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Are we exporting problems or solutions? A model for Transitional Field Hospitals in Natural Disasters

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MASTER THESIS

ARE WE EXPORTING PROBLEMS OR SOLUTIONS?

A model for Transitional Field Hospitals in Natural Disasters

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ABSTRACT

Natural disaster and conflict scenarios present challenging environments for healthcare treatment. In remote or underdeveloped areas where already scant healthcare services exist, this need is exacerbated - particularly when much existing healthcare infrastructure is destroyed by the disaster. Field Hospitals have been traditionally viewed as an attractive proposition, both in their efficiency of delivering a 'package' solutions of tools and infrastructure, as well as their tangibility to donors wanting to provide visible solutions. However, they have sometimes been hastily deployed with little regard for contextual factors and a lack of transition strategy to support long-term recovery. This thesis investigates the transitional role of Field Hospitals, drawing lessons learnt from transitional shelter guidelines along with best practice principles current in Field Hospital literature. The 2010 Haiti Earthquake has been used as a case study to analyse both how Field Hospitals were used, how well they responded to the context and the gap between their withdrawal and more permanent facilities opening. Further data was collected through interviews with key actors involved in Haiti across a range of different disciplines. The key findings were that there needs to be greater emphasis placed on the design and operation of semi-permanent health facilities (Transitional Field Hospitals) that can bridge the gap between initial relief and long-term recovery, responding to contextual factors and empowering locals to take back control.

PART 1: INTRODUCTION

Natural disaster and conflict scenarios present challenging environments for healthcare treatment. In remote or underdeveloped areas where already scant healthcare services exist, this need is exacerbated - particularly when much existing healthcare infrastructure is destroyed in the disaster.

Field Hospitals have been traditionally viewed as an attractive proposition, both in their efficiency of delivering a 'package' solutions of tools and infrastructure, as well as their tangibility to donors wanting to provide visible solutions. However, they have also attracted criticism for: a general lack of standardization and coordination; a "packaged solution" that neglects the real needs on the ground; a lack of exit strategy; and an over emphasis on the immediate trauma whilst neglecting secondary and ongoing physical and psychological complications (Miller & Arquilla, 2007; Von Schreeb et al, 2008; Norton et al, 2013; personal communication). Indeed it would seem that sometimes with Field Hospitals, we export problems rather than solutions.

In 2003, the World Health Organisation (WHO) along with the Pan American Health Organization (PAHO) assembled recommendations and guidelines for the deployment and use of Field Hospitals. These then underwent a major review in 2013 following the 2010 Haiti Earthquake (see Norton et al, 2013).

The original 2003 guidelines noted that, while Field Hospitals have had a long and effective history of use in conflict, their true effectiveness in natural disasters remains in question (WHO-PAHO, 2003). This paper will therefore focus on natural disasters, specifically earthquakes, as the context for analysis. There is a lack of scientific study of Field Hospitals used in response to natural disasters (Norton et al, 2013) and calls have been made for 'systematic and independent evaluation of (Field Hospitals) used in disasters ... to further refine (present) recommendations' (WHO-PAHO, 2003).

In addition, whilst much attention, funding and research has been focused on the deployment of field hospitals in the immediate aftermath (up to 6 months) post-disaster, little remains published on the longer term transition (5-10 years) until permanent facilities are restored. It is the contention of this paper that with greater forethought and planning towards this transition phase, semi-permanent 'Transitional Field Hospitals' could be utilised to better capture the initial funding impulse and bridge the gap until permanent facilities can be reopened 5-10 years after the event.

Research Question

How can Field Hospitals be designed to best support transition to long-term recovery and bridge the gap until permanent facilities are restored?

Objectives & Methodology

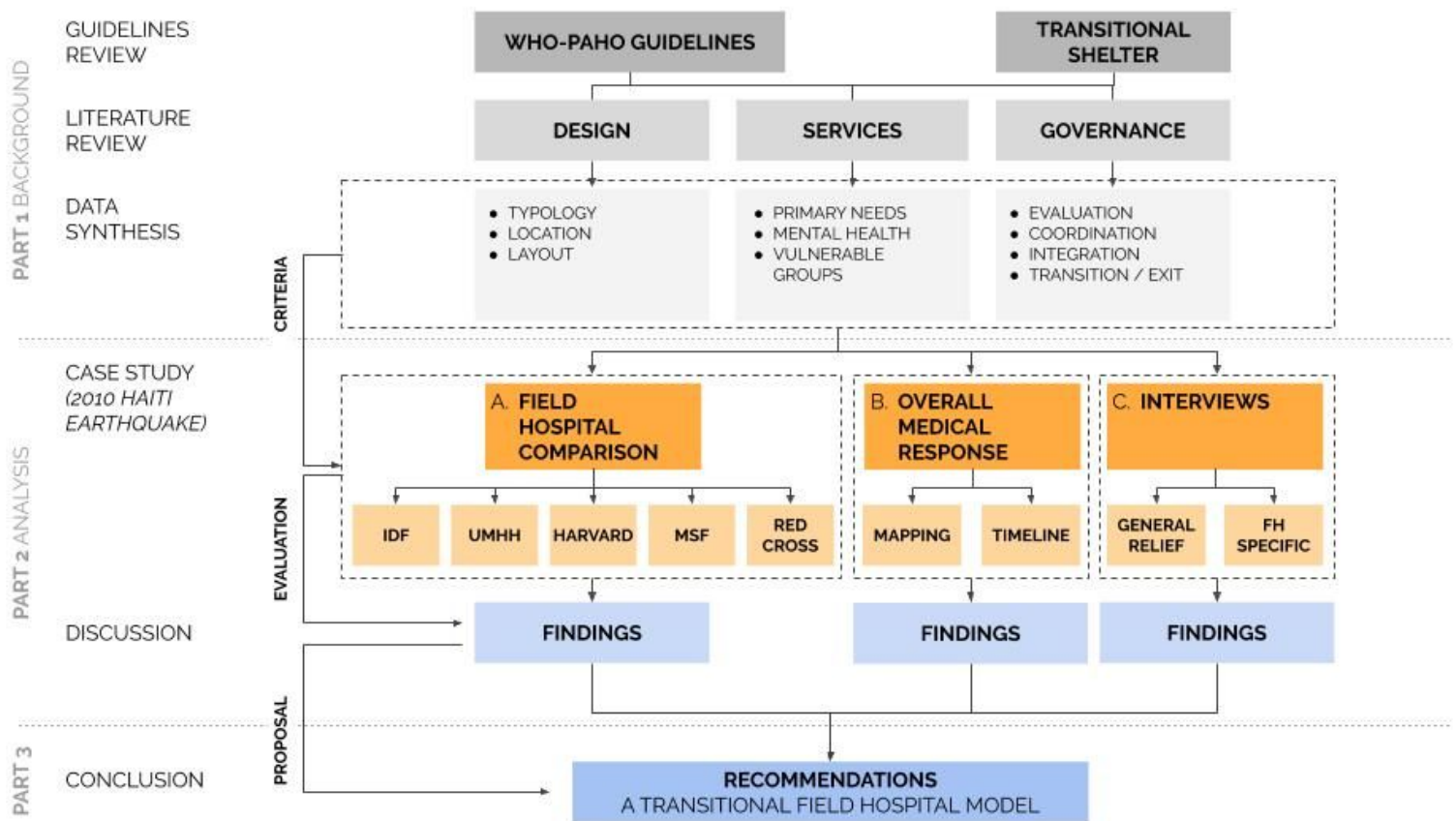


FIGURE 1: PROPOSED METHODOLOGY

(Source: Author)

This research seeks to firstly review current guidelines on the use and deployment of Field Hospitals in order to identify current recommendations on the use and deployment of Field Hospitals and identify what guidelines if any are provided around the transition phase. A review of transitional shelter guidelines will additionally be used to complement these findings and shed greater light on the challenges and opportunities of transitioning from the disaster to long-term recovery and identify potential linkages between temporary and permanent infrastructure.

Next, literature relating specifically to field hospitals will be reviewed to identify current best practice principles of field hospital deployment and establish a conceptual framework for analysis. This review will seek to identify key physical factors that should inform the *design* of Field Hospitals, key social and medical factors that should inform the *services* offered by Field Hospitals and key organisational factors that should drive good *governance* of Field Hospitals.

The analysis of this paper will centre around the chosen case study, the 2010 Haiti Earthquake. The 2010 Haiti Earthquake has been discussed widely in literature on Field Hospitals, chiefly because of its scale and ferocity, with 44 Field Hospitals in total being used, making it the largest ever roll-out of Field Hospitals in history, far eclipsing previous events (Gerdin, Wladis & Von Schreeb, 2012). Despite the relatively large timespan since the event (nearly 10 years) I believe it remains an important example of some of the very best and perhaps worst attempts at delivering emergency

healthcare into a very desperate and complex disaster. The length of time since the event also better enables analysis of the long-term transition to permanent health care facilities.

Analysis of the case study will consist of three parts: a) Comparison study of 5 Field Hospitals used in the disaster response to compare different approaches taken in relation to identified best practice principles; b) Review of the overall medical response and specifically gaps between the immediate deployment of temporary Field Hospitals and the reopening of permanent healthcare facilities; c) Interviews conducted with key actors to understand key areas still needing improvement and attention moving forward. Interviewees were involved in both the initial response, transitional recovery period and subsequent similar disasters (namely the 2015 Nepal earthquake). Comments from the interviews will be finally synthesised to form key considerations needed within each category of the conceptual framework. These key considerations along with other findings from the case study will ultimately form the basis for recommendations towards the proposal of a Transitional Field Hospital model for further research and development.

Limitations

Being nearly 10 years after the 2010 Haiti earthquake, there is a wide body of literature and publications published on the response. However, most of the key personnel who were there after the quake are now scattered around the world making interviews much harder to source. A number of contacts were made with aid workers who were there post the disaster, along with some long-term workers who were in Haiti when the quake struck and still remain there today. However most of those interviewed (with a few exceptions) did not have direct involvement with the running of Field Hospitals. Further work is needed to talk directly with each organisation deploying Field Hospitals to better understand the challenges and constraints involved in the use of such facilities.

Sadly, a field visit to Haiti also wasn't feasible within the scope of this study, however this would be valuable in providing opportunity to talk to members of the local community and particularly local healthcare workers. This would help to better understand the effect (both positive and negative) that Field Hospitals had in the aftermath of the quake, and the degree to which the local community was included in the process.

Finally, a detailed economic analysis of funding given towards Field Hospitals and the cost involved in deploying temporary facilities versus restoring permanent facilities would help to better inform the value of a transitional approach, however this was beyond the scope of this study.

Definitions

The following definitions will be used throughout this paper. Whilst they are somewhat arbitrary, they are used in this paper for the purposes of categorising what is in reality a highly fluid, contextual and overlapping series of processes and events.

*Field Hospital*¹

‘A mobile, self-contained, self-sufficient health-care facility capable of rapid deployment and expansion or contraction to meet immediate emergency requirements for a specified period of time. It can be set up in an existing structure or in a structure, tent or similar that is brought in with a Foreign Medical Team.’ (Norton et al, 2013).

Relief

Referring to the immediate humanitarian response to a natural disaster (from onset to approximately 6 months).

Recovery

Referring to the longer-term humanitarian response towards restoration of permanent infrastructure and services (from approximately 6 months until permanent facilities are restored).

Transition

Referring to the process of moving from relief to final recovery.

Temporary

Referring to structures designed to last up to 1 year.²

Semi-permanent

Referring to structures designed to last 5-25 years.³

Permanent

Referring to structures designed to remain indefinitely.

¹ Historically referred to as a Foreign Field Hospital (FFH) (WHO-PAHO, 2003).

² This timeline has been based on reflections from Interview #11

³ The 25 year figure has been taken from the Red Crosses' 'Semi-permanent Hospital Conceptual Plan for Dhunche, Nepal' (CRC, n.d.)

PART 2: THEORETICAL BACKGROUND

In order to build a conceptual framework for analysis of Field Hospitals used in the 2010 Haiti Earthquake, the following review has been undertaken in three parts: a) Review of current guidelines for the use and deployment of Field Hospitals to identify current recommendations, particularly around the transition phase; b) Review of Transitional Shelter guidelines to complement these findings and expand on and inform strategies for transition; c) Review of academic literature on Field Hospitals to inform best practice principles for the design, services and governance of Field Hospitals.

PART A: Principles for Field Hospitals - A Guideline Review

The roots of the Field Hospital go back to World War II where the first mobile surgical hospitals were brought to the battlefield by Baron Dominique Jean Larrey (Manoochery et al, 2018). It has only been in more recent years as the prevalence and severity of natural disasters has increased that they have been utilised on a widespread basis in such disasters, raising a number of challenges and complications.

In response to some of the emerging challenges and shortcomings of using Field Hospitals in such settings, the World Health Organisation (WHO) and the Pan American Health Organisation (PAHO) in 2003 together published a series of guidelines⁴. These guidelines first established best practice principles around the deployment and operation of Field Hospitals.

The guidelines identify three phases of Field Hospital deployment as shown in Table 1. Within each phase a number of essential requirements are listed along with optional but desirable criteria.

TABLE 1: SUMMARY OF WHO-PAHO GUIDELINES (Source: WHO-PAHO, 2003)			
PHASES	EARLY EMERGENCY MEDICAL CARE	FOLLOW-UP TRAUMA AND MEDICAL CARE	DONATION OF FFH (WITHOUT PERSONNEL) TO SERVE AS A TEMPORARY HOSPITAL
TIMELINE	First 48 Hours	Day 3 to Day 15	from Second Month to Several Years
ESSENTIAL REQUIREMENTS	<ul style="list-style-type: none"> ● Be entirely self-sufficient ● Offer comparable or higher standards of medical care than were available in the affected country prior 	<ul style="list-style-type: none"> ● Minimal need for support from the local communities ● Basic knowledge of the health situation and language, and respect for the culture ● Availability of selected specialties ● Sustainability (appropriate technology) 	<ul style="list-style-type: none"> ● Lack of other more cost-effective alternatives ● Appropriate standards for both the patients and the staff ● Design for use until final reconstruction ● Installation and maintenance

⁴ 'WHO-PAHO Guidelines for the use of Foreign Field Hospitals (FFH) in the aftermath of sudden impact disasters', 2003, WHO-PAHO.

	to the precipitating event	and healthcare service that can be sustained beyond FFH) <ul style="list-style-type: none"> • Evaluation of the cost-effectiveness and cost-benefit associated with the use of the FFH 	support provided at no cost to the affected country
OPTIONAL CRITERIA	<ul style="list-style-type: none"> • Be familiar with the health situation and culture of the affected country 	<ul style="list-style-type: none"> • Cultural similarity • Broad range of medical disciplines 	<ul style="list-style-type: none"> • Attention to numerous health considerations (water and sanitation) and technical factors (e.g., voltage, type of air conditioning, need for fuel) is important

The guidelines focused primarily on the *facility* of the Field Hospital, placing particular emphasis on timing of delivery and self-sufficiency. The guidelines also provided an extensive series of questions that each stakeholder (whether it be donors, NGO's or local government) were advised to ask in order to assess the necessity of using a Field Hospital as well as helping to determine the best location and type of deployment.

While the guidelines were an important first step in classifying and recommending best practice for Field Hospitals, a number of limitations have been identified. Von Schreeb et al (2008) in a review of 43 Field Hospital used in natural disasters in Iran (2003), Haiti (2004), Indonesia (2004), and Pakistan (2005) found none of the hospitals achieved the initial response time of 48 hours post disaster for Early Emergency Medical Care while only 15% achieved the essential requirements for Follow-up Trauma and Medical Care. This finding was further backed up by a review of the 2010 Haiti Earthquake where only 1 of the 44 Field Hospitals used in the response achieved the initial 48 hour requirement (Gerdin, Wladis & Von Schreeb, 2012). It was ultimately found that these guidelines did not “capture the diversity of foreign medical relief and services” provided through the different agencies involved in relief efforts and calls for reviews were made (Gerdin, Wladis & Von Schreeb, 2012, p.5).

In December 2010, almost 12 months after the Haiti Earthquake, the WHO and PAHO met to revise the guidelines, placing greater emphasis on the services delivered using ‘Foreign Medical Teams’ (FMT)⁵ as the primary indicator, rather than focusing just on the facility itself. The revision also acknowledged the importance of addressing disasters where large amounts of existing local healthcare infrastructure were destroyed (WHO-PAHO, 2010) whilst ultimately seeking to better align with the 2011 IASC Transformative Agenda (Norton et al, 2013).

The resulting recommendations were published by the WHO in 2013⁶. These standards outlined three types of medical teams, reflecting levels of “care, size, capacity, and capabilities to deliver predefined services” (Norton et al, 2013, p.28). Under each type it was acknowledged that care could be provided either within a specialised facility brought in by the FMT or within existing local infrastructure. The types are summarised in Table 2.

⁵ In December 2015 at a global WHO meeting in Panama, the terminology of FMT was changed to ‘Emergency Medical Team’ (EMT) to reflect an emphasis on building national teams and building connections with neighbouring countries (WHO, 2016). The term EMT will be used throughout the rest of this study to refer to such teams.

