IBRN
International Blast Injury Research Network

AMERICAN UNIVERSITY OF BEIRUT

MENA PAIR

University of Southampton

UNDERSTANDING HEALTH CHALLENGES, RESPONSE AND RECOVERY

THE 2020 BEIRUT BLAST AND MASS CASUALTY BLAST EVENTS

Workshop Report

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Abbreviations

AUB	American Univeristy of Beirut
ED	Emergency Department
EMR	Electronic Medical Record
EMS	Emergency Medical Services
EWIPA	Explosive weapons in populated areas
HCP	Health care professional
IBRN	International Blast Injury Research Network
MCI	Mass Casualty Incident
NGO	Non-govermental organisation
OT	Operating Theatre
PTSD	Post-traumatic stress disorder
SDG	Sustainable Development Goal
START	Simple Triage and Rapid Treatment
TBI	Traumatic brain injury
UNIDIR	United Nations Institute of Disarmament Research
UoS	University of Southampton

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INTRODUCTION

THE IBRN

The International Blast Injury Research Network (IBRN) conducts multidisciplinary and cross-sectoral research to improve the understanding of the consequences of explosive violence on civilians.

We aim to improve the protection and treatment of those injured by explosive violence, to inform risk reduction strategies and minimise harm and suffering of affected populations.

PILLARS OF IBRN ACTIVITY

- **01** Research
- **02** Challenge-focussed workshops
- **03** Collaboration & engagement
- **04** Policy & impact

IBRN THEMATIC AREAS

- **01** Health systems response & interventions
- **02** Systems approaches to preparedness & resillience
- **03** Blast engineering
- **04** Forensic research
- **05** Monitoring & reporting

THE CHALLENGE FOCUSSED WORKSHOP

We welcomed 35 attendees in Beirut, Lebanon in March 2023 to participate in our challenge-focused workshop on understanding the health challenges, response, and recovery of the health system to the 2020 Beirut Blast and other mass casualty blast events.

This workshop aimed to examine how the health response to the 2020 Beirut blast was managed and coordinated, looking at the immediate care of the injured and how the health systems were affected, how they coped, and how those injured were managed over the following two and half years. We aimed to draw out lessons from the health system response to the Beirut blast to help inform future preparedness planning and system reconstitution. Through shared understanding, we identified opportunities for increasing health system resilience, and the long-term rehabilitation and management of those affected by the blast.

BACKGROUND

The Beirut blast on August 4th 2020 was a devastating explosion that occurred in the port of Beirut, Lebanon. The explosion was caused by the ignition of approximately 2,750 tons of ammonium nitrate, a highly explosive material that had been stored in a warehouse in the port for several years. The explosion occurred around 6:08 pm local time and was felt as far away as Cyprus, over 200 km away.

The blast caused a massive mushroom cloud and a shock wave that devastated large parts of the city. The explosion resulted in over 200 deaths and injured thousands more. Many people were also reported missing in the immediate aftermath of the explosion.

The explosion also caused widespread damage to buildings, homes, and infrastructure in the surrounding areas. The blast shattered windows, collapsed roofs and walls, and destroyed cars, leaving many people homeless and without basic services such as electricity and water. Furthermore, the explosion also caused significant damage to hospitals and medical facilities, which were already under strain due to the COVID-19 pandemic.

Over 6,000 people were injured by the blast, with varying degrees of severity from major head trauma and crush injuries to lacerations, resulting in a large number of victims requiring medical attention. A majority of casualties suffered secondary blast injuries, such as lacerations predominantly caused by glazing, followed by tertiary blast injuries from being accelerated and thrown into obstacles (blunt injuries, closed and open brain injury, musculoskeletal injuries, or crush injuries) and primary blast injuries, including pulmonary blast injury, eardrum rupture and blast traumatic brain injury (TBI).

In addition to the physical and material damage, the Beirut port blast also had a profound psychological impact on the people of Lebanon. Many people experienced trauma, anxiety, and post-traumatic stress disorder (PTSD) as a result of the explosion, particularly those who were directly affected by it.

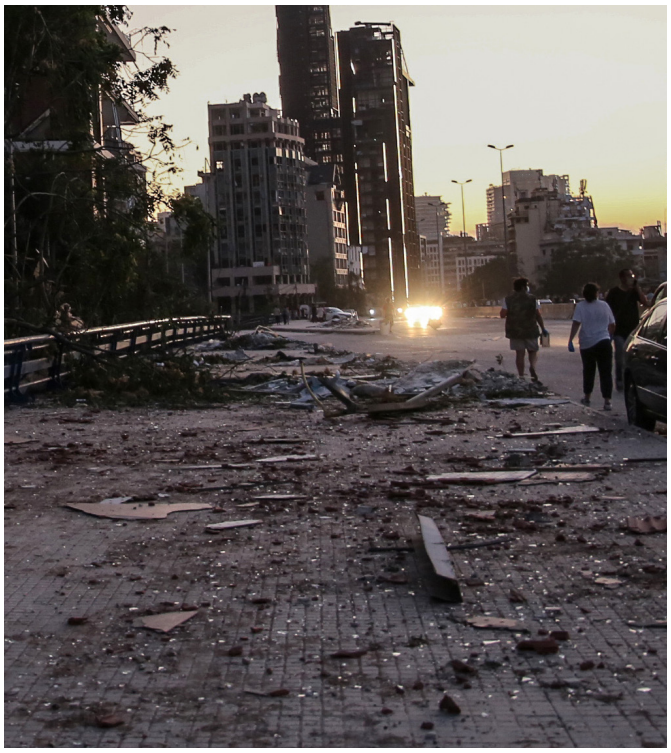
The Lebanese health system is a largely private one, with a focus on high quality hospital services directed at predominantly curative care. Government funding supports primary care and preventative care and there is a large NGO contribution to humanitarian health needs. The health system has had the added strain of managing a large influx of refugees, mainly from Syria, over the previous 8 years. About half of the population has health insurance and government funds can be accessed to contribute to health care needs, but coordination within the tertiary care system revolves largely around the major private providers, of which the American University of Beirut (AUB) is one of the largest.

