a curriculum that fits the civilian medical system and facilitates its adaptation to the context and available resources is a priority.

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