⁶ ‘Classification and Minimum Standards for Foreign Medical Teams in Sudden Onset Disasters’, Norton et al, 2013.

TABLE 2: SUMMARY OF FMT GUIDELINES (Source: Norton et al, 2013)

	FMT-Type 1	FMT-Type 2*	FMT-Type 3*
Description	Outpatient initial emergency care of injuries and other significant health care needs. (Day Care)	Inpatient acute care, general and obstetric surgery for trauma and other major conditions. (24 Hour Care)	Complex inpatient referral surgical care including intensive care capacity. (24 Hour Care)
Key Criteria	Triage and treat 100 outpatients per day	7 major or 15 minor operations daily	15 major or 30 minor surgical cases a day.
Setup	<i>ideally</i> within 24–48 hours,	<i>ideally</i> immediately, realistically several days	<i>ideally</i> immediately, realistically 5–7 days
Length of Stay	at least 2–3 weeks	at least 3 weeks, ideally longer	at least 2 months
Facility Requirements	<ul style="list-style-type: none"> • space for triage • light and portable • adequate shelter for outpatients from the elements while waiting for and receiving care 	<ul style="list-style-type: none"> • space for surgical triage • at least 20 inpatient beds per one operating table • enough capacity for the required support areas to manage cleaning and autoclave, storage of pharmaceuticals, consumables, equipment and areas for x-ray. 	<ul style="list-style-type: none"> • triage space as per type 2 • at least 2 operating tables in two separate rooms within the theatre area, • at least 40 inpatient beds (20 per table) • 4–6 intensive care beds with the ability to ventilate patients • support areas as per type 2

*An additional category was identified as **Additional Specialised Care Teams** to provide specialised care embedded within either a Type 2 team, Type 3 team or national hospital.

The standards form an important step forward towards registration and stronger accountability of Foreign Medical Teams prior to the onset of disaster under their respective type. They are expected to maintain the minimum standard within their type throughout the full duration of deployment (Norton et al, 2013). As of 2018, only one team has officially registered as FMT-Type 3⁷ (Alpert et al, 2018). The standards also call for teams to ideally be fully self-sufficient when being deployed and when not, to clearly identify areas of support required by local agencies (Norton et al, 2013). While the standards present a much needed revision of the definitions of emergency medical response and Field Hospital deployment, they lack detail about planning for exit strategies and the transition period from temporary health care

⁷ The Israeli Defense Force (IDF) Field Hospital

facilities to long term restoration of local health services (outside of ensuring patient treatment post FMT departure) (Norton et al, 2013). It seems largely assumed that such strategies would be formed and managed in-house within the FMT and in collaboration with local services.

To better inform and expand on strategies for transition, the following review has been conducted on Transitional Shelter guidelines.

PART B: Principles for Transitional Shelter - A Guideline Review

The challenges of transitioning from relief to recovery are not unique to healthcare. Indeed, there exists an extensive body of literature relating to shelter strategies for transitioning from relief to recovery. As one review put it:

“Providing adequate shelter is one of the most intractable problems in international humanitarian response. Tents are too costly and do not last long. Plastic sheeting can be good but most often is low quality and falls apart immediately. Rebuilding houses takes years, even when land issues are not major obstacles.” (Ashdown, 2011, p. 25)

At a broad level, the SPHERE standards (including both shelter and health sectors) call for plans for transition or exit strategies from the outset of any assistance program (SPHERE, 2018, p. 60). Such strategies should be rooted in national systems to be handed over for local control, with collaborative “design services (available) as soon as possible that will continue after the emergency programme has finished” (SPHERE, 2018, p. 61) and ideally integrate into existing systems (SPHERE, 2011, p. 170). Indeed the SPHERE standards call for evidence of improvement or ability of another actor to take responsibility for a program before it’s closer (SPHERE, 2018, p. 195).

The term ‘transitional settlement’ was first introduced with the ShelterCenter’s publication of ‘Transitional Settlement Displaced Populations’ (Corsellis, 2005) with transitional settlement defined as “settlement and shelter resulting from conflict and natural disasters, ranging from emergency response to durable solutions” (Corsellis, 2005, p.7). This sought to “emphasises the position of emergency shelter and settlement response within the wider continuum of relief, reconstruction/ rehabilitation, and development” (Corsellis, 2005, p.10). In essence, linking relief to development (Mira, Thrall & De Temmerman, 2014). The approach also sought to shift the focus towards the *process* rather than the *object* of shelter (Sanderson et al, 2014).

Since publication, a number of other approaches have been made to define and implement transitional shelter resulting in a broad spectrum of concepts and unfortunately a general lack of consistency in terms and understanding. The World Bank (2009) broadened Shelter Center’s definition to define Transitional Shelter not as “*a phase of reconstruction, but ... a philosophy ... The transitional shelter approach responds to the fact that post-disaster reconstruction can take a significant amount of time and that it is the affected population that does most of it*” (World Bank, 2009, ch1). However such broad terms have been found difficult to apply in practice (Maynard, Parker, & Twigg, 2017) and so others have taken a more objective approach, defining transitional shelter more in terms of the component parts and lifespan (IFRC, 2013). Additionally, criticism has been made around transitional shelter being seen as a final solution, ignoring the

fundamental definition of transition as a process directed towards a final, more permanent and desirable goal (Sanderson et al, 2014).

Rohwerder (2016) has identified three main approaches to transitional shelter which are summarized in Table 3 below:

TABLE 3: THREE APPROACHES TO TRANSITIONAL SHELTER (Source: Rohwerder, 2016)		
Shelter Centre , IOM: Transitional Shelter Guidelines. (Shelter Centre, 2012)	IFRC : Post-disaster shelter. (IFRC, 2013)	USAID : Transitional shelter. (USAID, 2012)
an incremental process rather than a multi-phased approach	an overlapping process of emergency, temporary, transitional, progressive, core and permanent housing	an assistance driven approach for a period of 6 months to 3 years
<p>Transitional shelter can be:</p> <ul style="list-style-type: none"> i) upgraded into part of a permanent house; ii) reused for another purpose; iii) relocated from a temporary site to a permanent location; iv) resold, to generate income to aid with recovery; and v) recycled for reconstruction' <p>This is driven by 10 broad principles:</p> <ol style="list-style-type: none"> 1. Assess the situation 2. Involve the community 3. Develop a strategy 4. Reduce vulnerability 5. Agree standards 6. Maximise choice of shelter options 7. Buy time 8. Undertake an incremental process that allows beneficiaries to upgrade, reuse, resell or recycle 9. Plan the site on land that is safe, legal and appropriate; 10. Ensure reconstruction occurs at the same time as transitional shelter programmes 	<p>Shelter can take the form of:</p> <p>Emergency shelter: Short term shelter that provides life saving support, the most basic shelter support that can be provided immediately after the disaster.</p> <p>T-shelters: Interchangeable term used for either Temporary or Transitional Shelter depending on what is more politically appropriate.</p> <p>Temporary shelters: Post disaster household shelter prioritising speed and limiting construction costs (lifetime thus limited).</p> <p>Transitional shelters: Rapid, post disaster household shelters made from materials that can be upgraded or re-used in more permanent structures, or relocated from temporary sites to permanent locations.</p> <p>Progressive shelters: Post disaster rapid household shelters planned and designed to be later upgraded to a more permanent status by integrating future transformation and alteration possibilities in structural basis of the unit.</p> <p>Core shelters / One room shelters: Post disaster household shelters planned and designed as permanent dwellings, to be the part of future permanent housing ... providing safe post disaster shelter that reaches permanent housing standards, and facilitates development, but not completing a full permanent house.</p>	<p>Transitional assistance may include the following:</p> <p>Transitional Shelter: The provision of inputs—sometimes including salvaged materials—construction, technical advice, and oversight needed to create shelter ... to re-engage disaster-affected households into longer-term incremental housing development process</p> <p>Hosting Support: The provision of assistance to host and displaced families.</p> <p>House Repair: Minor repair and improvement of existing, damaged housing</p> <p>Technical Assistance: Training on improved construction techniques</p> <p>Transfers: The provision of cash-grants, vouchers, rental support, and in-kind materials to disaster affected households</p> <p>Transitional Settlements: The improvement of existing neighborhoods, including informal settlements, to permit provision of shelter and basic services while reducing the need to relocate affected populations to new settlements.</p>

While each approach has different nuances, there remain important common elements. Fundamental to effective transition is a well-grounded understanding of the peculiarities of context, from political expectations, climate, land availability and local building practices (UNHCR, 2019). It is also broadly acknowledged that most disaster reconstruction is completed by people directly affected by the disaster, underlining the importance of locally rooted strategies. Figure 2 demonstrates an initial attempt to synthesis the main concepts present within each approach.

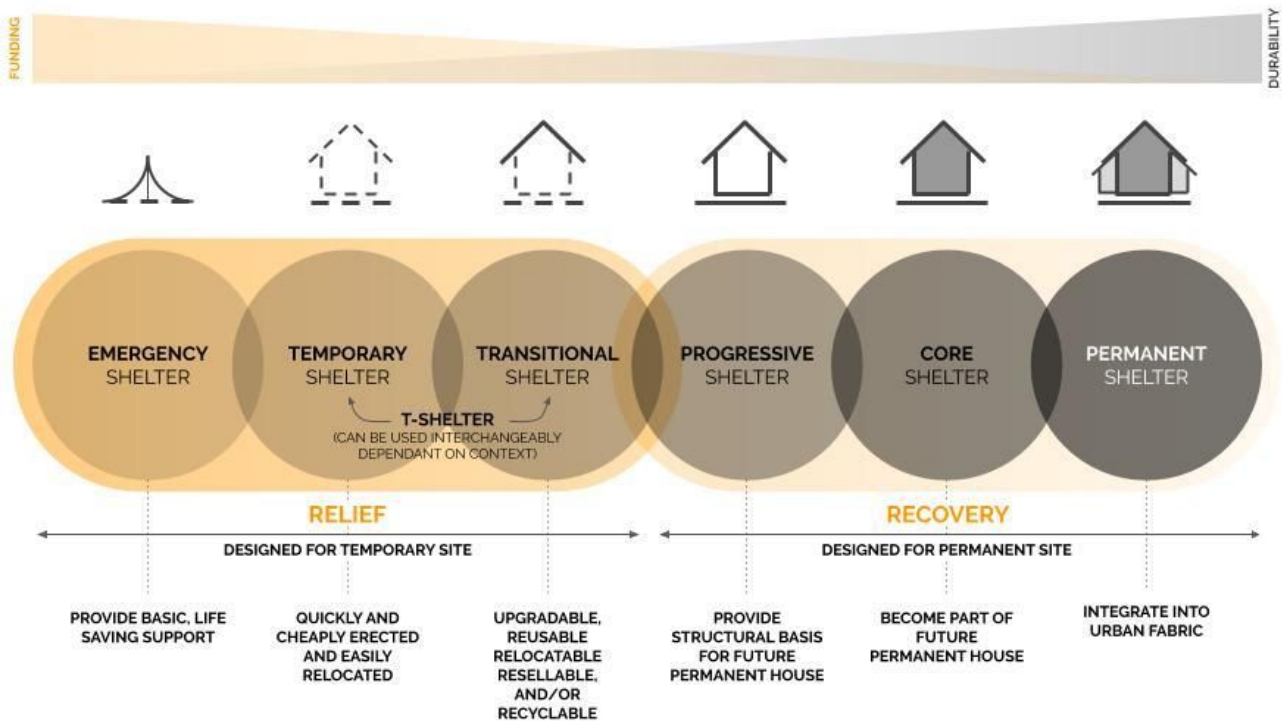


FIGURE 2: INDICATIVE SYNTHESIS OF OVERLAPPING DEFINITIONS OF AN INCREMENTAL TRANSITIONAL APPROACH

(Source: Author - based on IFRC (2013) and Shelter Centre (2012))

The six shelter types and descriptions listed in Figure 2 have been drawn from IFRC (2013) and aligned with visual descriptions used by Shelter Centre (2012). Importantly, each part of the process is highly contextual and overlapping. For example in situations where there is no officially planned end state, 'transitional' shelter may be considered unacceptable and rather temporary shelter must have longer duration (IFRC, 2013, p.9). Alternatively, where reconstruction is possible on permanent sites from an early point, it is often more appropriate to use 'progressive' rather than 'transitional' shelter (IFRC, 2013, p. 9).

Transitional shelter guidelines highlight the importance of maintaining continuity between the initial relief phase and long-term recovery, through an incremental process that can build on itself to eventually form the basis for permanent shelter. While Hospitals, as larger and more public infrastructure, require greater time and government backing to be re-established permanently, there still remains need for strategies to be planned and implemented from the immediate relief stage to bridge the gap until permanent facilities can be restored. Approaches shown above such as: transitional shelters that are designed to be upgraded; progressive shelters that could quickly form the structural basis of a more

permanent facility; or core shelters that provide a permanent unit around which the permanent structure is built - could be effective ways of bridging this gap within a hospital context.

PART C: Principles for Field Hospitals - A Literature Review

In order to understand best practice principles for Field Hospitals, a review of academic literature has been conducted on sources written since original 2003 guidelines, with particularly focus on natural disasters. A number of key themes emerged to form a conceptual framework for this study. These can be grouped under: Design, Services and Governance and relate respectively to physical, medical and organisational factors of Field Hospitals.

Design

In considering the design and construction of the Field Hospital facility, a number of sub-themes have emerged within the literature. These include typology, location and layout.

Typology

As a largely self-contained, self-sufficient unit, the Field Hospital represents a building typology not that dissimilar to a modern-day Emergency Department (ED). This common hospital typology has been used as a starting point for considering the optimum design, planning and layout of a Field Hospital (Bakowski, 2016). ED's within hospitals typically incorporate triage, consultation, treatment, resuscitation, X-ray examination and some short-stay inpatient facilities, and importantly can function as a largely independent and stand-alone unit of the hospital. Bakowski (2016) main finding is that modular construction systems can offer some of the best results in the layout of a Field Hospital similar to ED's, through efficiently and logically dividing spaces into different uses, in contrast to a single homogenous tent system with greater exposure and threat to the spread of infection (Lichtenberger et al, 2010; Bakowski, 2016). Figure 3 shows a flow diagram of an Emergency Department typical in Australia.

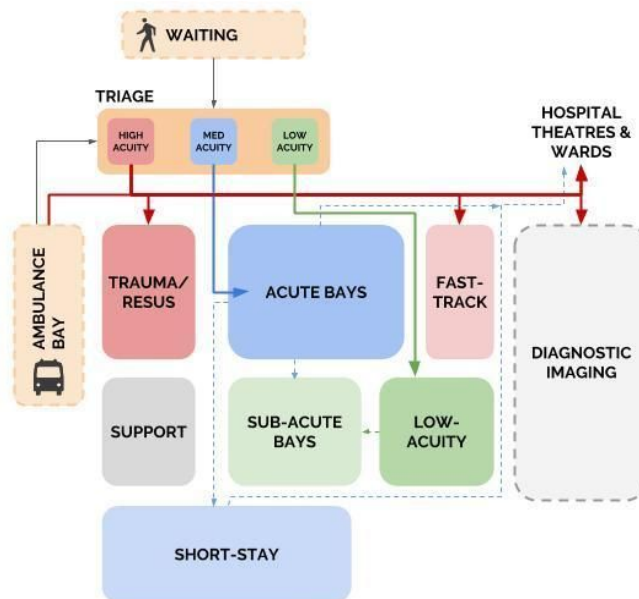


FIGURE 3: TYPICAL EMERGENCY FLOW DIAGRAM

(source: P. Longridge - adapted by Author)

Location

The location of the Field Hospital is another important consideration to its successful operation. There is broad consensus that Field Hospitals should wherever possible be located close to existing local health facilities, allowing for better integration with local health services and long term support (WHO-PAHO, 2003; Vafaei & Oztaysi, 2014). Vafaei & Oztaysi (2014) add additional criteria for consideration including: distance from arterial routes; surrounding population density; ability to get Field Hospital operational as soon as possible; and ability to maximise bed capacity. The 2003 WHO Guidelines acknowledge that choice of location ultimately needs to be weighed against medical needs, logistical imperatives and access by victims (WHO-PAHO, 2003).

Layout

The layout of the facility is an important design factor, particularly taking into account patient privacy, access and security. Miller & Arquilla (2007) in a study on the Turkish Red Crescent Societies Field Hospital in northern Pakistan following the 2005 earthquake consider the layout of the Field Hospital from the perspective of women. Miller & Arquilla (2007) argues that simple adjustments can be made to the layout and operation of Field Hospitals that have a major benefit to the effectiveness of care provided to women. Privacy is a key concern, with many women reportedly feeling “ashamed” and “exposed” when placed in situations where they may be intermingling with or overheard by men (Miller & Arquilla, 2007, p.270). In the case of Pakistan this included lines awaiting medical assessment with both male and female patients intermingling, no control over who entered treatment tents and patients often crowded inside tents where history and physical examinations of other patients could be overheard. Miller & Arquilla (2007) proposes a revised layout to the Field Hospital co-locating the Woman’s Clinic and Ward with Paediatrics and keeping these spatially separate from the Men’s Clinics and Ward (see Figure 4).