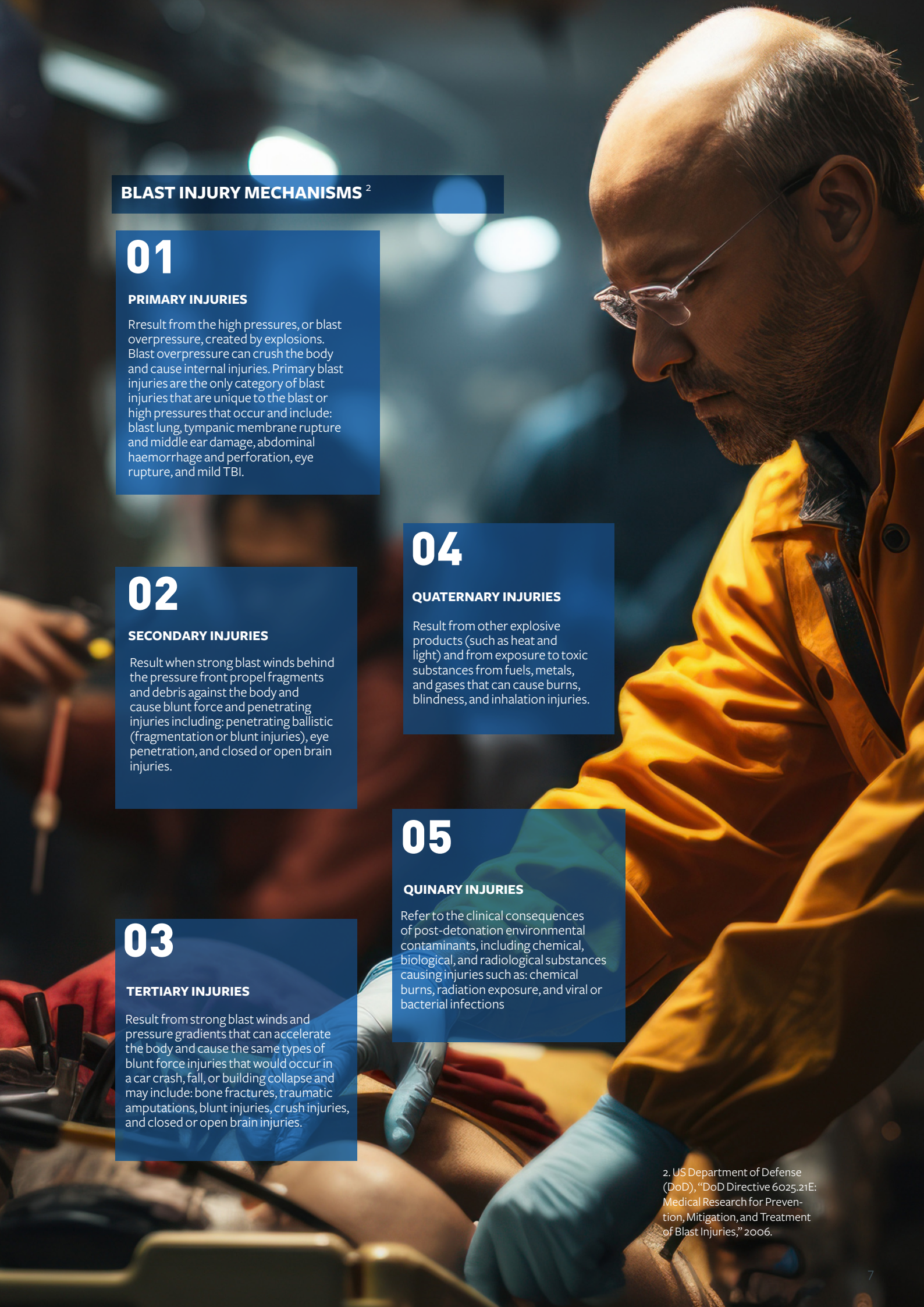
The challenges faced by the health system following the Beirut blast are similar to other mass casualty events, such as the earthquake in Turkey/Syria, major transportation events and other industrial accidents. Such emergencies require effort over many months and years, and the lessons that have been drawn from our colleagues in Lebanon are potentially of great importance in shaping the response and building resilience to other crises.

STATISTICS OF THE BEIRUT BLAST [1]

- **200+** Dead
- **6,500** people injured
- **86** missing cases
- **300,000** people displaced or suffering from losses and damage to their homes.

1. Human Rights Watch, "'They Killed Us from the Inside,' An Investigation into the August 4 Beirut Blast," 2021. Accessed: Sep. 21, 2023. [Online]. Available: https://www.hrw.org/report/2021/08/03/they-killed-us-inside/investigation-august-4-beirut-blast





BLAST INJURY MECHANISMS [2]

01

PRIMARY INJURIES

Rresult from the high pressures, or blast overpressure, created by explosions. Blast overpressure can crush the body and cause internal injuries. Primary blast injuries are the only category of blast injuries that are unique to the blast or high pressures that occur and include: blast lung, tympanic membrane rupture and middle ear damage, abdominal haemorrhage and perforation, eye rupture, and mild TBI.

02

SECONDARY INJURIES

Result when strong blast winds behind the pressure front propel fragments and debris against the body and cause blunt force and penetrating injuries including: penetrating ballistic (fragmentation or blunt injuries), eye penetration, and closed or open brain injuries.

03

TERTIARY INJURIES

Result from strong blast winds and pressure gradients that can accelerate the body and cause the same types of blunt force injuries that would occur in a car crash, fall, or building collapse and may include: bone fractures, traumatic amputations, blunt injuries, crush injuries, and closed or open brain injuries.

04

QUATERNARY INJURIES

Result from other explosive products (such as heat and light) and from exposure to toxic substances from fuels, metals, and gases that can cause burns, blindness, and inhalation injuries.

05

QUINARY INJURIES

Refer to the clinical consequences of post-detonation environmental contaminants, including chemical, biological, and radiological substances causing injuries such as: chemical burns, radiation exposure, and viral or bacterial infections

2. US Department of Defense (DoD), "DoD Directive 6025.21E: Medical Research for Prevention, Mitigation, and Treatment of Blast Injuries," 2006.

SESSION HIGHLIGHTS

SESSION 1: BLAST INJURIES & TREATMENT

Session Chairs
Dr. Hannah Wild (General Surgery Resident, University of Washington) & **Dr. Samar Al-Hajj** (Founding Director of MENA PAIR and Associate Professor, AUB

Session Scope
To understand the nature and distribution of blast injuries caused by the Beirut blast, the required treatments, and challenges.

The initial session provided detailed presentations on the type and severity of injuries, as well as the treatment challenges experienced in the aftermath of the Beirut port explosion. It considered the presence of other inpatients and the necessity of clearing and stabilising patients in theatres, while also addressing the care of existing patients who found themselves in damaged hospitals.

In this session, the casualty data from the Beirut port explosion was presented in the context of global conflict casualty data and injury epidemiology. Dr. Al-Hajj presented the findings of her multiple research studies on blast injuries, her presentation was entitled "Beirut Blast Preparedness Responses and Resilience," which assessed the characteristics and outcomes of these injuries. The study revealed that the majority of sustained injuries were secondary injuries, with lacerations (68%) being the most common, caused by shattered windows, particularly due to the absence of laminated glass.

Dr. Al-Hajj highlighted the implications of the blast not only on the population through inflicted injuries but also on the urban healthcare facilities and the fragile local healthcare system, which suffered substantial damage. The overall injury patterns revealed a predominance of secondary blast injuries (nearly 70%), followed by tertiary injuries (46%), primary blast injuries (11%), and quaternary blast injuries (2%).

IMPACT & INJURY [1, 3]

- **200** deaths
- **7,000** injuries
- **300,000** residents displaced with over 50,000 residences affected
- Nearly **200** schools damaged
- **10** hospitals affected
- **70%** secondary blast injuries - predominantly lacerations
- **46%** tertiary blast injuries - blunt injuries
- **11%** primary blast injuries - concussion/TBI
- **2%** quaternary blast injuries - environmental contamination
- Far-reaching indirect ecoomic effects

1. Human Rights Watch, "'They Killed Us from the Inside,' An Investigation into the August 4 Beirut Blast," 2021. Accessed: Sep. 21, 2023. [Online]. Available: https://www.hrw.org/report/2021/08/03/they-killed-us-inside/investigation-august-4-beirut-blast
3. Al-Hajj S et al.. The Beirut ammonium nitrate blast: A multicenter study to assess injury characteristics and outcomes. J Trauma Acute Care Surg. 2023 Feb 1;94(2):328-335. doi: 10.1097/TA.0000000000003745. Epub 2022 Aug 24. PMID: 35999664.

Among these categories, lacerations were the most common secondary injury, blunt injuries not otherwise specified were the most common tertiary injury, concussion/TBI was the most common primary blast injury, and environmental contamination was the most common quaternary injury.