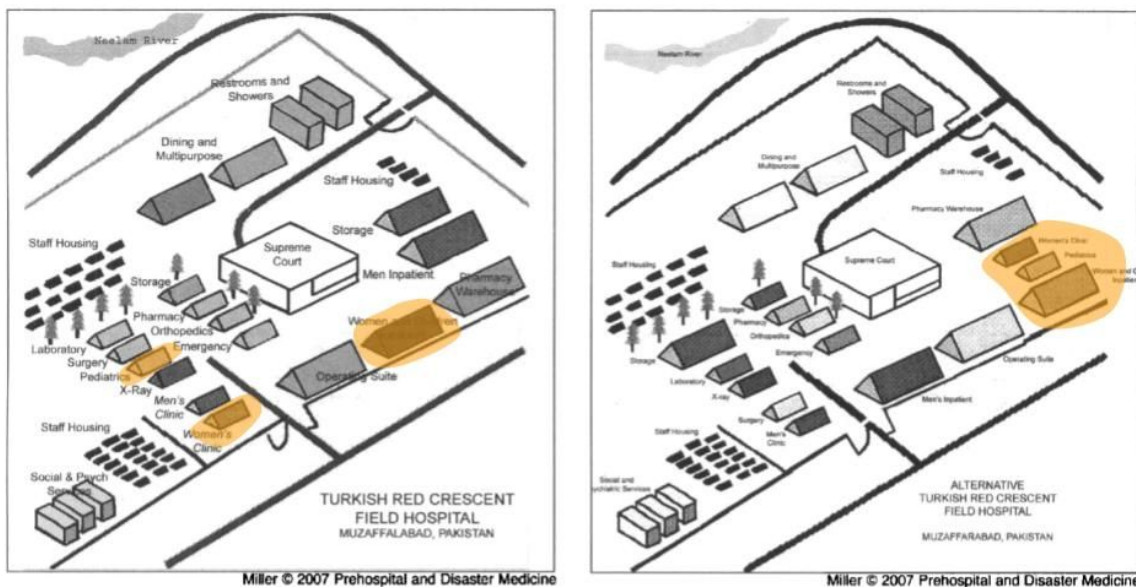


FIGURE 4: ADJUSTMENT MADE TO FIELD HOSPITAL LAYOUT (CO-LOCATION OF WOMEN'S AND CHILDREN'S WARD)

(Source: Miller & Arquilla, 2007)

Services

Critical to the successful delivery of healthcare services is a careful and accurate assessment of needs. There is often a discrepancy between the real needs on-the-ground and those the Field Hospital is designed and prepared to deal with (Mallek-Daclin, 2017). The literature identified a number of key areas to consider that directly affect the level of care and medical needs Field Hospitals should address. These include: understanding dominant healthcare needs, provision of mental health support and consideration for vulnerable groups.

Dominant Health Care Needs

Field Hospitals typically need to respond to a wide variety of different health care needs in the days and months following a natural disaster. Often large amounts of existing healthcare infrastructure are destroyed in disasters (up to 60% in the case of Haiti), meaning that not only do new disaster-related cases need attention, but also those that would otherwise require local hospital care (Von Schreeb et al, 2008; Gerdin, Wladis & Von Schreeb, 2012). In the immediate aftermath of earthquakes, studies have found that extreme trauma, crush syndrome and acute renal failure are generally most prevalent, all of which are highly life threatening and require immediate attention (Memarzadeh, Loghmani & Jafari, 2014). However, other studies have shown that by the time Field Hospitals have become operational post disaster (which usually at least 3 days), most cases are secondary complications from the event, with only 25% direct trauma, in contrast to what is often portrayed in the media (Giri et al, 2018). Von Schreeb et al (2008) propose a conceptual model identifying 4 phases of health care needs post disaster as shown in Figure 5.

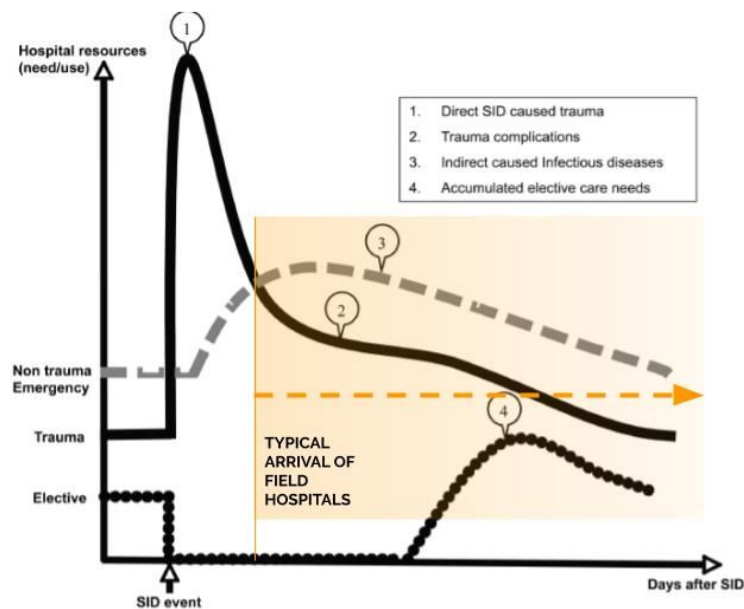


FIGURE 5: CONCEPTUAL MODEL FOR VARIATION OVER TIME OF HEALTH NEEDS

(Source: Von Schreeb et al, 2008 - adapted by Author)

Phase 1 typically lasts for around 3 days and is dominated by a need for care of direct injuries from the disaster; Phase 2 is dominated by an increased need for care of secondary complications from delayed initial injury treatment. Phase 3 is dominated by an increased need for regular health care. Phase 4 is when elective care begins to re-emerge. Routine medical emergencies must continue to be treated throughout all phases. While the WHO-PAHO 2003 guidelines recommend the deployment of first stage Field Hospitals to be 48 hours post event, this has rarely been achieved (Von Schreeb et al, 2008; Gerdin, Wladis & Von Schreeb, 2012), meaning in most cases the dominant needs are secondary complications. However, Von Schreeb et al (2008) found the majority of staff and resources in Field Hospitals were for emergency trauma rather than ongoing routine medical emergencies. Recommendations have been made that initial response be focused more on search and rescue teams requiring much less setup and ability to move into more remote locations quicker (Global-Haiti, 2011; Gerdin, Wladis & Von Schreeb, 2012). Ideally the first Field Hospitals would be brought in by neighbouring countries with an already pre-existing diplomatic and cultural understanding to the disaster location, however this is not always possible. Von Schreeb et al (2008) further recommend that Field Hospitals from international teams take on a longer-term treatment role, carrying the remaining load of routine emergencies and secondary complications that the local health service is unable to provide (Von Schreeb et al, 2008).

Mental Health provision

Mental health and Post Traumatic Stress Disorder (PTSD) have also been identified as an important, yet often overlooked factor in the wake of responding to extreme trauma (Ville de Goyet, Sarmiento & Grünewald, 2011; Memarzadeh, Loghmani & Jafari, 2014). However, conditions such as PTSD have a high risk of occurring in adults immediately post disaster and therefore a mental health action plan should be adopted as part of the longer term operation of a Field Hospital to cater for broader social recovery (Memarzadeh, Loghmani & Jafari, 2014).

Consideration for Vulnerable groups

Vulnerable groups in natural disasters have been identified as women (Miller & Arquilla, 2007; Memarzadeh, Loghmani & Jafari, 2014), children (Farfel et al, 2011; Memarzadeh, Loghmani & Jafari, 2014), elderly (Memarzadeh, Loghmani & Jafari, 2014) and disabled (Pape et al, 2010; Ville de Goyet, Sarmiento & Grünewald, 2011). In most cases of earthquakes up to 30% of patients seen within Field Hospitals can be children (aged 18 or under) (Memarzadeh, Loghmani & Jafari, 2014). This actually represents quite a small amount given the proportion of children often within the population and that a reduced presentation of pediatric patients is likely the result of higher mortality rate or inability of children to reach hospital due to "incapacitating familial conditions" (Farfel et al, 2011, p.521). As noted post the 2005 Pakistan Earthquake, women are often at greater risk of rape and gender based violence in the wake of natural disasters (Miller & Arquilla, 2007; Ville de Goyet, Sarmiento & Grünewald, 2011; Memarzadeh, Loghmani & Jafari, 2014). Disabled people are also often seen as inferior and rejected by society, an area of consideration important when weighing up the necessity for amputations which have sometimes been carried out excessively in Field Hospitals (Ville de Goyet, Sarmiento & Grünewald 2011; Norton et al, 2013). As discussed above, a number of simple strategies can be utilised in the design and layout of the Field Hospital to cater for groups at greater risk to create a treatment environment that is safe, accessible and conducive to healing - but these factors need to be considered from the outset.

Governance

While an effective Field Hospital relies on facilities and services that responds accurately to the real on-ground needs of the community, the governance of the hospital remains vital to its ultimate success. A number of key areas can be identified from the literature that can contribute to the formation of a strong organisational model for a Field Hospital. These include: evaluation & accountability; Coordination & referrals with other facilities & EMT's; integration with local authorities & services; and transition / exit strategies towards the long term restoration of normative locally operated healthcare.

Evaluation & Accountability

In their detailed review of Field Hospitals, Von Schreeb et al (2008) identified a general lack of data sharing and critical evaluation as a significant factor limiting the success of Field Hospitals. Gerdin, Wladis & Von Schreeb (2012) noted a similar trend, with no improvement since the 2008 study. The lack of information provided by agencies means there exists a disturbing lack of accountability and Gerdin, Wladis & Von Schreeb (2012) concluded that with the scant information collected and provided by active agencies implementing Field Hospitals in response to the Haiti earthquake, it remains impossible to determine the true medical impact, outcome, cost effectiveness and quality of care provided. Registration for EMT's inline with the above WHO FMT Types should mandate a prescribed level of data collection and sharing (Gerdin, Wladis & Von Schreeb, 2012).

Coordination & referrals with other facilities and EMT's

In addition to lack of evaluation and accountability, there has often been found a lack of coordination between EMT's in the operation of Field Hospitals (Von Schreeb et al, 2008; WHO, 2010). Von Schreeb et al (2008) reported that in the situation of 2004 Boxing Day Tsunami, it was sometimes "a matter of guesswork which facility had beds or surgical capacities available" (p.149). In Haiti, 2010, this was exacerbated by the sheer numbers of foreign medical workers and organisations working in a rapidly evolving environment (Jobe, 2010). A WHO report into the Regulation and Management of EMT's in 2017 has pointed out that with the almost complete collapse of a local healthcare system (as was the case in Haiti), EMT's need to be able to maintain some form of hierarchical linkage (such as patient referral services) that would otherwise have existed within the local healthcare system (WHO-IFRC, 2017). Such linkages require a high degree of coordination.

Integration with local authorities & services

Jobe (2010) also highlights the importance of integrating services with local authorities and services, particularly relevant for smaller organisations. In studies on the Haiti 2010 Earthquake cases were reported of organisations 'commandeering' land, recruiting mainly outsiders, creating unrealistic community expectations and largely taking over the role of local health care providers (Ville de Goyet, Sarmiento & Grünwald, 2011; Kligerman, Walmer & Bereknyei Merrell, 2017). Integration with local services and authorities is a crucial part of long term recovery and an important role for EMT's to play in building up local healthcare rather than undermining it (WHO-IFRC, 2017).

Transition / Exit Strategies towards long term restoration of normative local healthcare

Finally, there needs to be a clear and achievable transition strategy in place to promote the return of normative local healthcare. DeGennaro et al (2011) in their study on the Haiti 2010 Earthquake underline the importance of incorporating training for future workers into such transition strategy, providing short-term professional assistance in a volunteer capacity with a commitment to training locals to become nurses and doctors throughout. This is particularly critical in places where many local health workers have been killed or injured in the disaster as was the case in Haiti. DeGennaro et al (2011) argue that any solution involving foreign professionals first ensure full employment for all local personal as a prerequisite and should be driven by local government. These findings correspond with that of Kligerman, Walmer & Bereknyei Merrell (2017), who also studying the aftermath of Haiti, identified an “internal brain drain” as a result of ongoing aid provision within the country. Many local healthcare workers were pulled out of local services to work for international aid organisations with better pay, making the development of local public healthcare knowledge difficult (Kligerman, Walmer & Bereknyei Merrell, 2017). A rise in patient expectations was also noted due to the provision of free health care from international EMTs in the aftermath, which could not be sustained by the local healthcare sector (Kligerman, Walmer & Bereknyei Merrell, 2017). A limited time frame within which such free care is offered is thus proposed, with the use of a sliding scale payment based on patient means to encourage patients to continue to visit local healthcare providers (Kligerman, Walmer & Bereknyei Merrell, 2017). A pre-defined exit strategy and life-span set before deployment could also make it easier to withdraw when needed and allows local authorities to know how long the support will last for.

Summary of Key Findings

The following represent key findings drawn from the literature:

TABLE 4: LITERATURE REVIEW FINDINGS	
DESIGN	
TYPOLOGY	Modular construction systems can offer some of the best results in the layout of a Field Hospital in their ability to efficiently and logically divide spaces into different uses (Bakowski, 2016).
LOCATION	Field Hospitals should ideally be located as close as possible to an existing local health facility (WHO-PAHO, 2003)
LAYOUT	Simple adjustments made to the layout and operation of Field Hospitals can have a major benefit to the effectiveness of care provided to women and other vulnerable groups (Miller & Arquilla, 2007).
OPERATION	
DOMINANT HEALTH CARE NEEDS	Field Hospitals need to address ongoing care needs and secondary complications stemming from the disaster along with initial trauma (Von Schreeb et al, 2008). Additionally, Urban Search and Rescue (USAR) Teams could be considered as an important initial response while Field Hospitals are still be erected to address initial trauma needs as quickly as possible (Gerdin, Wladis & Von Schreeb, 2012).
MENTAL HEALTH PROVISION	Mental Health treatment and support is often not given sufficient attention but should be considered as part of an ongoing treatment strategy (Memarzadeh, Loghmani & Jafari, 2014).
CONSIDERATION FOR VULNERABLE GROUPS	Field Hospitals should consider the needs of children, women, elderly and disabled in their design and operation (Miller & Arquilla, 2007; Pape et al, 2010; Ville de Goyet, Sarmiento & Grünwald, 2011; Memarzadeh, Loghmani & Jafari, 2014).
GOVERNANCE	
EVALUATION & ACCOUNTABILITY	A clear level of data collection and sharing between EMTs should be mandated as an essential requirement for the registration and operation of EMTs to strengthen coordination (Gerdin, Wladis & Von Schreeb, 2012).

COORDINATION WITH OTHER EMTS	EMT's need to be able to maintain some form of hierarchical linkage (such as patient referral services) that would otherwise have existed within the local healthcare system making coordination essential (WHO-IFRC, 2017).
INTEGRATION WITH LOCAL AUTHORITIES & SERVICES	EMTs should seek to integrate with local authorities and health services to promote the restoration of normative local healthcare (WHO-IFRC, 2017).
TRANSITION / EXIT STRATEGY	A clear exit strategy that involves the training of local staff and a phasing out of free health care should be clearly identified from the onset of deployment (DeGennaro et al, 2011; Kligerman, Walmer & Bereknyei Merrell, 2017).

PART 3: CASE STUDY BACKGROUND

As the largest ever recorded deployment of Field Hospitals to a natural disaster, the 2010 Haiti Earthquake has been discussed widely as representing some of the very best and worst attempts of medical aid assistance (Gerdin, Wladis & Von Schreeb, 2012). In addition, the length of time since the event has provided for greater reflection and analysis on the long-term implications of the relief effort, thus providing an important case study for analysis of this research question.

Background - Haiti 2010

Haiti is for a number of reasons perhaps one of the most impoverished nations in the world, certainly in the Americas. Described sometimes as an “African nation in the Western Hemisphere”⁸ and a “republic of NGO’s”⁹ (Ville de Goyet, Sarmiento & Grünewald, 2011; #4), it could hardly have been a more vulnerable location for the massive 7.0 earthquake of January 12, 2010. Haiti is also the only independent French-Creole speaking nation in the region, with a culture and history unique to that of its neighbours. While it has made attempts at joining regional institutions it remains somewhat of an outsider, an “orphan without siblings, but with many foster parents” (Ville de Goyet, Sarmiento & Grünewald, 2011, p.6). The situation of Haiti pre-earthquake can be described as (Ville de Goyet, Sarmiento & Grünewald, 2011):

- One of the poorest countries in the world and the least developed country in the America’s
- Having high levels of corruption and social inequality
- Experiencing severe environmental degradation and deforestation
- No army, weak institutions and little control over the many thousands of NGO’s present in the country
- No export industries and large deficit
- General lack of local trained professionals - most of whom were moving to the US and Europe.
- Poor building standards, with little to no pre-existing building regulations.

The Haitian Health care system experienced similar challenges, including (Ville de Goyet, Sarmiento & Grünewald, 2011):

- Lack of medical information and statistics (with most of what was available showing severe morbidity and mortality).
- High levels of communicable diseases (including TB, HIV and Acute Diarrheal Disease). Only 53% of the population were vaccinated against tetanus as of 2008 (Pape et al, 2010; Farfel et al, 2011; Lichtenberger et al, 2010).
- Only 50% of the population had access to healthcare services, water or sanitation, most of it poor quality. There were an average of 3 doctors, 1 nurse and 8 hospital beds per 10,000 population (DeGennaro et al, 2011).
- 75% of health services delivered by NGO’s most of whom were unwilling to follow national guidelines.
- Mental health care provided by only two understaffed and ill-equipped hospitals in the country.

Within such conditions Haiti was unfortunately highly vulnerable to disaster, particularly earthquakes. While tropical storms are a seasonal occurrence in the region with some level preparedness within the country, rare but catastrophic

⁸ Interview - Yvonne, 21/03/2019

⁹ This was further confirmed in a number of interviews

events such as major earthquakes were not even contemplated (Ville de Goyet, Sarmiento & Grünewald, 2011). Given the struggle just for daily survival within the country, risk reduction wasn't a realistic option. An additional risk factor was the concentration of population and services in and around the capital, the eventual epicentre of the disaster. Sadly many of the buildings in the capital were not built to withstand or protect against earthquakes.

The earthquake struck at around 5pm, January 12, 2010, its epicentre only 25 km south-west of the capital, Port-au-Prince. Measuring 7.0 on the richter scale, it was the largest quake to strike the country in 200 years, causing 'unimaginable impact' and eventually leading to the deaths of somewhere in the range of 65,000 - 300,000 people¹⁰ (Ville de Goyet, Sarmiento & Grünewald, 2011). As a result of the earthquake, 60% of Haiti's major hospitals were destroyed (Gerdin, Wladis & Von Schreeb, 2012). In addition, many trainee nurses studying in the main university along with around 90% of staff in the Ministry of Health were killed in the quake, leaving a wide vacuum of skilled, local healthcare staff (DeGennaro et al, 2011).

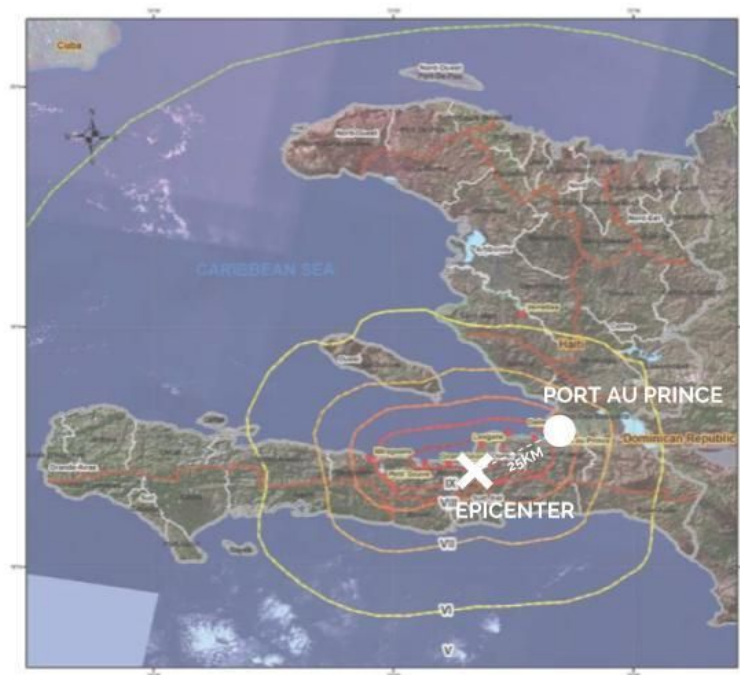


FIGURE 6: EPICENTER AND PROXIMITY TO CAPITAL
(Source: Ville de Goyet, Sarmiento & Grünewald, 2011)

In response to the disaster a major influx of foreign aid poured into Haiti, including a total of 44 Field Hospitals (Gerdin, Wladis & Von Schreeb, 2012). Prior to the earthquake, Haiti had a total of about 11,700 hospital beds. The earthquake resulted in total bed numbers reduced to 4,800, leaving a discrepancy of 6,900, of which 3,300 additional were made up by Field Hospitals at peak capacity on day 17 post earthquake (Gerdin, Wladis & Von Schreeb, 2012). In terms of timing, only one hospital (B-FAST, Belgium) was up and running within the first 48 hours while 22% were running within the first days which represents a slight improvement to previous disasters (Gerdin, Wladis & Von Schreeb, 2012).

¹⁰ The death toll is disputed. Numbers range from 65,575 (USAID) and 149,095 (Univ. of Michigan study) to 222,570 (reported by the Government in 2010) and eventually 300,000 (reported by the government in January 2011).

The aid response in Haiti has come under a large degree of criticism with concerns raised over a general lack of coordination and communication between teams with an over-saturation of foreign aid workers, arrival sometimes without invitation, a general lack of data sharing and accountability as well as vague exit strategies and a sometimes unhealthy concern about capturing media attention at the expense of appropriate and professional medical care (Van Hoving et al, 2010; Ville de Goyet, Sarmiento & Grünewald, 2011; Jobe 2011; Gerdin, Wladis & Von Schreeb, 2012; Norton et al, 2013). Personal communication with a healthcare worker operating in Haiti a number of years after the quake has revealed a feeling that international aid has often been crafted and formed out of context, intending to bring solutions that often become problems (#7). The overall response can be broken into two periods. The immediate 'life-saving' phase lasting from the occurrence of the earthquake until approximately 16 days (two weeks). Relief efforts then shifted more towards a focus on rehabilitation for a more indefinite period of time, with a number of Field Hospitals staying for around 6 months and even up to 1 year in some cases (Ville de Goyet, Sarmiento & Grünewald, 2011).

Part A of the analysis will consist of a comparative study of 5 Field Hospitals, evaluated through the framework identified above as shown in Table 5. Data will be collected through available in-house reports and a limited number of available studies, along with anecdotal evidence from a few interviewees.

TABLE 5: CONCEPTUAL FRAMEWORK AS IDENTIFIED FROM LITERATURE REVIEW		
Design (physical)	Services (medical)	Governance (organisational)
<ul style="list-style-type: none"> • Typology • Location • Layout 	<ul style="list-style-type: none"> • Dominant Healthcare Needs • Mental Health • Vulnerable Groups 	<ul style="list-style-type: none"> • Evaluation & Accountability • Coordination • Integration • Transition / Exit Strategy

Part B of the analysis will consist of a review of the general medical response and specifically gaps between the immediate deployment of Field Hospitals and restoration of permanent health care facilities. Data will be collected through available reports and studies in addition to collated evidence from satellite imagery to verify as closely as possible the duration of each field hospital on its original site.

Part C will consist of collated reflections from interviews conducted with key actors involved in: the initial response; the transitional recovery period; and subsequent similar disasters (namely in the 2015 Nepal earthquake). Two different interview groups have been identified: 1) those involved in the general relief efforts either in the immediate aftermath or in long term recovery; 2) those involved directly with Field Hospitals¹¹. A questionnaire was developed based on the conceptual framework identified above which formed the basis of the interviews and subsequent discussion (see Appendix C).

¹¹ Ideally the interview process would focus more on this second group involved directly with Field Hospitals, however was limited by the scope of this thesis and difficulty in making contacting with relevant actors.

PART 4: ANALYSIS AND DISCUSSION OF RESULTS

PART A: Field Hospital Analysis

In order to evaluate Field Hospital more specifically, five examples have been chosen, largely based on available information and contacts already made. These are summarized in Table 6 below:

TABLE 6: SUMMARY OF CHOSEN FIELD HOSPITALS (Source: Gerdin, Wladis & Von Schreeb, 2012)

<i>NAME</i>	<i>SITE</i>	<i>START (DAYS SINCE QUAKE)</i>	<i>DURATION</i>	<i>NO. OF BEDS</i>	<i>NO. OF OPERATIONS</i>	<i>TOTAL NO. OF PATIENTS</i>
Israeli Defense Force (IDF)	Football Field	Day 4	13 days	60	244	203
University of Miami Hospital in Haiti (UMHH)	Airport Grounds	Day 15	5 months	250	1000	500
Harvard Disaster Recovery Center (DRC)	Orphanage	Day 13	4 months	400	350	2000
Médecins Sans Frontières (MSF)	School Sports Field	Day 10	At least 11 months*	200	617	-
Red Cross Rapid Deployment Emergency Hospital Emergency Response Unit (RDEH ERU)	Hospital Grounds	Day 6	4 weeks	20	300	-

*Approximation - based on Google Earth aerial imagery

Justification & Objectives

The IDF Field Hospital has been widely reviewed in academic literature and broadly regarded as one of the most sophisticated Field Hospitals in the world, with staff highly experienced working in Field Hospitals in natural disaster settings. The UMHH represents an ad-hoc Field Hospital arrangement with collaborations made between a locally present NGO (Project Medi-share) and a University medical school (University of Miami). The Harvard Disaster Recovery Center played an important role in follow-up post-operative care, and was also formed through an ad-hoc alliance between numerous parties. The MSF Field Hospital represents an advanced and long-running field hospital (at least 11 months) across a large semi-permanent site. The Red Cross Field Hospital represents an important example of a Field Hospital co-located with existing healthcare facilities (namely the main University Hospital of Port au Prince) to support and integrate with local healthcare services.

Timeline

Figure 7 shows the timing of these Field Hospitals opening and closing. All were operational within the first 2 weeks. The IDF Field Hospital was one of the first to depart after operating for 13 days. UMHH and Harvard closed down from approximately 4 months after the earthquake. The MSF St Louis Field Hospital stayed operational for at least 11 months until a semi-permanent hospital was opened to take over (MSF, 2012). The Red Cross hospital operated for only 4 weeks at the main University Hospital however it was moved to Petit Guave where it continued to be used for an additional 6-8 months.

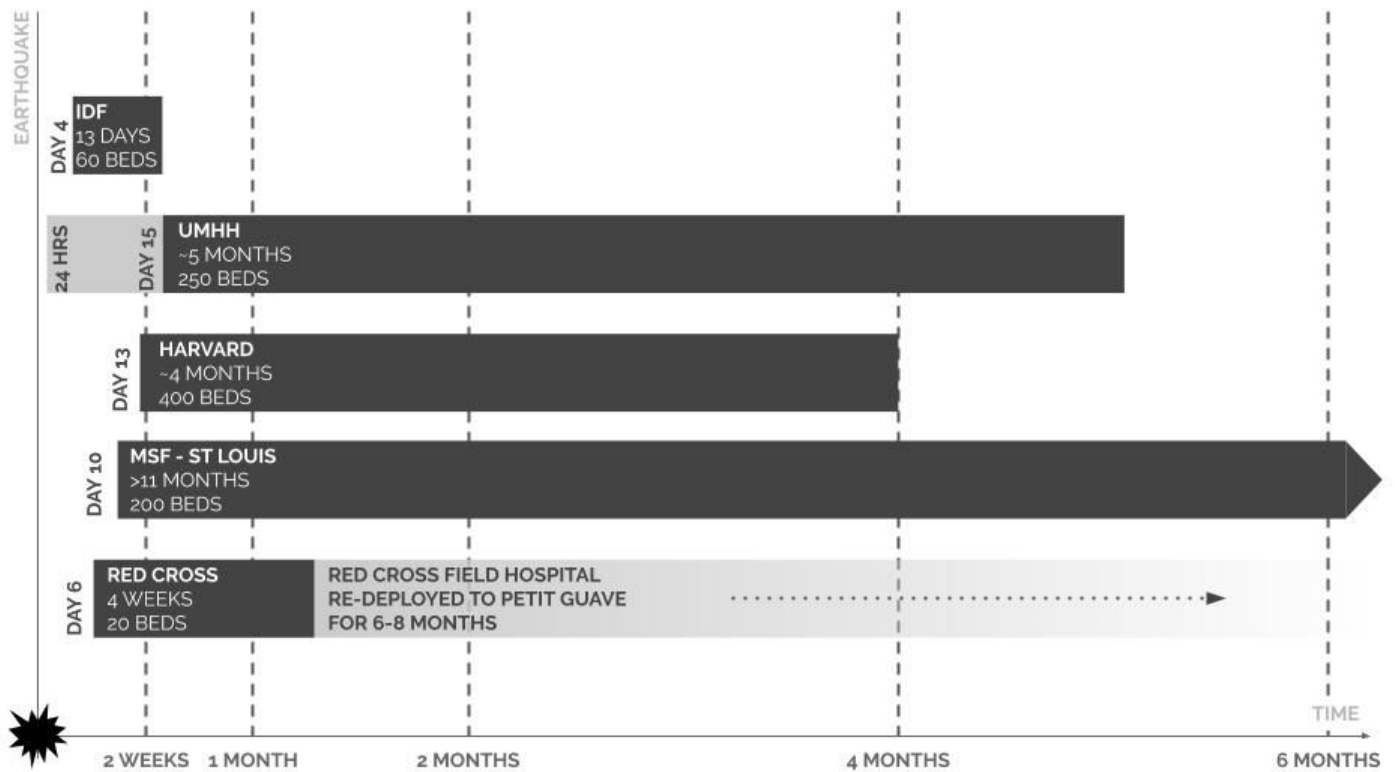


FIGURE 7: TIMELINE OF SELECTED FIELD HOSPITALS

Location

IDF, UMHH & MSF Field Hospitals were all located within 2.5km of the main International Airport (an important logistics node), while the Red Cross Field Hospital was located outside the main University Hospital (Hôpital General) as well as closer to most of the surviving health facilities in the city (Figure 8).



FIGURE 8: MAP OF CHOSEN FIELD HOSPITALS WITHIN PORT-AU-PRINCE
(Source: Google Earth. Further information drawn from Haiti GeoDB)

The Harvard Field Hospital was located 35 km out of the capital on an Orphanage site (Love A Child), close to the Dominican Republic (Figure 9). Given its proximity to the border it dealt regularly with the Dominican Republic which ultimately provided more support than the Haitian officials (Interview #6).



FIGURE 9: MAP OF CHOSEN FIELD HOSPITALS INCLUDING HARVARD FIELD HOSPITAL
(Source: Google Earth)

Israeli Defense Force (IDF)

The IDF Field Hospital ran a highly organised fully-deployable field hospital in Haiti consisting of internal, surgical, orthopedic, pediatric, gynecologic, ambulatory clinic and auxiliary units (Farfel et al, 2011). Due to the sophistication of the IDF setup they received a number of referred patients from other field hospitals unable to cater to specific needs of the patients. In order to deal with the increased demand, they would arrange for the referring hospital to receive one of their patients for post-operative care, a kind of patient exchange (Farfel et al, 2011). This enabled the hospital to focus on patients they were in a unique position to cater for. The IDF Field Hospital team had no prior experience in Haiti, but significant experience working on numerous similar disasters (Lichtenberger et al, 2010). They were one of the first Field Hospitals open (on day 4) and the first (along with Russia) to leave (on day 17) (Gerdin, Wladis & Von Schreeb, 2012).