These findings provided a contextual basis for the session chairs to share their firsthand experiences in responding to the immediate aftermath of the Beirut port explosion.

Dr. Marianna Helou
Clinical Assistant Professor and Division Head of Emergency Medicine, Lebanese American University.

Talk 1: Lessons Learned from the Beirut Explosion

The session's first speaker Dr. Helou, Professor and Division Head of Emergency Medicine at Lebanese American University, shared her experience in the Emergency Department (ED) following the port explosion. She shed light on the fact that the number of registered injuries and documented casualties from health facility records likely underestimated the true magnitude of the disaster. Dr. Helou further emphasised that private transportation, rather than formal Emergency Medical Services (EMS), was the predominant mode of prehospital transportation.

In her presentation, Dr. Helou discussed the profound impact of the blast on the health facilities and healthcare personnel (HCP) who were simultaneously responding to the tragedy while dealing with damage to their workforce and infrastructure. She highlighted that more than 120 HCP were injured, with at least six nurses among the deceased. The hospitals themselves suffered infrastructural damage, being located within 2.8km from the blast site. Dr. Helou then addressed the facility's experience in creating surge capacity within an understaffed setting, with only one ED physician available at the time of the blast. She pointed out the challenges faced in implementing formal triage criteria and highlighted that the Simple Triage and Rapid Treatment (START) triage system was impossible to implement due to staffing and resource limitations. Instead, a

fundamental triage principle was adopted, prioritising the care of those who were 'unable to walk and ill' over those who were 'stable and able to walk'.

Issues related to patient traffic control were also discussed, emphasising the need to restrict access to the ED, which was designated as a Red zone, while other areas were considered Green zones for patients with lower acuity. 'Crowd control' was identified as a critical element for an effective response.

Another significant challenge highlighted by Dr. Helou was the management of medical records and clinical documentation. The standard Electronic Medical Record (EMR) system was overwhelmed, resulting in some patients being triaged and discharged without proper identification. Dr. Helou proposed potential solutions, such as pre-made bracelets and stickers, emphasising the need to develop these solutions in advance of a mass casualty event. Furthermore, the anticipation of paper records and a process for digitization once the acute Mass Casualty Incident (MCI) has passed were deemed necessary.

Additionally, Dr. Helou discussed the use of simple coloured jackets to designate the roles of medical personnel and emphasised the importance of establishing communication systems among team members when telecommunication infrastructure is damaged, such as through the use of radios. Effective communication was not only crucial within their facility but also between hospitals for transfers and casualty coordination, as well as with EMS personnel to direct them to facilities with available capacity.

Dr Jamal Hoballah
Professor & Chairman of the Department of Surgery, AUB

Talk 2: The Beirut Port explosion, lessons learned from the AUBMC experience

The session's second speaker was Dr. Jamal Hoballah, Professor & Chairman of the Department of Surgery, from American University of Beirut Medical Center. Dr. Hoballah talked about the Beirut Port explosion and the lessons learned from the AUBMC experience.

During his presentation, Dr. Hoballah highlighted the challenges, lessons learned, and recommendations based on AUBMC's experience in managing the aftermath of the Beirut blast. AUBMC faced the daunting task of handling over 350 injured individuals in a limited 42-bed ED space, causing disruptions in workflow across the ED and the Medical Center Operating Room. In response, elective surgeries were cancelled, and the hospital focused on providing specialised services in various fields such as orthopaedics, plastic surgery, ophthalmology, ENT, vascular surgery, and neurosurgery to the blast victims.

Dr. Hoballah underlined the importance of AUBMC's Emergency Preparedness Plan, which involved zoning the hospital and assigning teams with specific roles to address potential electronic record limitations. He also discussed the challenges encountered during the disaster, including patient identification difficulties, limited capacity for casualty registration, varying types of injuries, emotional trauma, managing patients' relatives, and the added complexities of the COVID-19 pandemic.

Despite these challenges, positive aspects emerged, such as the successful implementation of triage protocols, mobilisation of experienced surgeons and emergency physicians, efficient management of lacerations, discharge of stable patients, and optimal utilisation of staff and facility resources while ensuring safety measures.

Dr. Hoballah emphasised that effective disaster planning should anticipate mass casualty scenarios, communication disruptions, and challenges in patient registration. His key recommendations included conducting drills to simulate overwhelming mass casualty incidents, addressing identified deficiencies through debriefing sessions, prioritising assessment of victims with life-threatening treatable conditions in triage, ensuring dynamic and ongoing triage by trained providers, and preparing for potential electronic record failures by employing paper documentation and keeping patient records with the patients. The MCI plan should also incorporate provisions to handle pandemics like COVID-19, implement stringent personal protective equipment protocols, and establish psychological support programs for healthcare providers.

Furthermore, Dr. Hoballah stressed the importance of engaging local health authorities in developing a comprehensive public health model for disaster management, particularly in challenging circumstances, and emphasised the need for real-time coordination of information between hospitals and emergency services to facilitate an effective response.

SESSION HIGHLIGHTS

SESSION 2: UNDERSTANDING THE HEALTH SYSTEM RESPONSE & CHALLENGES

Session Chairs
Maj Gen Michael von Bertele (Former Director General of the Army Medical Services, Former Humanitarian Director of Save the Children Intl.) & **Prof Shadi Saleh** (Founding Director for the Global Health Institute)

Session Scope
This session sought to understand how the health system in place at the time of the explosion managed the response. The aim was to understand the specific factors that contributed to the emergency response in order to identify lessons that might be applied to other mass casualty events linked to explosive blast.

The goal of the medical response to MCIs, both pre-hospital and in hospital, is to reduce the critical mortality associated with the disaster. Critical mortality rate is defined as the percentage of critically injured survivors who subsequently die. Factors influencing the critical mortality rate include:

a. **Triage accuracy**, particularly the incidence of over triage of victims
b. **Rapid movement** of patients to definitive care
c. **Implementation** of damage control procedures
d. **Coordinated** regional and local disaster preparedness.

The objective of conventional trauma triage is to do the greatest good for the individual patient, but it applies only when there are adequate resources to manage all casualties. In contrast, the objective of triage in a MCI is to do the "greatest good for the greatest number of patients". Critically injured patients who have the greatest chance of survival with the least expenditure of time and resources (i.e., equipment, supplies, and personnel) are treated first. Thus casualties who are still alive but either expected to die, or on whom a disproportionate level of resource must be expended, and which would detract from the care of many more less seriously injured casualties, may not be treated in line with conventional triage guidelines.

These principles are enshrined in SALT - Sort, Assess, Lifesaving Interventions, Treatment/Transport. This change to normal practice should be activated by the most senior clinician present and adds an extra category of triage to normal practice. The categories applied are:

a. **Red** (immediate, massive haemorrhage, airway, breathing, impaired circulation)
b. **Yellow** (delayed – immediate life-saving intervention not required)
c. **Green** (minimal)
d. **Black** (dead)

These principles may be applied in the pre-hospital setting as well as in the hospital, but in the case of the Beirut blast, and in similar urban settings, pre-hospital care and evacuation was severely disrupted. This leads to another feature of MCIs where a large cohort of less seriously injured casualties may present at hospital, having made their own way, in advance of the more seriously injured who are waiting first responders to transport them. Explosions in an urban setting will typically cause both chaos and paralysis of transport systems and this happened here since the explosion occurred at a time of peak traffic in the centre of the city.

TERMINOLOGY IN THIS CONTEXT IS IMPORTANT

Two terms were employed to differentiate the nature of different responses:

Multi-casualty Incidents (MCIs) are situations in which medical resources (i.e., pre-hospital and hospital assets) are strained but not overwhelmed. In the UK context these would be referred to as Medical Major Incidents and the **Major Incident and Medical Management Support (MIMMS)** principles set the standard for how they are dealt with.

Mass-casualty Incidents (MCIs – NATO MASCAL) result when casualty numbers are large enough to disrupt the healthcare services in the affected community or region. Demand for resources always exceeds the supply of resources in an MCI to the extent that the employment of normal processes is no longer appropriate.

They are therefore not just a matter of scale but of the ability of a system to cope. In these situations, the normal process of triage that is employed by all mature health systems may be inverted and this will be discussed later.

SESSION TWO SUMMARY : KEY HEALTH SYSTEM RESPONSE CHALLENGES

1. There were very high numbers of victims in a very short period of time
2. Complex challenges in accessing the victims due to the nature of disruption at a city-wide level
3. Nearby major hospitals were directly affected by the blast
4. Nearby Emergency Medical Services stations were affected

*It should be noted that this is a case of a very rare event at a city level.

Dr. Anthony Nasr
Lebanese Red Cross

Talk 1: Lebanese Red Cross Beirut blast response

Dr. George Abi Saad, Associate Professor, Department of Surgery, American University of Beirut Medical Center

Talk 2: Beirut explosion in the pandemic era: how to manage a mass casualty event & lessons learned

Presentations were given by two key speakers, Dr Anthony Nasser from the Lebanese Red Cross and Professor George Abi Saad, Head of Trauma Services and Surgical Critical Care at the AUB. The Lebanese Red Cross provides both services and coordination in the pre-hospital setting and supports the national blood transfusion service.

Both speakers made similar points about how well prepared the health system in Beirut was for an incident on this scale. To put this in the context of military unrest in the region, Lebanon has witnessed more than 65 conflict related MCIs in the past 14 years and the AUBMC's ED, the largest and busiest in Beirut, has managed ten mass casualty incidents, including one with more than 250 victims, two with more than 60 victims and seven with approximately 70 victims. This is an unusual level of activity and supported the key lesson of the response – preparedness based on learning from prior events is the best way to ensure a competent response to the next event.

Their presentations revealed that their hospitals had clear plans for management in a MCI based on experience of previous MCIs. A number of lessons had been incorporated and formal rehearsals and impromptu drills had been conducted over several years. This is an unusual situation but some element of rehearsal will always be required if staff are to understand their roles and be able to respond to a MCI.

Both presentations identified and discussed the following health system response challenges:

a. **Local and regional plans** assumed that each facility would act largely in isolation for the first 6-12 hours. This had implications for staff and for stock levels which needed to be adequate for anticipated casualty loads, but in this case were exceeded in some respects
b. **Alerting and recall of critical staff**. All emergency plans will set out how staff are to respond but in an urban setting such as this the whole population became aware almost immediately of the emergency. Many made their way to their place of work, impeded only by the traffic chaos that had ensued. Mobilisation plans are usually based on a cascade system but although activated, this was probably not required.
c. **Dedicated areas for management** of casualties of different categories are planned in advance so that triage and direction of casualties to appropriate areas is rapid, and the "front door" does not become blocked. In this case, and in other events of explosive violence, the access points to a hospital may have been damaged and alternatives must be considered in planning scenarios.
d. **Patient recording** switched from digital to paper, using pre-populated and numbered records, investigation requests and clipboards. This facilitated management of unconscious patients but must be understood and practised in advance so that records are firmly attached to patients and only subsequently reconciled with patient details. This practice might be problematic if patients were rapidly referred to other facilities.
e. **Communication** both within the hospital and with other agencies is rapidly disrupted and a secondary means may be necessary – in an age of mobile telephony, networks may become overloaded and a back-up handheld short wave radio alternative may be required. This was activated by the Red Cross and enabled mobilisation of ambulances from outside of the city boundary.
f. **Coordination** within the hospital and between departments must be maintained.
g. **Resource coordination** both within the hospital and with other facilities can rapidly become a constraint on treatment. In this case the Lebanese Red Cross provided essential escalation of blood supply, managing the transfusion service and the distribution of blood in a very short period of time.
h. **Bystanders**, friends and relatives often transport the injured to hospital and can rapidly overwhelm the space, therefore crowd control was vital.
i. **A primary principle of management in a MCI is the discharge of non-critical patients**, emptying of ED departments of non-urgent cases, and then the onward evacuation of patients after immediate care. This proved extremely difficult in a largely private system as the normal receiving facilities queried how they were to be paid for the urgent reception of large numbers of patients.
j. **A large number of injuries were caused by falling debris, and notably glass**. These caused numerous lacerations, but they did not have the characteristics of high velocity fragment injuries and many were treated on the spot with simple cleansing, anti-tetanus and wound stapling. This allowed large numbers of casualties to be rapidly turned round and discharged.
k. **In addition there was a high incidence of head injury** – this is in stark contrast to military injury patterns where head protection is the norm.
l. **Routine emergency cases** will still present and must be triaged and treated at the same time.

SESSION HIGHLIGHTS

SESSION 3: HEALTH SYSTEM PREPAREDNESS & SIMULATION APPROACHES

Session Chairs
Prof James Batchelor (Associate Dean International Research & Director of the Clinical Informatics Research Unit, University of Southampton) & **Dr Josette Sfeir-Rahme** (Head of MWSS/RMSDD for UN-ESCWA)

Session Scope
To better understand hospital preparedness plans in the Beirut context and identify opportunities and strategic decisions to improve future health system response and resilience, including the usefulness of systems simulations.

Dr. Nuhad Dumit
Professor & Associate Dean, Hariri School of Nursing, American University of Beirut Medical Center

Talk 1: Investing in the healthcare workforce for better response and Recovery

The presentations in this session focused on the importance of proper investment in workforce and resources/tools for emergency preparedness.

Dr. Nuhad focused on the importance of public investment in the healthcare workforce for the various levels of emergency response which included investment in education (or production of healthcare workforce), optimal distribution of healthcare workforce by specialties and geography, and investment to support the healthcare workforce work life balance (e.g., to avoid burnout).

She discussed the opportunity to better utilise the nursing workforce to support the response to MCIs. Nurses can help with many of the processes in emergency response, due to their experience on the ground and their overall knowledge of the healthcare service provision. Nurses can provide service at the point of care and provide auxiliary services, for example taking care of minor injuries in alternate sites. They can also help provide continued care for people affected by the disaster and evaluate their needs for extra extra due to post traumatic conditions.

Prof Stephan Onggo
University of Southampton

Dr Edilson Arruda
University of Southampton

Talk 2: How modelling and simulation can support health system preparedness and response decisions for mass-casualty Events

The presentation by Prof. Onggo and Dr. Arruda shared an opportunity to apply mathematical modelling, analytics and simulation methods that can potentially support emergency preparedness. This included both the preparedness and immediate response, but also in terms of tackling the long-term consequences for the physical and mental health of the affected population.

For emergency preparedness, it is important to understand the service provision and possible ways of coordinating private and public healthcare services in the country. This can lead to integrated planning that takes into account the geographical distribution of medical services and resources in the region, to make sure all regions are covered in case of disaster and that there are nearby facilities that can be used in case of a disaster in any region. This is very important to avoid the concentration of resources/facilities in small areas, which can be catastrophic - since a disaster affecting these facilities would hinder the emergency response. This can lead to lack of supplies, lack of medical facilities and even medical personnel in case of a disaster.