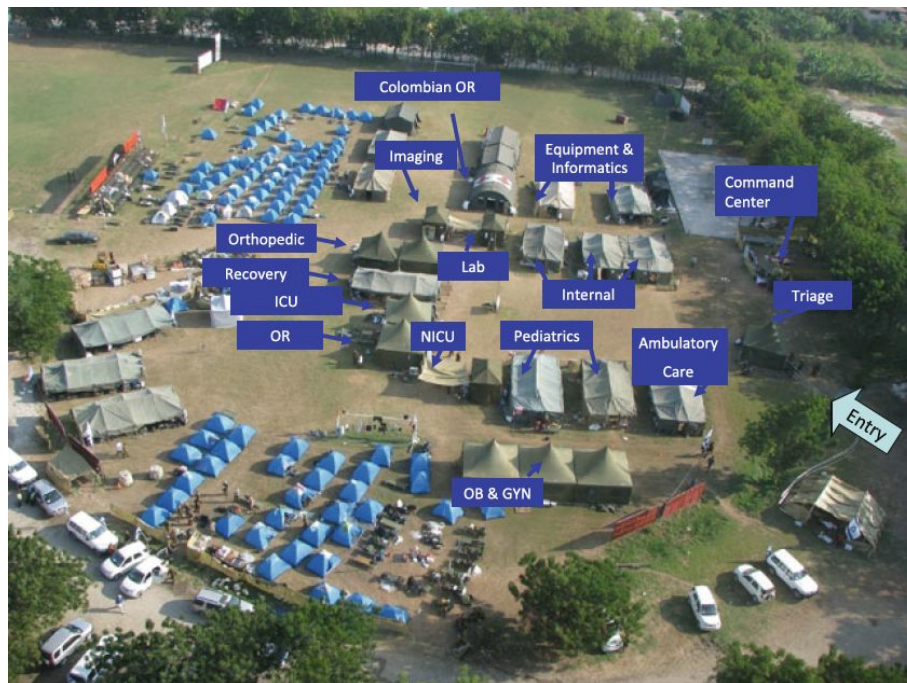


FIGURE 10: LAYOUT OF IDF FIELD HOSPITAL
(Source: Farfel et al, 2011)



FIGURE 11: EVOLUTION OF THE IDF FIELD HOSPITAL
(Source: Google Earth)

UMHH (University of Miami Hospital in Haiti)

UMHH was erected within a week of the disaster on the grounds of Port-Au-Prince Airport. The site was initially used as a makeshift treatment space in two large open storage tents within the UN compound at the Airport, with the first medical staff arriving from Miami 20 hours after the quake (Ginzburg et al, 2010). The team worked in partnership with Project Medishare, a pre-existing NGO with extensive experience in Haiti. Due to the challenges involved in operating in such a makeshift space (operations were initially occurring on a table outside one of the tents), a longer term Field Hospital was erected in four large event tents (Ginzburg et al, 2010). The airport location allowed for quick assembly of infrastructure as it was flown in. The tents were made out of waterproof UV-light-resistant white material with wooden floors raised above the ground to minimize flooding and included basic air conditioning (Lichtenberger et al, 2010). The Field Hospital was staffed completely by volunteers with limited experience working in a Field Hospital (Lichtenberger et al, 2010) and continued operating for up to 5 months (Hotz, 2010). The hospital quickly evolved into a tertiary referral centre where many patients were referred to from other field hospitals and also continued longer term to provide rehabilitation for post-operative patients putting considerable strain on its capacity (Hotz, 2010).



FIGURE 12: LAYOUT OF UMHH FIELD HOSPITAL

(Source: Lichtenberger et al, 2010)



FIGURE 13: EVOLUTION OF THE UMHH FIELD HOSPITAL

(Source: Google Earth)

Harvard (Disaster Recovery Center)

The Disaster Recovery Center was set up approximately 13 days after the earthquake on the site of Love A Child (LAC) orphanage, in an area called Fond Parisien. The Hospital was established by faculty members and researchers from the Harvard Humanitarian Initiative (HHI), collaborating with LAC, the University of Chicago and eventually the American Refugee Committee (who set up a nearby displaced persons camp to house patients post treatment) (Powell, February 2010). The hospital focused on rehabilitation, following the two-part strategy of Harvard affiliated Partners-in-Health (PIH), (a major pre-existing NGO health provider in Haiti) that immediate acute care be conducted by Field Hospitals located within Port-au-Prince, while those outside of the capital serve as rehabilitation for post-operative patients (Ireland, 2010). It was also one of the main receiving hospitals for a large hospital ship, the USNS Comfort (Powell, 2011; Interview #6). The Field Hospital operated until May with HHI staff aiming to stay long enough to rehabilitate patients to the point where they could integrate back into the community whilst providing ongoing support and training for local health workers (Powell, March 2010; HHI, 2010). In May, the transition from the disaster rehabilitation phase towards long-term recovery started through a grant provided from the US Agency for International Development's Office for Foreign Disaster Assistance that enabled the establishment of a full-time outpatient medical clinic set up at the ARC displaced persons camp (Camp Hope) and the decommissioning of the Field Hospital (HHI, 2010; Powell, 2011).



FIGURE 14: HARVARD FIELD HOSPITAL
(Source: Ide, 2010)



FIGURE 15: HARVARD FIELD HOSPITAL LAYOUT
(Source: Google Earth)

MSF

MSF has had a long standing presence within Haiti, with a number of their permanent hospital facilities severely damaged or destroyed by the earthquake. With the high influx of new patients, they deployed a fully-inflatable Field Hospital (known as the 'Saint Louis Hospital') on a local school sports field to provide additional capacity (MSF, February 2010). The inflatable structure had the added psychological benefit of helping patients feel less anxious and more willing to enter a covered space for treatment, compared to the solid buildings many had seen crumble to the ground from the earthquake (MSF, January 2010). Satellite imagery indicates that the hospital remained on site for at least 11 months. In May 2011, a semi-permanent modular hospital was opened in the northern section of the capital to take over from this temporary Field Hospital (MSF, 2012). The replacement semi-permanent hospital then remained in operation until mid 2018 (Charles, 2018).



FIGURE 16: MSF FIELD HOSPITAL

(Source: Jarden, 2010)



FIGURE 17: EVOLUTION OF THE UMHH FIELD HOSPITAL

(Source: Google Earth)

Red Cross

The Red Cross mobilized its largest ever single-country response in the wake of the earthquake, amongst which was the deployment of its Rapid Deployment Emergency Hospital Emergency Response Unit (RDEH ERU) led by the Norwegian Red Cross (NRC). The fully self-sufficient hospital was up and running within 6 days of the earthquake on the grounds of the main University Hospital and operated for four weeks before being relocated to another site outside of the capital (Gerdin, Wladis & Von Schreeb, 2012; Elsharkawi et al, 2010). It consisted of a 20 bed medical/surgical facility with teams from Norway, Canada, Israel and Denmark all joining forces with local healthcare workers (Elsharkawi et al, 2010). The tent setup provided a crucial treatment space for patients and staff still shell-shocked from the quake and the thought of returning to the neighbouring University Hospital particular as aftershocks continued. However this meant many patients were exposed to the elements as they waited for spaces to be set up or made available. A major limitation found during the operation of the field hospital was a lack of available ward nurse to support post-operative patients as most of the focus was on initial trauma treatment (Elsharkawi et al, 2010). Satellite imagery of this Field Hospital indicates quite a constrained site in terms of expansion.



FIGURE 18: RED CROSS FIELD HOSPITAL - SHOWN JUST AFTER AN AFTERSHOCK AS PATIENTS WERE TAKEN OUT OF THE MAIN HOSPITAL AWAITING SPACE IN THE TENT FIELD HOSPITAL
(Source: Elsharkawi et al, 2010)



FIGURE 19: EVOLUTION OF THE RED CROSS FIELD HOSPITAL
(Source: Google Earth)

Summary of Findings

TABLE 7: SUMMARY OF FINDINGS FROM CASE STUDY FIELD HOSPITALS					
DESIGN	IDF	UMHH	HARVARD	MSF	Red Cross
TYPOLOGY	Fully-deployable: -16-bed regular Military Tents -Heavy Canvas -No flooring (except Op Theatre) or air con	Ad Hoc: -4 Large Event Tents -Waterproof UV Light resistant white material -Raised wooden floor	Ad Hoc: -Series of Military Tents	Fully-deployable: -Inflatable Tent - extended significantly over time	Fully-deployable: -Rapid Deployment Emergency Hospital Emergency Response Unit (RDEH ERU) Tent system. -Tiled flooring in Operating Theatre
LOCATION	Football Field	Port-au Prince Airport grounds	LAC Orphanage Site - near Dom. Republic	School Sports Field	Grounds of main University Hospital
LAYOUT	Tents organised around central open area - smaller tents set-up at perimeter of site	Tents arranged side by side - smaller tents set-up at perimeter of site	Rows of tents	Tents interconnected from short end. Open area kept available on Football field for Helicopter landings	Tents arranged in available open space in hospital carpark. Limited expansion space.
SERVICES					
DOMINANT HEALTH CARE NEEDS	Acute trauma - conditions requiring specialised treatment	Acute trauma - then post-operative rehabilitation	Post-Operative rehabilitation Amputees (#6)	Orthopedic injuries - secondary infections	90% of cases were non-trauma - paed, maternity, ED procedures, C-sections, obstructed labour - not as much crush injuries (Interview #10)
MENTAL HEALTH PROVISION	None reported	None reported	None reported	None reported	Some Psychological First Aid provided
CONSIDERATION FOR VULNERABLE GROUPS	None reported	None reported	None reported	None reported	None reported
GOVERNANCE					
EVALUATION & ACCOUNTABILITY	Several studies published	Some studies published	No available studies found. One in-house report and news articles found.	No available studies found. One in-house report and news articles found.	No available studies found. One detailed in-house study and documentary found.

COORDINATION & REFERRALS TO OTHER FACILITIES/ EMTS	Took referrals	Took referrals	Took referrals from US Comfort Not much contact with other groups. (Interview #6)	None reported	Sometimes referred patients to other facilities (interview #10)
INTEGRATION WITH LOCAL AUTHORITIES & SERVICES	Little - perceived as stand-alone unit	Partnered with local NGO's (Project Medishare)	Dominican Republic had large influence and support to Field Hospital due to proximity to border	Pre-existing local presence. Unclear what connections made with local health services.	Pre-existing local presence. Partnered with local University Hospital
TRANSITION / EXIT STRATEGY	Stayed 13 days	Stayed approximately 5 months	Stayed 4 months and then transitioned care to nearby facility in IDP camp. Provided training throughout.	Stayed at least 11 months then transitioned care to semi-permanent modular hospital until 2018.	Stayed 4 weeks then relocated Field Hospital to Petit Guave for 6-8 months.

Conclusion

The following are key findings from this comparison.

Typology

The use of tents (particularly the inflatable MSF tent) was important in the immediate response as the trauma of buildings collapsing along with continuing aftershocks made it difficult for patients and staff to trust permanent solid buildings, even if they were still structurally sound

Location

While it is generally ideal to co-locate the Field Hospital to existing healthcare facilities (such as the Red Cross example) a number of the other Field Hospitals were located closer to the airport which functioned as a vital logistical node. In the case of UMHH this enabled staff to start operating on patients much quicker.

Layout

The choice of site location obviously constrained the layout of the Field Hospital. IDF and MSF were set-up on large open sites allowing for future expansion and a helipad (particularly with MSF), which weren't possible with Red Cross. Satellite imagery revealed the Field Hospitals continued to be expanded after first becoming operational. This underlines the importance of adaptability.

Dominant Health Care Needs

While both IDF and UMHH Field Hospitals reportedly treated a number of acute trauma case, Harvard, MSF and Red Cross reported more chronic and secondary complications for treatment, with such case as high as 90% in the Red Cross facility (Interview #10).

Mental Health provision

There was little evidence of Mental Health support being offered at any of the chosen Field Hospitals with the exception of the Red Cross Field Hospital that provided some psychological first aid / mental health treatment within the Field Hospital (Interview #10). This may also have been un-reported.

Consideration for Vulnerable Groups

There was little evidence of vulnerable groups being directly considered in the design, however this may have remained un-reported.

Evaluation & Accountability

There was a broad selection of academic reports available for the IDF Field Hospital and some for UMHH. Little independent analysis has been published on the other examples outside of Field Reports and news articles, however the Red Cross has produced a detailed in-house study of their Field Hospital.

Coordination & referrals to other facilities/ EMTs

Most of the Field Hospitals appeared to take and send referrals to other facilities. IDF reported a well structured referral system whereby the referring facility would have to take a stabilised or low-acuity IDF patient (as an exchange) to manage surge capacity.

Integration with local services

Field Hospitals that had some local connection whether through prior experience in Haiti or partnership with a local NGO generally had better success in providing ongoing support and dealing with language/ cultural barriers (particularly seen with UMHH, Harvard and MSF).

Transition/ Exit Strategy

Whilst the IDF with its sophisticated facilities and well-experienced staff were very effective in arriving quickly and managing complex referral processes, their presence in Haiti was limited to just 13 days. UMHH, through collaborative efforts with local NGO's was effective at pulling together quite a large (200 bed) and almost completely ad-hoc facility in a very short amount of time that was able to remain in operation for at least 4 months. However it is unclear where patient's in this facility went after it was packed down. The Harvard Field Hospital similarly brought together a number of different local and international parties to form an ad-hoc facility operating for a 4 month period then was able to hand over care to a nearby pre-established facility. The MSF Field Hospital was by far the longest in operation and occupied probably the largest site, taking up the full football field space at its full extent. Though it was able to transition care to a semi-permanent hospital, the length of time taken meant the field was unable to be used by the school throughout this whole period. The Red Cross appeared successful in integrating with the neighbouring health facility and was able to relocate its Field Hospital after 4 weeks to continue in operation on another site. These examples demonstrate the importance of finding a transition strategy ideally within the first 6 months post disaster, and definitely within the first 12 months.

PART B: Overall Field Hospital Response

Of particular interest to this study is the length of time Field Hospitals were operational in Haiti, before semi-permanent or permanent facilities were opened. By 3rd Feb, there was shared consensus at Health Cluster meetings that “organizations arriving to Haiti should preferably stay for a period of between 6 months to one year in order to meet existing needs and ensure the continuity of care” (Health Cluster, 2010, p.1). However the collected data below suggests this was not completely achieved.

Gerdin, Wladis & Von Schreeb (2012) conducted a comprehensive review of all Field Hospitals used in Haiti, with data collected on start dates and duration of most Field Hospitals up until February 12. However, the period beyond this time has not been reviewed in any available literature. In order to better assess the duration of Field Hospitals throughout the first year, data has been collected building on Gerdin, Wladis & Von Schreeb’s (2012) initial study, from a broad range of sources (including in-house reports, new articles and satellite imagery) to review the full first year after the earthquake (see Appendix A). The results from this data collection are represented in Figure 20. This graph is by no means a comprehensive analysis of exactly how long every Field Hospital was operation, due largely to limited availability of data and difficulty in cross-checking sources. However, it is hoped it can at least provide an indicative picture of trends in the timing of Field Hospitals used post earthquake.

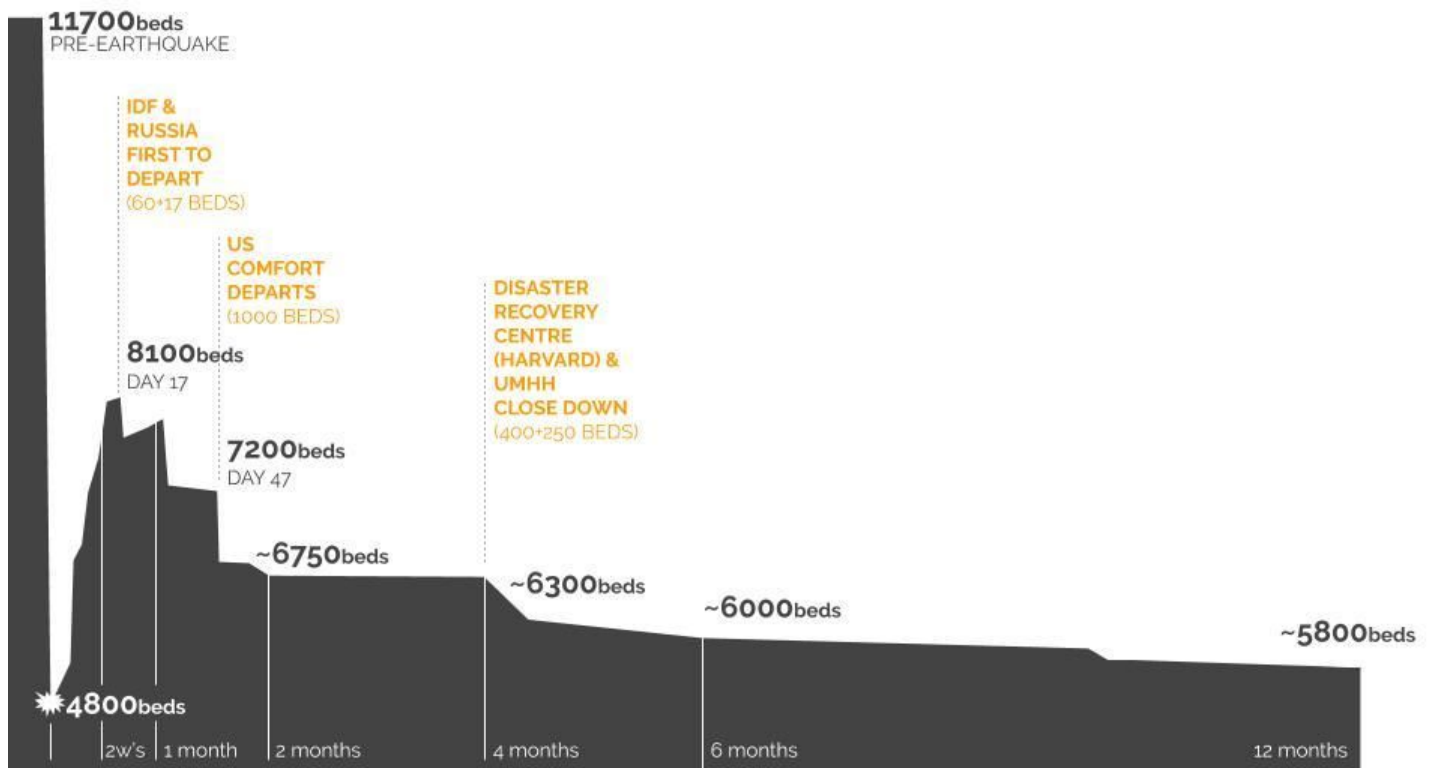


FIGURE 20: TOTAL BED NUMBERS THROUGHOUT THE FIRST 12 MONTHS POST EARTHQUAKE

(Source: Author based on Appendix A)

This graph was then extended across the following 9 years, to chart the timing of semi-permanent and permanent facilities opening as seen in Figure 21. It is assumed that there are likely to be many other facilities not captured in this graph - however, these have been presented to represent general trends.