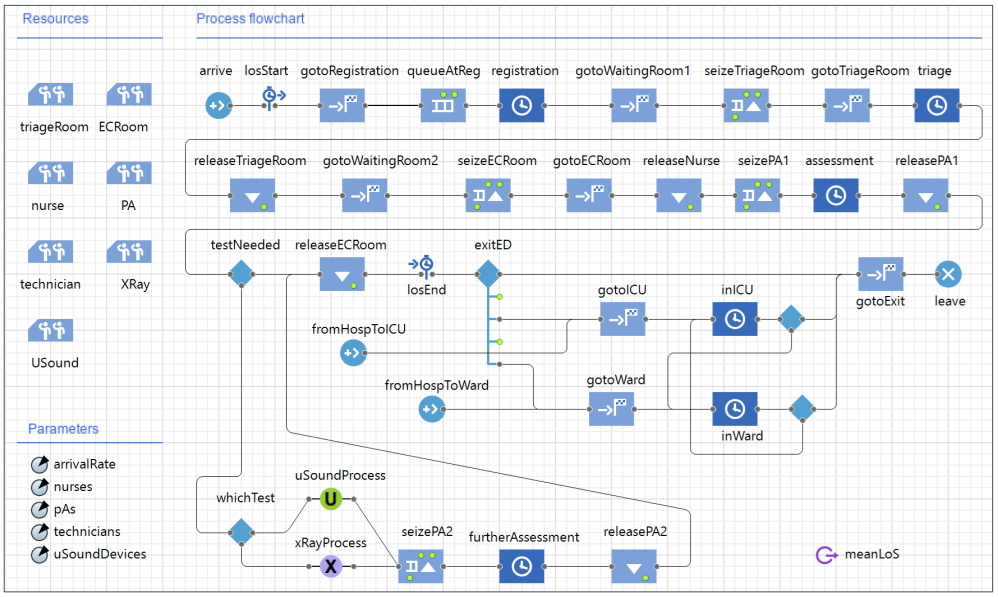
An integrated plan should, therefore, strive to distribute resources across the country, to make sure there are always resources to be tapped into in the regions neighbouring a disaster zone. This opens up many research questions, such as: i) where to locate facilities?; ii) where to place vital inventory of medical supplies that would be needed in a mass casualty event; ii) how to organise the response and how to coordinate the existing resources across the public and private sectors, as well as NGOs. Optimisation and healthcare modelling can help answer these questions and quantify the results of proposed courses of action.

OPPORTUNITIES & CHALLENGES FOR MODELLING & SIMULATION

One of the key focuses of Session 3 was to understand how modelling and simulation approaches could be developed and useful in preparing for MCIs such as the Beirut Blast.

Different modelling approaches and research can be used to better understand service provision during an MCI. Post-disaster studies can help clarify patient pathways and the different needs of resources for different types of injuries. Blast modelling can help predict the types and gravity of injuries due to EWIPA incidents and such predictions could be combined with patient pathway data for these injuries in past disasters. This could lead to models that can quantify the need for resources in possible mass casualty scenarios, and therefore help guide operational and planning decisions regarding supplies and the distribution of healthcare service provision.

Fig(s): Creating models of a typical emergency dept. as part of the UoS Interdisciplinary Study



MODELLING THE BEIRUT HEALTH SYSTEM - A PILOT PROJECT (2022-2023)

The UoS-AUB health system modelling project set out to understand the feasibility of gathering data for the development of simulation models of the Beirut health system to understand the health system response to mass casualty blast events.

Data required for developing a model specific for the Beirut health system during a major incident was identified through the development of a fictitious hospital model and collected via a baseline survey. The survey was sent to health care professionals and hospital management personnel at several health facilities in Beirut to collect baseline data of hospital capacity and capability.

The data are useful to provide initial baseline understanding of the parameters that should be included into a model of the system's response to catastrophic events. The data showed that there is a significant variation between hospitals. The data and literature also suggest that the processes/procedures when responding to the blast also vary between hospitals (this was confirmed during the workshop). Hence, it is hallenging to create a model to simulate the health system's response to a blast event that is applicable to all hospitals. An ideal follow up to the workshop would be to develop a model for a specific hospital and then extend it to a network of hospitals.

The workshop provided context for this pilot project and improved understanding the health system response to the blast from a systems perspective. This included via real-world accounts from people who were involved directly in the response to the Beirut port blast responding to the blast and its aftermath.

SESSION HIGHLIGHTS

SESSION 3: HEALTH SYSTEM PREPAREDNESS & SIMULATION APPROACHES

KEY CONSIDERATIONS THAT AROSE FROM PRESENTATIONS AND DISCUSSIONS THROUGHOUT THE WORKSHOP

- **The distribution and composition of the health system is important for modelling the system's response - in Lebanon, the health system is concentrated in and around Beirut, especially in the capital's city centre. The fact that the system mainly comprises private hospitals is an important factor, as it provides additional challenges to any public healthcare preparedness initiative.**
- **The concentration of hospitals around a small geographic area makes it difficult to coordinate responses and resource sharing with regions not affected by an event.**

These issues provide a motivation for possible facility location approaches, with a view to devise strategies to appropriately locate and distribute resources and supplies in case of mass casualty events. This will also help address the risk of having healthcare facilities in a very small area, as a disaster in this area may compromise or hinder response efforts, since it may affect the very facilities that would respond to the event.

Also due to the concentration of healthcare resources around the capital, many people move to the city to have better healthcare coverage and resources, hence modelling approaches to promote fair and equitable access to healthcare may be of help to the system.

- **Modelling challenges include casualty flow and long-term pathways of patients affected by a disaster, as this may cause lifelong needs that have to be provided afterwards, both in terms of physical and mental health.**

Data remains a key challenge when it comes to developing models and simulations of health systems. Data is needed before, during, and after the crisis. Collecting data on what happens between a disaster event and hospital arrivals is particularly challenging. "Benchmarking" data can be used to establish baselines and develop the models of health systems, but data collected during the crisis is also required to validate models and increase understanding of the response and capability of health systems during an MCI. Good baseline data about health facility mapping and capabilities with ability for continuous/real-time updates is important for planning, preparedness and response to MCIs.

Prospective needs of patients should be modelled to plan for the extra service provision that will be required following the event. There is a need firstly to quantify the post-disaster demand for care among those affected by the blast, as well as the extra demand that will be caused by the provision of sub-optimal service during the response. Active follow-up of patients affected by the blast event, would help to assess long-term needs, and design the necessary capacity for these needs. This would, for example, help quantify the need for mental health services after the blast injury, to avoid large wait times for these services.

Through analysis of post-disaster patient pathway data, additional research questions can be explored including:

i) **what types of post-traumatic treatments are needed** after a given type of injuries, and what are the resources involved across the patient's lifetime?
ii) **what is the need for mental health provision** and what types of services are needed and for how long?
iii) **what is the effect of the sub-optimal provision of care** during the disaster response for the future health of the patients (e.g., chronic pain and other health conditions)?

SESSION HIGHLIGHTS

SESSION 4: REVERBERATING HEALTH IMPACTS

Session Chairs
Dr Iain Overton (Director of Action on Armed Violence) & **Dr Zeina Akiki** (Research Manager, Embrace Lebanon)

Session Scope
To understand the longer-term health impacts caused by the blast, including mental health, life-long injuries and disabilities, and provision for rehabilitative care, in addition to the repercussions for the health system

Mr Jake Tacchi
BBC World Service Investigations

Talk 1: UN EWIPA Indicators - SDG 3 and measuring explosive harm from the Beirut Blast

Jake Tacchi shared findings from two research projects he conducted in 2021 with the UK-based charity, Action on Armed Violence. The first research project focused on a rocket attack in eastern Ukraine in 2015, whilst the second covered the Beirut blast.

His research was driven by a research framework developed by the United Nations Institute for Disarmament Research (UNIDIR), called the "Menu of Indicators to Measure the Reverberating Effects on Civilians from the use of Explosive Weapons in Populated Areas" (known as UNIDIR EWIPA indicators)[4]. These indicators, first published in February 2021, had set out to better measure and compare the multifaceted impacts of explosive violence on civilian populations by moving beyond death and casualty figures. Instead, UNIDIR presented a more holistic approach where populated areas are seen as complex ecosystems which explosive violence can seriously disrupt - causing lasting and far-reaching impacts on health, education, society and culture.

The UNIDIR EWIPA indicators are aligned with the UN's Sustainable Development Goals (SDGs), namely SDG 16 (Peace, Justice and Strong Institutions), 11 (Sustainable Cities and Communities), 3 (Good Health and Well-Being) and 4 (Quality Education)[5]. The indicators are also delineated into three levels: first, second and third. The first level focuses on immediate damage and destruction caused by explosions, while the second and third levels address the impacts on services and service delivery resulting from the damage.

Mr Tacchi did not discuss specific findings from his two research projects during his presentation. Instead, he focused on the opportunities and potential pitfalls of the UNIDIR EWIPA framework, hoping to provide insights for future research on mass casualty blast events. Due to the health-focused nature of the workshop, Mr. Tacchi's primary focus was primarily the EWIPA indicators tied to health (SDG 3).

While assessing the relative merits of using the UNIDIR EWIPA indicators as part of research projects, Mr. Tacchi compared and contrasted two differing approaches which had arisen from his research in Ukraine and Lebanon. For the first research project, conducted in March 2021, AOAV had decided to use the EWIPA indicators rigidly - as quantitative indicators. This method was deployed in an attempt to both "stress test" the indicators, but also to offer opportunities for comparisons between different explosive weapons and explosive events. It was highlighted that this method was feasible for UNIDIR's first-level indicators (such as damage and destruction to health facilities or destruction of ambulances) where impacts could be counted or measured and researchers could more effectively attribute cause and effect.

However, when it came to rigidly using second and third level indicators serious issues emerged. Mr Tacchi highlighted that problems of measurement, attribution and causality became very prevalent. In particular, indicators which look to measure changes in mortality rate arising from diseases such as cancer or HIV are incredibly difficult to attribute solely to explosive violence and even more difficult when it is a single explosive event. Such factors are likely the result of an extremely complex interplay of numerous socio-economic factors and to attribute them solely to a single incident of explosive violence would create serious methodological problems. Therefore, Mr Tacchi highlighted the fact that results for many of the second and third level indicators were: "figure not known" or "impossible to accurately represent". This - understandably - failed to capture the fact that explosive events are likely to have long term health impacts.

4. Wille. C and A. M. Baldo, 'Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas', UNIDIR, 2021, https://unidir.org/sites/default/files/2021-03/EWIPA%20Research%20Framework%20-%20Final.pdf.

5. UNIDIR have since added a "second menu of indicators" incorporating SDGs 6, 2, 15 and 1.

SESSION HIGHLIGHTS

SESSION 4: REVERBERATING HEALTH IMPACTS

These learnings then influenced a second research project which applied the UNIDIR framework to the Beirut blast. In this study, conducted in August 2021, Mr Tacchi highlighted how the EWIPA indicators were used in a far more flexible way, more in keeping with UNIDIR's intention for the indicators to be "tools to contribute to the process of thinking of urban environments as ecosystems". This allowed the researcher to think about how the Beirut blast had impacted - and would continue to impact - on different aspects of Lebanon's health system more generally, without a rigid focus.

Using the indicators in this way provided opportunities for more detailed and structured research and insights. For example, Mr Tacchi stated that dividing health impacts into first, second and third level was incredibly useful for dividing the focus of research and ensuring that individuals thought more carefully about chains of casualty which may emerge from explosive events. It also forced the researcher to think more about the linkages between first level impacts and subsequent second and third level impacts. For example, how damage to a specific health facility would likely lead to disruptions in service and an overall reduction in the quality of care.

Mr Tacchi also highlighted how first-level indicators became key tools in framing discussions, albeit in a more holistic manner. Instead of trying to meticulously record the amount of damage inflicted on a given health facility, researchers could identify badly damaged health facilities and ask health professionals how damage to the facility impacted their work in the immediate and longer-term aftermath of the explosion. This - he stated - gave far more interesting responses, and allowed rich qualitative data to be collected.

It was also mentioned that - learning from the previous research in Ukraine - it was needed to use second and third-level indicators in an even less rigid way. Long-term impacts were best discussed more loosely, but it was important for the researcher to remain aware of longer-term health impacts which may emerge following an explosion.

Overall, Mr Tacchi highlighted that using UNDIR's EWIPA indicators as fixed, quantitative measurements proved incredibly difficult in practice, and likely created more issues than benefits to the researcher. However, he went on to suggest that if the indicators were used more flexibly, as qualitative measures or ways of framing and focusing research, they offered clear benefits and helped push forward the idea that the impacts of explosive violence go far beyond initial death and destruction. Instead, they may impact civilians in a myriad of complex ways which can last for years and even decades.

Dr Myriam Zarzour
Co-Director, Embrace Lebanon

Dr Yara Chamoun
Co-Director, Embrace Lebanon

Talk 2: The Embrace Mental Health Center (EMHC) experience post Beirut blast; acute response, long-term consequences and lessons learned

The final presentation of the day focused on the mental health impacts of the Beirut blast. This was important as the psychological impacts of mass casualty blast events are often overlooked, despite their prevalence and lasting effects. Dr Zarzour and Dr Chamoun focused on the experience of the Embrace Mental Health Center (EMHC) in the immediate and longer-term aftermath of the port explosion.

Embrace is an NGO dedicated to providing mental health awareness, providing support and offering services to individuals and communities in Lebanon. The organisation carries out a range of projects and services - one of which - the EMHC - was set up as a response to the Beirut blast to provide direct, affordable, quality mental health care for individuals living in Lebanon.

Dr Zarzour and Dr Chamoun first described Embrace's initial response, which began moments after the explosion. The organisation established a "basecamp" close to Beirut's port where a range of key services were provided - including a mental and emotional support clinic providing direct support.

In response to the high numbers of individuals reporting high levels of anxiety and depression in the first ten days following the blast, Embrace launched the EHMC walk-in clinic to provide mental health services to all those affected. By November 2021, the EMHC had already run

204 consultations with either psychiatrists, psychologists or psychologists in training. In particular, Dr Zarzour and Dr Chamoun highlighted the high levels of PTSD which were recorded following the Beirut blast. In response to this, EMHC provided specialised therapies for PTSD. This included both individual reconsolidation therapy and group EDMR.