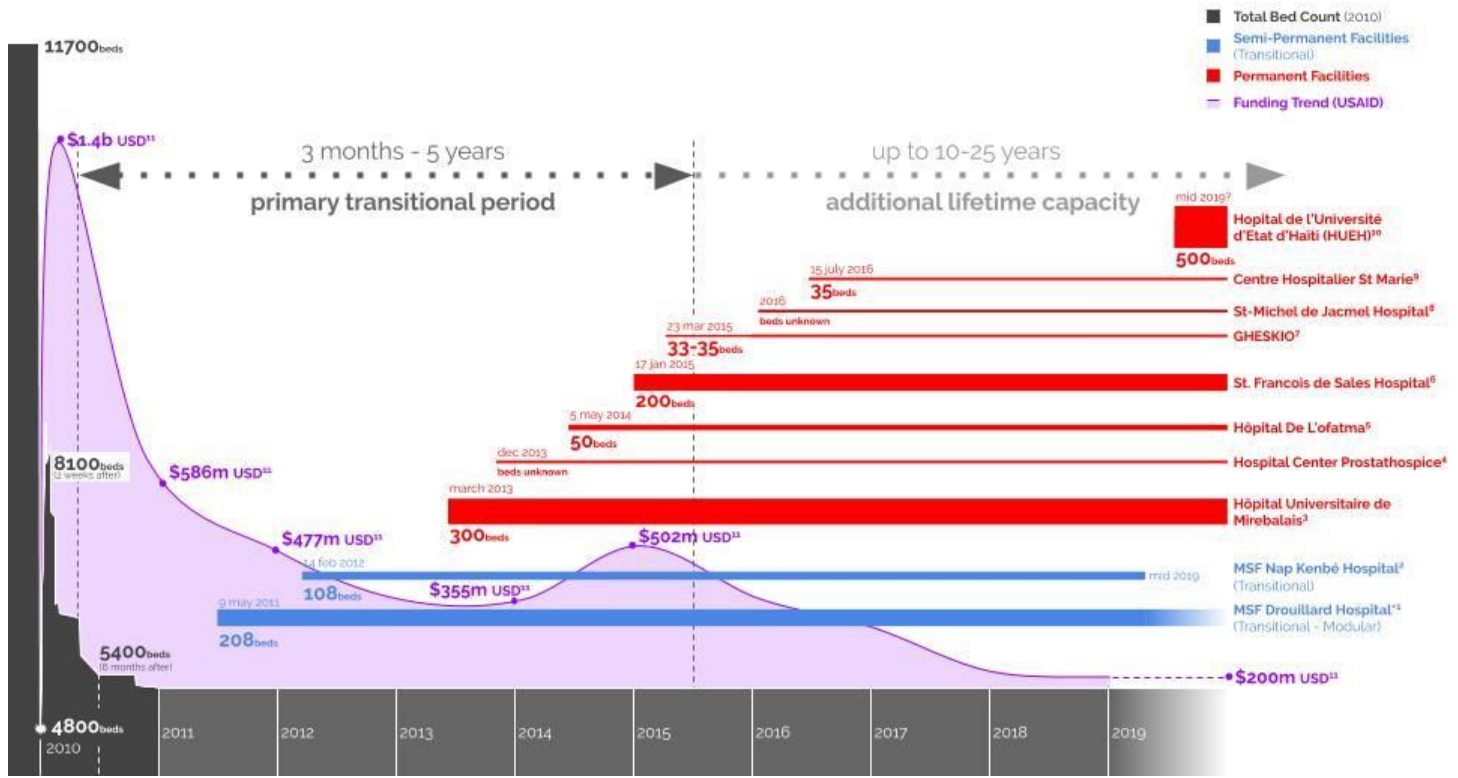


FIGURE 21: 9 YEAR REVIEW OF HEALTH FACILITIES RE-OPENING

(Sources: 1: MSF, 2012; 2: Charles, 2018; 3: Red Cross, 2013; 4: Prostat Hospice, n.d.; 5: Oliver, 2014; 6: CHA, 2015; 7: Mass Design, n.d.; 8: Galipeau, 2017; 9: Viard, 2016; 10: HaitiLibre, 2018; 11: USAID, n.d.)

Total funding provided by USAID has been plotted as an example to demonstrate the general funding trend in the years since the disaster. Most permanent facilities only started to be reopened from approximately 5 years after the earthquake. The main exceptions were the Hôpital Universitaire de Mirebalais which opened March 2013 (Red Cross, 2013) and the main 500 bed Hôpital de l'Université d'Etat d'Haïti (HUEH) which only opened to 80% completion in August 2018 (HaitiLibre, 2018).

While Field Hospitals were able to provide a significant number of extra beds by day 17 (bringing the total from 4800 to 8100), there was a significant drop off by about the 2-3 month mark as many short term Field Hospitals (particularly those operated by foreign defence forces such as Israel, Russia and the US Navy) withdrew. The first longer term hospitals identified in the available data were two MSF semi-permanent hospitals opened May 2011 and Feb 2012 respectively. These operated until approximately mid 2018 and mid 2019 respectively when they were closed down having exceeded their original life-span and requiring "significant (further) investments to turn ... into a permanent, more long-term structure" (Charles, 2018, p.1). Given the major health needs still present in the country along with the main hospital only just re-opening and continued outbreaks of violent protests, the timing of these closures has been met with some criticism (Charles, 2018).

Ultimately Figure 21 highlights an important gap between temporary Field Hospitals pulling out from around the 2-3 month mark and semi-permanent hospitals opening from about 18 months - 2 years post quake, before permanent facilities start opening at the 5 year mark. It is suggested that the primary transitional period be from 3 months to 5 years post earthquake with semi-permanent transitional hospitals able to continue in operation for up to 25 years post earthquake. Focusing on provision of transitional structures from the 2-3 month mark could better capture the initial funding impulse as well as better reduce the initial gap of bed numbers as temporary Field Hospitals reach the limit of their viable lifespan. Additionally, providing semi-permanent transitional field hospitals with the structural integrity to last up to 25 years gives significant margin for inevitable challenges and delays involved in reopening permanent facilities, particularly in countries with already weakened government procedures and institutions.

PART C: Interviews

Interviews were conducted with a range of different actors as mentioned above and detailed in Appendix B. For the purpose of consistency, the following findings have been grouped under the categories identified above.

Typology

Key Finding:

- Field Hospitals need to fundamentally be easily assembled, stand-alone, durable, adaptable and context specific.

Whilst quick assembly has always been an important factor of successful Field Hospital design, comments from interviewees consistently highlighted the importance of providing durable structures even in the immediate emergency phase. Conversations with members of J/P HRO who took over tented Field Hospitals from the US Army and MSF Belgium from about the 6 month mark noted that the structures struggled in storms that came October and were partially damaged (#9). A leader of the Red Cross team noted that while their Field Hospitals are designed to be quickly setup and packed down, they also invest in extremely robust, expensive but durable tent structures which are intended to last as long as possible and with the intention of being handed over to locals (#10). They also try to ensure they can operate stand-alone so not be a burden (#10).

In the case of J/P HRO, prefabricated domes were provided to provide a more durable shelter for parts of the Field Hospital (and became used for their maternity services) (CAN-DO, n.d.). There were some mixed opinions about its effectiveness, most appreciated the durability of the structure (#8, #9) but some questioned its potential price point and suitability to the context and climate (#4, #8). One interviewee concluded:

“in situations like Haiti, it is likely much more cost effective to be able to quickly put up (a) relatively simple high tin roof -- even without permanent siding - as the principle concerns are rain and sunshine/heat... I think that especially in urban settings if you have the permission to build something semi permanent on the land, something ... which can be flexibly adjusted to fit the full available space and which uses locally known construction techniques and locally available supplies is a much better approach for transitional construction” (#8).

Location

Key Finding:

- Consideration should first be given to proximity to existing hospitals, then to proximity to access routes (airports, ports, etc). Avoid occupying public spaces (sports fields) unless unavoidable. Consider use of satellite/ mobile units to access more remote locations (#7 & #10)
- Utilise as much existing infrastructure as possible (#10)

A range of different locations were used for Field Hospitals in Haiti. Most interviewees concluded that due to the complexity and severity of the disaster, most decisions on where to locate Field Hospitals came from necessity, using

whatever land was available (#5, #9). However, others pointed to important factors that should inform best practice for locating field hospitals. The question of access is crucial, both for patients and supplies. One interviewee highlighted the importance of placing Field Hospitals in places people “know” to go for healthcare (such as at existing hospitals) (#10). Another noted the value in considering mobile or satellite units to access populations in difficult to reach areas such as slums (#7). A leader of the Red Cross Field Hospital also pointed to considerations around who is staffing the facility, noting the value of co-locating with existing health facilities to better incorporate local health workers, as well as salvage as much surviving healthcare infrastructure as possible (#10).

Layout

Key Finding:

- Should follow logic of typical healthcare system as much as possible (#10)

This factor was not elaborated on in detail, but it was broadly acknowledged that the layout should follow the logic of any healthcare system to best support triage systems (#10). However one interviewee noted that in some cases “everybody was mixed in together” with little separation between minor illnesses and major illnesses (#5).

Dominant Health Care Needs

Key Findings:

- By the time Field Hospitals are operational, most health needs are secondary to the initial trauma. (#10)
- Dominant needs include Chronic Health, Post-operative amputees, paediatrics and maternity. (#2, #3, #8, #10)
This is often not reflected in media coverage. (#10)

Most interviewees consistently point to secondary complications, chronic illness and pediatric and maternity care as the dominant needs throughout the operation of Field Hospitals (#2, #3, #8, #10). One interviewee estimated such cases accounted for approximately 90% of patients, with initial crush trauma injuries nowhere near as prevalent by the time Field Hospitals arrive on site as what is generally portrayed in the media (#10).

Mental Health provision

Key Findings:

- Psychological support (for both staff and patients) should be integrated as an essential part of Field Hospital operations.
- Need to consider impact on volunteers not used to dealing with trauma (i.e. translators) (#9)
- Mental Health - typically spikes 3/4 weeks post-event - need direct psychological first aid support. (#10)
- Need to complement with community based Psychosocial support - “active survivors not passive victims” (#10)

Mental Health and Psychological support for both patients and staff was consistently acknowledged as extremely limited in Haiti (#5, #9), with one interviewee noting that even after 9 years much of it is still unprocessed (#9). One interviewee noted that the most affected people were translators in Field Hospitals, most of whom had had very little previous exposure to trauma (#9). Another interviewee noted that medically treatable psychological trauma spiked at around the 3-4 week mark, highlighting the need for Field Hospitals to take this into consideration in terms of timing (#10). More general psychological support should be encouraged on a community level, treating people as “active survivors” not “passive victims”, whilst encouraging gatherings and community based activities (#10). In this context, it is important to consider the prolonged impact of Field Hospitals occupying sites that would otherwise be available for community activities (such as football fields, etc) (#10).

Consideration for Vulnerable Groups

Key Findings:

- Accessibility to healthcare is a critical factor - people in remote areas, disabled or immobile were particularly vulnerable (compounded by amputations and geographical constraints particularly present in Haiti) (#3)

As noted above, accessibility is a critical factor for the effectiveness of Field Hospitals, and a number of interviewees pointed to this as directly relating to which groups are typically most vulnerable (#2, #3). One interviewee noted that due to the steep terrain of Haiti, people that were disabled, elderly or immobile were at a significant disadvantage for accessing healthcare, thus reinforcing the consideration of utilising mobile or satellite clinics for such areas (#3).

Evaluation & Accountability

Key Findings:

- Greater knowledge sharing needed - open street database to map health or vulnerable neighbourhoods (#7). Introduction of an advert/'how to' fact sheet (#4)
- Need to take time to review operation - opportunity through partnerships with academic institutions (particularly local) (#10)
- Need to review clinical outcomes - extremely difficult in emergency context (#10)

Most interviewees noted that greater data sharing and evaluation is needed for disasters such as Haiti. One suggested that an open street database that could capture health needs and neighbourhoods of particular vulnerability could be a helpful improvement (#7). Another suggested the production of a simple fact sheet to explain to local government exactly what international groups (such as those bringing in Field Hospitals) are able to provide (#4).

One noted that for groups like the Red Cross, there is little time for evaluation as the next emergency is always on the horizon (#10). Partnerships with academic institutions are therefore important to best review operations (#10). A remaining challenge is to review long-term clinical outcomes of patients treated in Field Hospitals - though difficult, this could potentially be done through partnering as early as possible with a local university or teaching program that will have an ongoing presence with patients (#10).

Key Findings:

- Need organisations to subject themselves to the coordination process (#8)
- Donors need to have this as a requirement (#8)
- Need to elect entity in charge from an early point (#8)

Coordination between different international organisations was consistently acknowledged as poor, somewhat delayed and undermined by competition for funding (#1, #3, #8). One interviewee argued that the biggest obstacle to long-term success in Haiti stemmed from weak coordination and a lack of willingness on the part of international organisations to subject themselves to the cluster process (#8). This interviewee pointed to the role of donors to ultimately force this as a requirement for organisations (#8). Cluster meetings were noted as largely unproductive (#9) and a point for improvement was suggested to elect a single entity in charge from an early point to streamline decision making processes (#8).

Integration with Local Authorities & Services

Key Findings:

- Need to “stay local” - try and find 1-1 correlation/counterpart with local govt (#4). Government collaborations can be more meaningful at the local level with mayors who are “experts of place” (#8). However, the authority of mayors remains disputed (#1; PTV, 2011)
- Focus on “giving back” health facilities to locals (#10)

Interviewees consistently pointed to a ‘localised focus’ within a specific neighbourhood and ideally connection to local healthcare facilities and pre-existing NGO’s that had well-established connections to the community, as key to best integrating support into the local context (#8). One interviewee pointed to the importance of international organisations finding a 1-1 counterpart within the local government (#8). This interviewee felt that the most meaningful collaborations occurred at a local level with mayors (who in Haiti have a large degree of localised authority and almost operate as like a “village chief”) (#8). However, another interviewee disputed the helpfulness of mayors noting they “didn’t have any control” (#1) whilst a different source illustrated that oftentimes the lines of authority between different mayors were blurred with some sections of neighbourhoods being claimed by more than one mayor at a time (IDH).

One interviewee highlighted that the focus in bringing in Field Hospitals should ultimately be on giving back to locals - “this is yours - you own it, we’ll help you take it over” (#10).

However, most interviewees regretfully concluded that the international community generally had not been good at integrating with local authorities, not with malicious intent but more out of ignorance (#1, #3, #9). One concluded that “we literally took tools out of the locals hands” (#9).

Key Findings:

- Focus on transition not exit (#10)
- Needs to be deeply rooted in real understanding of local context (#1, #7, #10)
- Recovery needs to start from day 1 (#4, #10)
- Use Transition to prepare for next disaster - pre-positioning stock, improve building codes, etc (#4, #7)
- Free-healthcare - danger if prolonged of destroying local private health care (#3, #7). However, not in all cases (#8)

A common theme emerging from the interviews was that Haiti is “not a short-term project” but a “generational question” (#1, #7, #10) - one interviewee concluded “there has been no and there will be no exit strategy since Haiti depends only on international aid” (#2) while another noted problematic connotations associated with the word “exit”, suggesting focus should rather be placed on “transition” (#10). Most interviewees agreed that successful transition depends directly on a genuine willingness to understand the local context (#1, #7, #10). This is particularly important in the process of securing land for semi-permanent and permanent healthcare facilities (#7, #9). There was also general agreement that recovery needs to start from day 1 (#4, #10), but seeing it as a long term process. Ideally, the process towards recovery needs to incorporate planning for the next disaster (#4, #7) including pre-positioning stock and improving construction quality through introducing and reviewing building codes and standards (#4).

There were a range of opinions around the merit of free healthcare provision, with some noting that many medical professionals were upset about charging money, concerned that people who most needed it were going to struggle to get access (#8). While others went so far as to say that the extended provision of free-healthcare from international NGO's “destroyed the (local) medical community” (#3). Another interview concluded that whilst free healthcare can be necessary to manage demand, it should not extend for any longer than 6 months (#7).

PART 5: PROPOSAL & FINDINGS

The research conducted throughout this study reflects a clear need for greater attention towards the transition phase between Field Hospitals pulling out and Permanent Hospitals opening and re-opening. A semi-permanent transitional Field Hospital could thus form an important step towards filling this gap. There exists a number of groups that are increasingly implementing such semi-permanent facilities¹², however there remains little published on them and no available academic literature found on the topic. This thesis, therefore, seeks to set out a transitional model that could be used to inform the design and implementation of such semi-permanent facilities, to best bridge this gap and support long-term recovery.