In the first months following the port explosion, it became clear that the needs of the walk-in clinic were immense and that a more long-term, sustainable model was required. At this time, Embrace were able to secure funding in order to expand the walk-in clinic to a community mental health centre. As a result, Embrace were able to recruit mental health professionals and furnish the EHMC in order to accommodate the load of patients. Meanwhile, Embrace established connections with universities in Lebanon in order to host a clinical training program alongside the day-to-day running of the centre. This ensured the EMHC could function as both a free clinic and a training site for graduate psychology students.

Dr Zarzour and Dr Chamoun then described the growth of Embrace and the EMHC over the past two years, which has taken place during two of the most difficult years in Lebanon's history. Despite the deteriorating socio-economic situation, EMHC has experienced significant growth and established a successful model of a community mental health centre within a Lebanese context. The centre has expanded its services to enhance the quality of care and increase the chances of recovery for beneficiaries. To align with their mission of providing the highest standards of care, the EMHC developed a personalised electronic health record system, enabling them to transition from paper to electronic files, thus effectively tracking beneficiaries' treatment progress. Dr Zarzour and Dr Chamoun went on to reflect on the achievements of the EMHC over the past two years which included the delivery of 11,255 free mental health sessions to roughly 1,032 beneficiaries. Furthermore, Embrace was able to cover the cost of medication for around 357 beneficiaries suffering from acute mental health conditions.

Despite these successes, it was also important to reflect on the difficulties of providing mental health care in the Lebanese context. Dr Zarzour and Dr Chamoun concluded by highlighting the ongoing difficulties they faced - predominantly arising from increasing demand for their services, despite limited resources.

DISCUSSIONS

DECISION-MAKING & COORDINATION

The workshop participants discussed the lack of centralised government coordination in the health system's response to the Beirut blast, leading to difficulties in decision-making and coordination among medical facilities. Despite these challenges, most hospitals had well-defined disaster plans influenced by Lebanon's history with explosive violence. However, the blast's impact on healthcare facilities and unclear contingency plans revealed their fallibility.

To ensure healthcare coverage and resource distribution across the country, it is necessary to have services readily available near disaster areas. This requires comprehensive emergency planning and prioritising coordination and coverage of healthcare services by government bodies, NGOs, and hospitals.

The coordination within Lebanon's healthcare system, with private hospitals operating independently from each other and government bodies, creates challenges. Effective coordination between the health system, emergency services, NGOs, security forces, and government bodies, could further improve the response to MCIs. Establishing an effective mechanism for mobilising civilians and coordinating their involvement in response efforts could be beneficial to response efforts.

Organisations like the Lebanese Red Cross can play a vital role in connecting healthcare actors, civilian organisations, and logistics/supply chains to facilitate coordinated efforts. Strengthening crowd control measures and coordinating supply donations would enhance response effectiveness. Additionally, establishing a contingency transportation system, such as utilising motorcycles for off-duty staff when roads are blocked, and coordinating civilian volunteers for patient transport and supply coordination, could be prioritised. Ensuring well-coordinated mobility of personnel and medical resources can guarantee the availability of healthcare supplies at the site of injuries.

Following the blast, ED and operating theatres (OT) quickly reached capacity, due to the high influx of patients. To effectively manage the situation, medical professionals focused on triaging patients, aiming to prevent overcrowding and over-triaging in the ED in preparation for subsequent waves of more severely injured patients. To alleviate overcrowding, low-risk patients were transferred to other facilities, while medical students provided first aid to those who did not require immediate ED admission. However, the presence of a large number of medical students created new challenges for supervision and overcrowding when more acute injuries arrived at hospitals.

Medical staff recognised the importance of considering patients as a whole and making decisions that minimised overall harm. However, the damage caused by the blast limited the number of available beds, posing challenges to ward admissions and safe hospital operations. Efficient discharge processes were crucial to clearing beds for incoming casualties. Some hospitals struggled to accommodate the large number of patients and lacked proper management systems to link patient identities and provide necessary documentation. The management of patient records and information exchange became challenging when IT mechanisms were unavailable. As a result, alternative methods such as attaching paper records to patients or making notes on their bodies were suggested to mitigate logistical challenges.

The simultaneous arrival of off-duty staff at hospitals caused additional issues, with crowded and damaged roads hampering resource utilisation. Coordinated efforts were required to ensure efficient deployment of available resources and avoid further overcrowding. Due to insufficient emergency vehicles, private cars and motorcycles were used for patient transportation, further complicated by impassable roads.

Delays in reaching hospitals occurred due to various modes of transportation, including personal vehicles and taxis. It was recommended to mobilise citizens and raise awareness about disaster preparedness beyond hospital personnel. Additionally, utilising surrounding spaces to increase hospital capacity was suggested as a potential solution.

LESSONS LEARNT & OPPORTUNITIES

- Emergency plans existed but execution of plans experienced delays due to a lack of decision making and coordination. **A Disaster Management Council could be established** to facilitate implementation of emergency plans and coordination between government and private sector.
- **Improving discharge planning** - patients were meeting all discharge criteria but were not promptly dispositioned, or patients with minor/superficial injuries were not departing due to shock/grief, limiting hospital capacity.
- **Possibility for using on-call triage Nurses** who can be rapidly mobilised in an emergency setting.
- **Strengthen sector expertise and specialists** in disaster management and health preparedness.
- **Need to plan for post-disaster health care provision**. This includes continuing medical attention for acquired chronic conditions and long-term mental health provision.
- **There is a need for the mobilisation of citizens** for disaster response, not just hospital personnel and to raise awareness among civilians for disaster preparedness.
- **There are opportunities for coordination** between stakeholders through a central organisation for example, the Lebanese Red Cross, to facilitate communication between health care actors, civilian organisations, logistics/supply chains, etc.
- **Emergency roles must be assigned to staff in advance**, may not be their "normal" role, and coloured tabards to aid identification of roles are invaluable within teams and to distinguish them from members of the public who will inevitably access treatment areas. Plans should also identify staff who should be released early so that they are available as reinforcements in the following 12-24 hours after the onset of the emergency.
- **Each area should have a nominated leader** in charge on the spot, and responsible for upwards and outwards liaison. That person should ideally not be directly involved in care.
- **Hospital management should have a dedicated manager** on the floor, in direct communication with the overall management team who provide coordination between departments, functions and external agencies.
- **Bystanders and family members arriving at hospitals may pose a considerable risk to safety and security** and must be separated from treatment areas. In the case of the dead, a separate area should be provided where relatives can identify and view the deceased as soon as possible and in surroundings that do not cause further distress.
- **In a private health system contingency plans** must assure patient evacuation plans and if necessary, underwrite subsequent payments.
- **Media access must be controlled** and only one person authorised to issue statements.

RESOURCES

One factor that workshop attendees addressed as an overall difficulty when it came to responding to the blast was the ability to effectively manage and resupply medical supplies. This was especially apparent in the days and weeks following the explosion.

Resource provision during the Beirut blast was influenced by factors such as the patient demographics and outcomes, triage considerations in a MCI, and resource shortages. Due to the range and scale of injuries brought about by the blast, less common medical supplies were being used up quickly. Medical professionals in attendance of the workshop mentioned that due to stretched capacity, the specialist knowledge required to effectively identify and access essential supplies was not always present. Staff may not have had the knowledge of the resupply protocols for less commonly used supplies.