In order to better inform such strategies, an interview was conducted with an architect within the Red Cross who has worked on transitional semi-permanent hospitals deployed by the Red Cross in India and Nepal who was able to provide some important considerations for this phase.

Key Findings:

- Time is crucial - Due to limited life-span of most tented Field Hospitals (generally only up to 12 months), semi-permanent facilities need to ideally be available by the end of the first year following a disaster. (#11)
- Hospital construction (even if semi-permanent) has to follow Government policy for tendering and construction. This usually takes a significant amount of time. The most time efficient method to speed up this process is to conduct the design and tendering process during the official state of emergency where fast tracking may be more feasible (#11)
- Ready made designs for a transitional Field Hospital (modular type) with a bill of quantities (BoQ) as well as specifications and tender documents currently don't exist but would be very helpful for future work. (#11)
- Semi-permanent hospitals are generally based on the size of the previous existing facility they are substituting. Pre-fabrication is very useful, but only if it can be adapted to varying sizes and contexts. A modular system or kit of parts that can be rearranged, expanded and contracted based on the context and site could be very useful for future uses (#11).

Representatives from MSF were also contacted however were unavailable for interviews within the timeline of this study.

¹² Including the Red Cross (CRC, n.d.), MSF (MSF, 2014), Normeca (Normeca AS, 2005) and AmeriCares (2010).

The below model has been proposed as a method to capture both the emergency relief and long-term recovery needs and factors in the provision of healthcare following natural disaster (Figure 22).

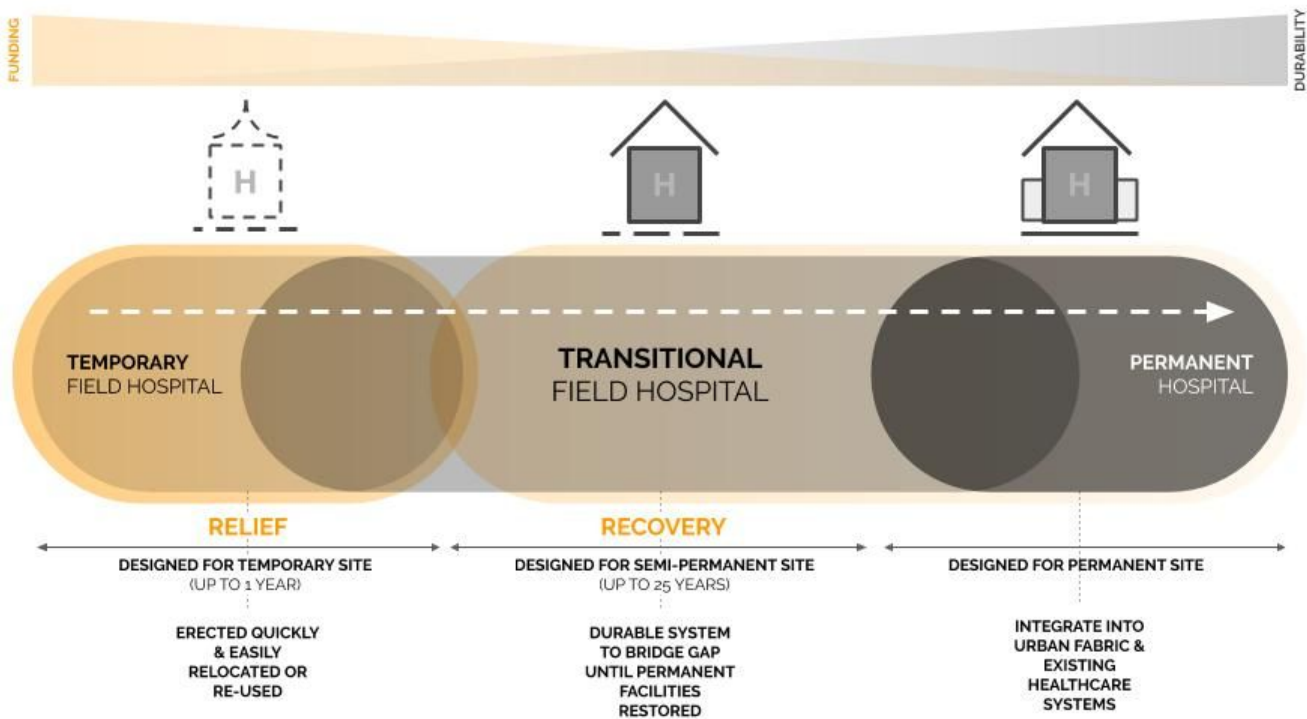


FIGURE 22: A TRANSITIONAL FIELD HOSPITAL MODEL
(source: Author)

This model suggests two new definitions to capture both the relief and recovery stages of emergency healthcare provision.

Temporary Field Hospital

These should be designed for deployment with maximum speed and efficiency on a temporary site and with enough durability to last up to 1 year post disaster. They should be able to be erected quickly and easily with the ability to be relocated and reused on different sites if needed. Ideally, they should be deployed to be ultimately handed-over to local services to operate when EMT's have to withdraw. Importantly, they should be provided with the intention of being replaced by a semi-permanent transitional facility by the end of the first year, if permanent facilities are still not available.

Transitional Field Hospital¹³

These should be designed as a durable system to bridge the gap from Temporary Field Hospitals until permanent facilities can be restored. As such they will need to occupy a semi-permanent site for between 5 - 25 years, or have the ability to be relocated if necessary. A prefabricated, modular system is recommended with a kit of parts that can be rearranged, expanded and contracted based on the context and site. Such system should be pre-documented to enable

¹³ The inclusion of the word 'Field' has been used to reinforced the semi-permanence of such facilities - though these facilities may be used for many years, they are not the final solution. This also helps avoid confusion with "Transitional Hospitals" often used to refer to transitional models of care for patients moving from one healthcare setting to another, or to home (Dewart & Hoover, 1994; AGS, 2007).

the tendering process to occur as soon as possible after the disaster, ideally within the state of emergency (up to 6 months post disaster) to best fast track the process to be ready by the 12 month mark post disaster.

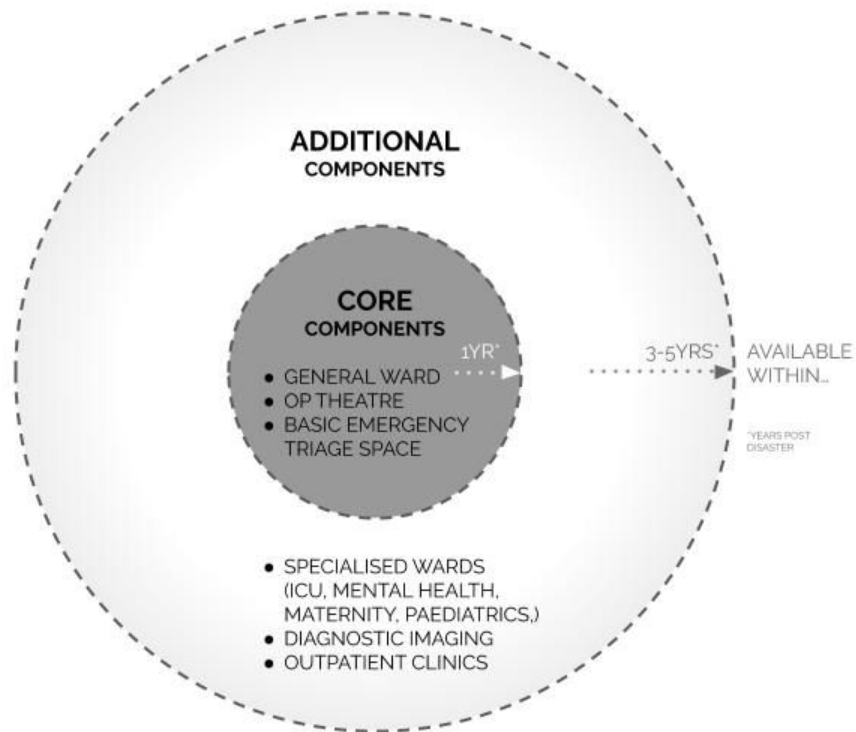


FIGURE 23: CORE & ADDITIONAL COMPONENTS THAT COULD BE USED FOR A TRANSITIONAL FIELD HOSPITAL
(Source: Author)

The Transitional Field Hospital could also be constructed in phases, with core elements available within the first year post-disaster, then additional components added across the following years. This may help to expedite the initial setup process and allow the structure to be adapted and extended over the longer term as per Progressive and Core Shelter principles identified above. Figure 23 is an indicative example of such an approach. Adaptability, customization for context and use of appropriate technology should all be considered to best tailor the facility to the location in which it is to be established.

PART 6: CONCLUSION

This study has identified a broad range of different factors that contribute to Field Hospitals being designed, serviced and governed to best support transition to long-term recovery and bridge the gap until permanent facilities are restored.

Existing guidelines have set the foundation towards standardizing and regulating the delivery of emergency healthcare through Field Hospitals, but are limited in guidance around the transitional process to long-term recovery.

Transitional shelter guidelines illustrates the importance of maintaining continuity between the initial relief and long-term recovery phases, recommending an incremental process that seeks to provide durable structures that can be easily upgradable and extendable. This process should be started as soon as possible post disaster to make best value from the initial funding impulse.

Analysis from the 2010 Haiti Earthquake highlighted an important gap in the provision of hospital beds between Field Hospitals pulling out of the country (from the 3-12 month mark) and semi-permanent and eventually permanent facilities being opened (18 months and 5 years respectively after the event). The fundamental conclusion is that there exists a need for greater emphasis be placed on semi-permanent facilities that can bridge the gap between initial relief and long-term recovery.

Further research is needed to better understand current semi-permanent transitional Field Hospitals, particularly given the significant lack of current academic literature on the subject. A detailed cost-benefit analysis could prove helpful to better understand the value of temporary versus semi-permanent facilities.

Ultimately, the key problems identified throughout this research centre around two areas. Failure to adequately understand and respect the local context in which the medical assistance is provided, and a failure to align emergency medical efforts to long-term recovery.

Solutions, however, should come from greater attention to context and greater attention to long-term recovery. As one interviewee noted, the future of Field Hospitals exists in “extreme modularity, extreme adaptability, customization for context and the use of appropriate technology for community in which it is situated” (#10). It is suggested from this research that the use of Transitional Field Hospitals could be an effective strategy to best support transition to long-term recovery and bridge the gap until permanent facilities are restored.

APPENDIX A: FIELD HOSPITAL BED NUMBERS AND TIMING

TABLE A: SUMMARY OF FIELD HOSPITAL LOCATION, TIMING AND BED NUMBERS FOLLOWING THE 2010 HAITI EARTHQUAKE					
NAME	SITE	START (DAYS SINCE QUAKE)	DURATION	NO. OF BEDS	SOURCE
B-FAST Belgium/ Puerto Rico	School Sports Field - near MSF St Louis FH* (18°33'18.8"N 72°18'01.0"W)	2	86-107 days	15	B-Fast, n.d.
Brazilian Airforce	Near US Embassy* (18°33'49.0"N 72°14'59.9"W)	4	53-65 days	25	Google Earth
Canadian Army		17	39 Days	103	Talbot et al, 2012
CMAT Canada	School Grounds (18°30'29.6"N 72°37'43.7"W)	4	2 Months	8-12	Google Earth
CRUDEM		11	9 Days	400	Gerdin, Wladis & Von Schreeb, 2012
Disaster Recovery Centre (Harvard)	Orphanage Site - near Dom Republic (18°31'12.15"N 71°58'53.91"W)	13	5 months	400	Interview #6
France FFH	School Ground (18°32'20.6"N 72°18'34.1"W)	4	28-39 Days	60-70	Google Earth
ELIAZAR Germain Hospital		12	9 Days	45	Gerdin, Wladis & Von Schreeb, 2012
IDF	Football Field (18°34'16.43"N 72°18'58.74"W)	4	10 Days	60	Gerdin, Wladis & Von Schreeb, 2012
Jordan	Airport Grounds (18°34'30.1"N 72°17'40.7"W)*	3	>Feb 12	50	Gerdin, Wladis & Von Schreeb, 2012
MSF Carrefour		19	>Feb 12	100	Gerdin, Wladis & Von Schreeb, 2012
MSF Choscal		2	>Feb 12	100	Gerdin, Wladis & Von Schreeb, 2012
MSF Chancerelles		6	>Feb 12	248	Gerdin, Wladis & Von Schreeb, 2012
MSF Jacmel		17	>Feb 12	70	Gerdin, Wladis & Von Schreeb, 2012
MSF Bicentenaire		29	>Feb 12	76	Gerdin, Wladis & Von Schreeb, 2012
MSF St Louis	School Sports Field (18°33'22.46"N 72°18'7.25"W)	10	>12 months	200	Gerdin, Wladis & Von Schreeb, 2012+ Google Earth
MSF Leogane		10	>12 Months	90	Gerdin, Wladis & Von Schreeb, 2012
MSF Lycee		22	>Feb 12	85	Gerdin, Wladis & Von Schreeb, 2012

MSF Mickey		18	>Feb 12	100	Gerdin, Wladis & Von Schreeb, 2012
Merlin UK		9	>12 months	40	Merlin UK, 2012
Red Cross NRC/CRC (University Hospital)	Hospital Grounds (18°32'23.98"N 72°20'23.35"W)	6	4 Weeks	20	Elsharkawi et al, 2010
Red Cross GRC/FRC		16	11 Months (31/12/2010)	160	Red Cross, 2010
Russia	Police Academy (18°31'22.3"N 72°15'11.4"W)	3	15 Days	17	Gerdin, Wladis & Von Schreeb, 2012
Turkey Ankara National Medical Rescue Team	Near Police Academy (18°31'29.46"N 72°15'0.96"W)	9	57 Days	20	Google Earth
UMHH	Airport Grounds (18°34'35.74"N 72°17'7.16"W)	15	5-6 Months	250	Google Earth
USNS Comfort	At Sea	7	40 Days	1000	USNS, 2010
*Approximate Location					

Note: A number of other Field Hospitals were present in Haiti according to Gerdin, Wladis & Von Schreeb, 2012, however data was unable to be found on when they arrived, how long they were present or how many bed numbers they had.

These include:

- China
- Colombian army
- Cuba (Arcahaie, Croix des Buquet, Carrefour, Leogane and Jacmel)
- DIHMyy, Switzerland
- France (Sirocco, French Navy and Advanced medical unit)
- GHESKIO
- Partners in Health, USA (L'Ho^pital de l'Universite' d'Etat d'Haiti)
- Partners in Health, USA/Zanmi Lasante, Haiti (Cange, Hinche, Saimt-Marc and Petite-Riviere)
- Qatar
- Spain

APPENDIX B: INTERVIEWEES

TABLE B: SUMMARY OF INTERVIEWEES					
#	NAME	ORGANISATION IN HAITI	ROLE IN HAITI	TIME IN HAITI	INTERVIEW GROUP*
#1	Marie Aquilino	Caritas international	General Recovery	Recovery phase - 5 year duration	1
#2	Jean-Paul Bondreau	Emergency Architects Foundation	Mission leader for structural evaluation of buildings	From Day 3 until Day 10	1
#3	Eric Cesal	J/P HRO	General Recovery	Recovery phase - 1 month after earthquake	1
#4	Dave Hampton	J/P HRO	Design and Planning of permanent solutions	10 months after the earthquake	1
#5	Yvonne Trimble	Haiti for Christ Ministries	Translator in 3 Field Hospitals	Living in Haiti since 1978 until present day - was there right throughout earthquake and recovery period.	2
#6	Bobby & Sherrie Burnette	Love a Child Orphanage	Directors of Orphanage (hosted Harvard Field Hospital)	Living in Haiti until present day - were there right throughout earthquake and recovery period.	2
#7	Anne-Marie Petter		Worked on two hospitals	2012 - 2014	1
#8	Benjamin Krause	CRS then J/P HRO	Former Country Director for J/P HRO	March 2010 - until 2014	1
#9	Beth Milbourne	CDTI then J/P HRO	Nurse working at J/P HRO Field Hospital	3 weeks after earthquake - until Oct 2011	2
#10	Hossam Elsharkawi	Canadian Red Cross	Led Field Hospital	From within 24 hrs of earthquake	2
#11	Laxman Chhetry	Canadian Red Cross	Field Hospital Architect	Not in Haiti - India (2000) and Nepal (2015)	2
<p>*Interview Groups: 1) those involved in the general relief efforts either in the immediate aftermath or in long term recovery; 2) those involved directly with Field Hospitals</p>					

APPENDIX C: INTERVIEW QUESTIONNAIRE

TABLE C: INTERVIEW QUESTIONNAIRE*	
DESIGN	
TYPOLOGY	What were the Field Hospitals that you saw made out of? Did they utilise any existing infrastructure or were they a standalone unit?
LOCATION	Do you know how decisions were made around where to locate Field Hospitals originally?
LAYOUT	Did the layout of the hospital cater for different levels of acuity/ vulnerability?
SERVICES	
DOMINANT HEALTH CARE NEEDS	What were the greatest medical needs when you arrived? How effectively were Field Hospitals able to address these?
MENTAL HEALTH	Were you aware of any provision for supporting patients with ongoing psychological trauma? (i.e. PTSD)
VULNERABLE GROUPS	In your opinion what groups were most vulnerable / overlooked by the response?
GOVERNANCE	
EVALUATION	How were response efforts monitored and evaluated? Was there much data collection and sharing that you were aware of?
INTEGRATION	How much input did local authorities have versus NGO's? How could this have been improved?
COORDINATION	Were there many linkages or partnerships made between other NGO's to support things like patient referrals, etc? Was information available about what services other Field Hospitals offered?
TRANSITION / EXIT STRATEGY	Was there an exit strategy? How did this play out? What were the main challenges in transitioning into long-term recovery?
*The questionnaire was adjusted slightly throughout the course of the interview process based on where I felt the research was leading. The above table represents the questions in their final form.	