LESSONS LEARNT & OPPORTUNITIES

- **A level of coordination is required** to assess stock levels and resupply across the system
- **Good logistics and supply chain management** within health facilities is important
- **Need for decentralised inventory policies** and study on the usage of resources for different types of trauma injuries, so health care personnel can estimate their needs and communicate them to the logistics team
- **Need to keep minimum supply of resources** needed to treat traumatic injuries, and to define protocols of access and resource provision
- **Decentralised inventory** to avoid destruction of supplies in a single event.

REAL-TIME ASSESSMENT & FOLLOW-UP DATA

Real-time data is essential for managing the response to an MCI as well as for preparedness, recovery and patient follow-up.

Real-time assessment during an incident can have many benefits including:

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- **Facility mapping and capacity**
  Broadly, in terms of systems planning, to ensure that major hospitals are geographically distributed/decentralised to prevent destruction of all health facilities in a single event. More specifically, during an incident, understanding the capabilities and capacities of facilities in real-time can optimise patient care and flow through the health system.

- **Patient management**
  Understand capacity at each hospital to ensure that patients can seek care appropriately, with an emphasis on understanding each facility's capabilities and the need to refer patients for specialised procedures (like burn treatment or reconstructive surgery) to optimise patient outcomes. Real-time assessment can also help to anticipate the influx of patients 24-48 hours post event with non-traumatic health emergencies who delayed seeking care during the immediate incident, as well as their need for resources. Data collected in real-time will provide reliable data to inform patient follow-up after the event. This could be used to inform response protocols and both short- and long-term service provision for patients affected by MCIs.

- **Personnel management**
  Keeping track of personnel working during an MCI would help to best utilise human resources available. This includes volunteers, both domestic and foreign and would assist in implementing protocols for emergency approvals for volunteers to practise and work in facilities..

LESSONS LEARNT & OPPORTUNITIES

- **A good data collection system** is needed to improve responses for future incidents; during a crisis, there is a need to be able to actively document followed by digitising data after the incident for subsequence analysis.
- **Need for real-time notification system** regarding capacity at each hospital so that patients can seek care appropriately
- **Need for reliable information** for the follow-up of patients. Improved documentation of patient's clinical and psychological needs and resource usage after the event is needed to design proper response protocols and service provision for patients affected by disaster.
- **Opportunities to develop a software-based solution** that can assist with the coordination of the response to an MCI using real-time data and assessment of current capacity and capabilities of health systems.
- **Reporting and coordination** is important at every level and the system cannot be set up after the event. Staff must know what is routinely recorded and reported and plans must be clear about how that might be adapted, but new systems should not then be introduced. This should include stock levels (including blood), staff numbers broken down by qualification and availability, bed occupancy, and a breakdown of casualty numbers by type and location.
- **It is difficult but essential to gain situational awareness** and to attempt to estimate expected arrivals at the hospital. This may be a function of pre-hospital care but in the event that this has been disrupted, the rule of thumb adopted is to expect double the number of arrivals in the second hour, as arrived in the first hour, and of increasing severity.

DISCUSSIONS

CLINICAL TREATMENT

The magnitude of the explosion and the large number of victims overwhelmed the medical response to severe injuries. In order to accommodate the influx of patients, strict triage principles had to be implemented. The Beirut experience demonstrated how mass casualty drills can reinforce triage criteria should an actual event occur; and highlighted the role of deploying the most senior staff to make such decisions given the limited resource of surgeons and operating rooms.

As in many conflict settings, emergent management of threats to life and damage control procedures took precedence over more definitive or time-intensive approaches. For example, a person with a severe extremity crush injury with associated soft tissue defects would typically require extensive reconstructive surgery. However, due to the overwhelming number of casualties, such comprehensive treatment was not possible. Medical staff had to make difficult decisions and opted for quick life-saving procedures instead. In this case, amputation of the leg was deemed necessary to address the broader needs of the population.

Head trauma cases presented additional challenges for medical personnel. Blast overpressure often resulted in immediate fatality, but survivable head injuries caused by blunt trauma requiring emergent decompression overwhelmed the capacity of staff surgeons. The shortage of neurosurgeons further complicated the treatment of head trauma injuries. However, temporary "damage control" surgeries were identified as a viable solution that could be performed by chief residents. This allowed neurosurgeons to focus on more critical cases without significantly increasing the risk of negative outcomes.

Limited blood supplies became a critical issue, despite emergency blood banks being set up. Decisions had to be made regarding the allocation of blood resources, weighing the likelihood of saving a patient's life against the available supply.

During the workshop, participants identified important stages in the patient pathway. Initial triage was essential to identify patients requiring immediate attention, those who could be discharged quickly, and those in need of palliative care. The specific resources needed for different types of injuries, such as imaging tests and operating theatres, were discussed. The importance of establishing a clear and standardised pathway was emphasised to ensure consistent care delivery.

LESSONS LEARNT & OPPORTUNITIES

- **Triage criteria should be reviewed and exercised regularly during MCI drills.** The most senior trauma care providers should be responsible for making triage decisions to optimise utilisation of scarce surgical resources
- **Offloading staff and space** by facilitating expeditious discharge of minor casualties is essential to optimise resources towards the most critical casualties
- **There is a need to reframe expectations** around salvageable injuries and need for acute injuries to take precedence
- **Compared to military personnel with protective body armour, a higher incidence of head injury in unprotected civilians is to be expected** and contingency plans must include protocols for managing large numbers on the basis of clinical signs if imaging capability is low or absent.
- **With appropriate oversight, task-shifting may be appropriate in MCI situations;** for example, enlisting medical students to assist with simple laceration repairs – so long as adequate measures are in place to ensure adherence to basic principles of wound management (e.g., copious irrigation, administration of tetanus vaccine when indicated, ensuring that contaminated wounds are not closed)
- **The need for a clear and consistent standardised pathway** was discussed and highlighted, as protocols for patient flow bear significant implications for clinical management

PSYCHOSOCIAL

The psychosocial effects of MCIs, like the Beirut blast, are often overlooked, despite their prevalence in casualties, witnesses, and emergency response and health care personnel.

The true burden of the mental health impacts following the Beirut blast are unknown as well as long-lasting effects on an individuals quality of life. The utilisation of a mental health centre provided by Embrace Lebanon demonstrates the need for such services and the importance of this service provision following the blast.

LESSONS LEARNT & OPPORTUNITIES

- **There is a need to link social work services and mental health provision** with the acute trauma response following an MCI.
- **Lessons from the Beirut blast have indicated a need for a continuum of care** to include consideration of the psychosocial needs of patients, particularly those with lower-acuity injuries. This involves ensuring that vulnerable groups like paediatric patients with minor injuries (e.g. lacerations, superficial abrasions) receive appropriate support, such as access to a nurse or companion before being reunited with their families to mitigate the psychological impact

SUMMARY

This workshop covered many topics surrounding the health system response to the 2020 Beirut blast. Through fruitful discussions, key lessons and opportunities for future developments and research to improve the response to future MCIs were identified. The workshop provided a platform for honest and holistic conversations to understand the response and burden of the Beirut blast on the health system both in the immediate aftermath and the long-term consequences.

KEY OPPORTUNITIES

01

Improved decision making and coordination methods between healthcare actors, government, private sector, civilian organisations, logistics/supply chains etc.

02

Improved disaster management education for healthcare actors and civilians

03

A good data collection system is needed to improve responses for future incidents

04

A clear and consistent standardised pathway of care is needed for the clinical treatment of blast casualties

05

There is a need for a continuum of care following the immediate aftermath of an incident and should include the consideration of the psychosocial needs of the victims.

WORKSHOP ATTENDEES

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George Muller, International Criminal Court
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