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(Source: Author)

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BIBLIOGRAPHY

- AGS (2007). American Geriatrics Society (AGS) Position Statement: Improving the Quality of Transitional Care for Persons with Complex Care Needs, AGS Health Care Systems Committee
<https://web.archive.org/web/20070202011119/http://www.americangeriatrics.org/products/positionpapers/complex_care.shtml>.
- AmeriCare (2010) AmeriCares Establishing Transitional Field Hospital in Chile
<<https://reliefweb.int/report/chile/americares-establishing-transitional-field-hospital-chile>>.
- Ashdown, P. (Chair) (2011) Humanitarian Emergency Response Review, London.
<https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/67579/HERR.pdf>.
- Bakowski, J. (2016). A mobile hospital – its advantages and functional limitations. *International Journal of Safety and Security Engineering*, 6(4), 746-754. doi:10.2495/SAFE-V6-N4-746-754
- Bartal, C., Zeller, L., Miskin, I., Sebbag, G., Karp, E., Grossman, A., Kreiss, Y. (2011). Crush syndrome: Saving more lives in disasters: Lessons learned from the early-response phase in haiti. *Archives of Internal Medicine*, 171(7), 694. doi:10.1001/archinternmed.2011.122
- B-Fast, (n.d.), 'Earthquake hits Haiti: B-FAST helps Haitians in overcoming the devastating earthquake',
<<https://b-fast.be/en/content/earthquake-hits-haiti>>.
- CAN-DO, (n.d.), Haiti Dome Project <<https://can-do.org/projects/haiti-dome-project/>>.
- CHA (2015) Five Years After Earthquake, A New Haitian Hospital Is Set To Open
<<https://www.chausa.org/newsroom/news-releases/2015/01/09/five-years-after-earthquake-a-new-haitian-hospital-is-set-to-open>>.
- Charles, J (2018) Doctors Without Borders closes the first of two hospitals in Haiti, Miami Herald, Sat., July 21, 2018
<<https://www.miamiherald.com/latest-news/article215062735.html>>.
- Corsellis, T (2005) Transitional Settlement Displaced Populations
<https://www.ifrc.org/PageFiles/95884/D.01.06.%20Transitional%20Settlement%20Displaced%20Populations_%20OXFAM%20and%20Shelter%20Centre.pdf>.
- CRC (n.d.) Conceptual plan for Dhunche Semi-permanent hospital (Draft 3) (unpublished internal document).
- Degennaro, J., Vincent, Degennaro, S., Vincent, & Ginzburg, E. (2011). Haiti's dilemma: How to incorporate foreign health professionals to assist in short-term recovery while capacity building for the future. *Journal of Public Health (Oxford, England)*, 33(3), 459-461. doi:10.1093/pubmed/fdq104
- Dorwart, R. A., & Hoover, C. W. (1994). A national study of transitional hospital services in mental health. *American Journal of Public Health*, 84(8), 1229-1234.
- Elsarkawi, H., Jaeger, T., Christensen, L., Rose, E., Giroux, K., & Ystgaard, B. (2010). Mobile field hospitals in the Haiti earthquake response: a Red Cross model. *Humanitarian Exchange Magazine*, 48, 10-13.
- Farfel, A., Assa, A., Amir, I., Bader, T., Bartal, C., Kreiss, Y., & Sagi, R. (2011). Haiti earthquake 2010: A field hospital pediatric perspective. *European Journal of Pediatrics*, 170(4), 519-525. doi:10.1007/s00431-011-1423-8
- Galipeau, C (2017) In Haiti, a new hospital ... and without resources (À Haïti, un hôpital neuf... et sans ressources)
<<https://ici.radio-canada.ca/nouvelle/1055815/hopital-haiti-manque-ressources-financement>>.
- Gerdin, M., Wladis, A., & von Schreeb, J. (2013). Foreign field hospitals after the 2010 haiti earthquake: How good were we? *Emergency Medicine Journal : EMJ*, 30(1), e8. doi:10.1136/emmermed-2011-200717
- Ginzburg, E., O'neill, W. W., Goldschmidt-Clermont, P. J., De Marchena, E., Pust, D., & Green, B. A. (2010). Rapid medical relief—Project Medishare and the Haitian earthquake. *New England Journal of Medicine*, 362(10), e31.
- Giri, S., Risnes, K., Uleberg, O., Rogne, T., Shrestha, S. K., Nygaard, Ø. P., ... & Solligård, E. (2018). Impact of 2015 earthquakes on a local hospital in Nepal: A prospective hospital-based study. *PloS one*, 13(2), e0192076.
- GLOBAL-HAITI (2011): Search and Rescue Standards Turn 20. Integrated Regional Information Networks (IRIN), 2011.
<http://www.irinnews.org/report.aspx?reportid=91584> (accessed 26 Mar 2019).
- HaitiLibre (2018) Haiti - Health: The new Hospital of the State University of Haiti completed at 80% (Haïti - Santé : Le nouvel Hôpital de l'Université d'État d'Haïti achevé à 80%)
<<https://www.haitilibre.com/article-25245-haiti-sante-le-nouvel-hopital-de-l-universite-d-etat-d-haiti-acheve-a-80.html>>.
- Health Cluster, (2010) BULLETIN N°15, 3 February 2010
<https://www.paho.org/disasters/index.php?option=com_docman&view=download&category_slug=haiti-january-2010&alias=743-haiti-health-cluster-bulletin-3-february-2010&Itemid=1179&lang=en>.

- HHI (2010). From Rapid Response to Sustainable Solutions: Disaster Response and Recovery in Post-Earthquake Haiti. *Harvard Humanitarian Initiative*, January 2010.
- Hotz, G., Ginzburg, E., Wurm, G., DeGennaro, V., Andrews, D., Basavaraju, S., ... & Tappero, J. (2010). Post-earthquake injuries treated at a field hospital-Haiti, 2010. *Morbidity and Mortality Weekly Report*, 59(51/52), 1673-1677.
- Ide, J (2010). Helping Haiti. *The Harvard Gazette*, April 30, 2010.
- IFRC, (2013) Post-disaster shelter: Ten designs
<<http://shelterprojects.org/files/tshelter-8designs/10designs2013/2013-10-28-Post-disaster-shelter-ten-designs-IFRC-lores.pdf>>.
- Ireland, C. (2010). Harvard mobilizes relief fund. *The Harvard Gazette*, January 15, 2010.
- Jarden, X (2010). HOWTO set up a plug-and-play hospital - Doctors Without Borders. *BoingBoing*.
- Jobe, K. (2010). Disaster relief in post-earthquake haiti: Unintended consequences of humanitarian volunteerism. *Travel Medicine and Infectious Disease*, 9(1), 1-5. doi:10.1016/j.tmaid.2010.10.006
- Kligerman, M., Walmer, D., & Berekyei Merrell, S. (2017). The socioeconomic impact of international aid: A qualitative study of healthcare recovery in post-earthquake haiti and implications for future disaster relief. *Global Public Health*, 12(5), 531-544. doi:10.1080/17441692.2015.1094111
- Lichtenberger, P., Miskin, I., Dickinson, G., Schwaber, M., Ankol, O., Zervos, M., Munoz-Price, L. (2010). Infection control in field hospitals after a natural disaster: Lessons learned after the 2010 earthquake in haiti. *Infection Control and Hospital Epidemiology*, 31(9), 951-957. doi:10.1086/656203
- Mallek-Daclin, S., Daclin, N., Dusserre, G., Lhéritier, B., Blanchard, J., & Arnaud, I. (2017). Maturity model-driven assessment of field hospitals. *IFAC PapersOnLine*, 50(1), 4642-4647. doi:10.1016/j.ifacol.2017.08.685
- Manoochehry, S., Hoseinzadeh, E., Taha, P., Rasouli, H. R., & Hoseinzadeh, S. (2018). Field hospital in disasters: A systematic review. *Trauma Monthly, In Press*(In Press) doi:10.5812/traumamon.65126
- Mass Design (n.d.) GHESKIO Tuberculosis Hospital <<https://massdesigngroup.org/work/design/gheskio-tuberculosis-hospital>>.
- Maynard, V., Parker, E., & Twigg, J. (2017). The Effectiveness and Efficiency of Interventions Supporting Shelter Self-Recovery Following Humanitarian Crises.
- Memarzadeh, M., Loghmani, A., & Jafari, N. (2004). The field hospital setting in earthquake. *Journal of Research in Medical Sciences*, Retrieved from <https://www.openaire.eu/search/publication?articleId=doajarticles:956967f53b9069f004a88069fbf5e657>
- Merlin UK, (2012), 'EVALUATION REPORT: Evaluation to assess Merlin's Emergency Response in Haiti'
<<https://reliefweb.int/report/haiti/evaluation-assess-merlin%E2%80%99s-emergency-response-haiti>>.
- Miller, A. C., & Arquilla, B. (2007). Disasters, women's health, and conservative society: Working in pakistan with the turkish red crescent following the south asian earthquake. *Prehospital and Disaster Medicine*, 22(4), 269-273. doi:10.1017/S1049023X00004842
- Mira, L. A., Thrall, A. P., & De Temmerman, N. (2014). Deployable scissor arch for transitional shelters. *Automation in Construction*, 43, 123-131.
- MSF, (January 2010). MSF Project Update: Teams in Haiti distribute tents after storm destroys shelter patients in Haiti. *MSF*, 26 January 2010.
- MSF, (February 2010). MSF Operational Update: Haiti Earthquake Response. *MSF*, February 18, 2010.
- MSF (2012). MSF increases hospital capacity in the area affected by the earthquake
<<https://www.msf.org/haiti-msf-increases-hospital-capacity-area-affected-earthquake>>.
- MSF (2014). Innovative materials and a new beginning: MSF's interim hospital on the Philippines typhoon shore
<<https://www.msf.org/innovative-materials-and-new-beginning-msfs-interim-hospital-philippines-typhoon-shore>>.
- Normeca AS, (2005) Semi Mobile Hospital Based In Flat Pack Containers
<<http://www.normeca.no/products/products/Flatpack%20containers/Flatback%20Container/resources/SEMI%20MOBILE%20HOSPITAL%20BASED%20IN%20FLAT%20PACK%20CONTAINERS.pdf>>
- Norton, I., von Schreeb, J., Aitken, P., Herard, P., & Lajolo, C. (2013). *Classification and minimum standards for foreign medical teams in sudden onset disasters* Global Health Cluster, WHO.
- Oliver, LJ (2014) The Hospital in Les Cayes is ready, *Le Nouvelliste*, 2014-05-16
<<https://lenouvelliste.com/article/131110/the-ofatma-hospital-in-les-cayes-is-ready>>.
- Pape, J. W., Fitzgerald, D. W., Joseph, P., Johnson, W. D., Ford, H., & Rouzier, V. (2010). The GHESKIO field hospital and clinics after the earthquake in haiti — dispatch 3 from port-au-prince. *The New England Journal of Medicine*, 362(10), e34. doi:10.1056/NEJMp1001787
- Poles, L., Kunicheski, S., & Polishuk, Y. (2006). Testing the efficacy of a portable anteroom system air filter unit. *AORN Journal*, 87(6), 1243.
- Powell, A. (February 2010). Hospital rises in the grass. *The Harvard Gazette*, February 8, 2010.

- Powell, A. (March 2010). 'Building back, better'. *The Harvard Gazette*, March 4, 2010.
- Powell, A. (2011). Progress in Haiti 'painfully slow'. *The Harvard Gazette*, January 11, 2011.
- Prostat Hospice (n.d.) History <<http://www.prostathospice.com/histoire.html>>.
- PTV (2011) Inside Disaster Haiti, 3 Part Documentary Series, PTV Productions.
- Red Cross, (2010) Haiti Assistance Program (HAP) Projects and Partnerships
<<https://www.redcross.org/content/dam/redcross/uncategorized/11/RedCross-Projects-Partnerships-Haiti.pdf>>.
- Red Cross, (2013) Mirebalais Hospital Opens New Units to serve Haitians
<<https://www.redcross.org/about-us/news-and-events/news/Mirebalais-Hospital-Opens-New-Units-to-serve-Haitians.html>>.
- Rohwerder, B (2016) Transitional shelter in post-disaster contexts,
<<https://assets.publishing.service.gov.uk/media/58582313e5274a13030000ec/HDQ1387.pdf>>.
- Sanderson, D., Sharma, A., Kennedy, J., & Burnell, J. (2014). Lost in transition: principles, practice and lessons from Haiti for urban post-disaster shelter recovery programs. *Asian journal of environment and disaster management (AJEDM)*, 6(2), 131-151.
- Shelter Centre (2012) Transitional Shelter Guidelines
<<https://www.iom.int/files/live/sites/iom/files/What-We-Do/docs/Transitional-Shelter-Guidelines.pdf>>.
- SPHERE (2011) Sphere Handbook | Standards for quality humanitarian response
<https://spherestandards.org/wp-content/uploads/2018/06/Sphere_Handbook_2011_English.pdf>.
- SPHERE (2018) Sphere Handbook | Standards for quality humanitarian response
<<https://spherestandards.org/wp-content/uploads/Sphere-Handbook-2018-EN.pdf>>.
- Talbot, M., Meunier, B., Trottier, V., Christian, M., Hillier, T., Berger, C., ... & Taylor, S. (2012). 1 Canadian Field Hospital in Haiti: surgical experience in earthquake relief. *Canadian Journal of Surgery*, 55(4), 271.
- UNHCR (2019) Shelter Solutions <<https://emergency.unhcr.org/entry/254351/shelter-solutions>>.
- USAID, (n.d.) Foreign Aid Explorer, <<https://explorer.usaid.gov/>>.
- USAID (2012), Description Of Humanitarian Shelter And Settlements Sector Activities
<<https://reliefweb.int/report/world/usaid-dcha-description-humanitarian-shelter-settlements-sector-activities>>.
- USNS, (2010) Comfort Hospital Ship Operation Unified Response 8 June 2010 Defense Health Board Meeting,
<<https://health.mil/Reference-Center/Presentations/2010/06/08/Haiti-Relief>>.
- Vafaei, N., & Oztaysi, B. (2014, June). Selecting the field hospital place for disasters: A case study in Istanbul. In *Joint international conference of the INFORMS GDN selection and EURO working group on DSS* (pp. 323-336).
- Van Hoving, D. J., Wallis, L. A., Docrat, F., & De Vries, S. (2010). Haiti disaster Tourism—A medical shame. *Prehospital and Disaster Medicine*, 25(3), 201-202. doi:10.1017/S1049023X00008001
- Viard, R (2016) Young Haitian woman returns home and opens world-class medical facility, Le Nouvelliste, 2016-08-05,
<<https://lenouvelliste.com/article/161760/young-haitian-woman-returns-home-and-opens-world-class-medical-facility>>.
- Ville de Goyet, Claude de, Sarmiento, J. P., & Grünewald, F. (2011). *Health response to the earthquake in haiti: Lessons to be learned for the next massive sudden-onset disaster*. (). Washington, D.C.: PAHO. Retrieved from
<http://new.paho.org/disasters/dmdocuments/HealthResponseHaitiEarthq.pdf>
- Von Schreeb, J., Riddez, L., Samnegård, H., & Rosling, H. (2008). Foreign field hospitals in the recent sudden-onset disasters in iran, haiti, indonesia, and pakistan. *Prehospital and Disaster Medicine*, 23(2), 144-151. doi:10.1017/S1049023X00005768
- WHO. (2016). *Emergency medical teams: World health organization EMT initiative* WHO.
- WHO-IFRC. (2017). *The regulation and management of international emergency medical teams* WHO-IFRC.
- WHO-PAHO. (2003). Guidelines for the use of foreign field hospitals in the aftermath of sudden-impact disaster. *Prehospital and Disaster Medicine*, 18(4), 278-290. doi:10.1017/S1049023X00001229
- WHO-PAHO. (2010). *Proceedings of the WHO/PAHO technical consultation on international foreign medical teams (FMTs) post sudden onset disasters (SODs)* WHO-PAHO.
- World Bank (2009) Stronger communities safer people, Washington.