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Analysis of Mobile Clinic Deployments in Conflict Zones

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Abstract. The purpose of this study is to deepen the understanding of the challenges and implications entailed by deploying mobile clinic in conflict zones to reach populations affected by violence and cutoff from healthcare services. Armed conflicts have a direct impact on the population's health and access to healthcare. Mobile clinic deployments are often used and recommended to provide access to healthcare to populations that are vulnerable and cutoff from healthcare services. This article highlights the dearth of peer review literature documenting or developing decision support tools for mobile clinic deployments and provides direction for future research. The paper thus combines an integrated literature review and an instrumental case study. The literature review is composed of two targeted reviews on conflict zones and mobile clinics to provide insights. The case study describes the process and challenges faced during a mobile clinic deployment during and after the Iraq War. The data are gathered with mixed methods over a two-year period (2017 to 2018). This article highlights the gaps in literature and provides direction for future research to support the development of valuable insights and decision support tools for practitioners.

Keywords: Mobile clinics, operations management, conflict zones, healthcare access, literature review

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1 Introduction

The aftermath of armed conflicts (hereinafter conflicts) has resulted in the inception of various humanitarian organizations. For example, the International Red Cross and Red Crescent Movement started in response to the lack of healthcare during the war of Sulferino in 1859 (IFRC, 2016). Similarly, when the United Nations (UN) was created during World War II in 1945, its members highlighted the importance of creating a global health organization to provide humanitarian assistance to those in need and protect human rights (UN, 2015b). Hence, the World Health Organization (WHO) was founded (WHO, 2022b). Yet, scholars of the discipline of humanitarian logistics have “ignored the area of conflicts, wars and complex emergencies” (Altay et al., 2021, p.579). However, authors (Besiou et al., 2021) have address the UN 2030 Sustainable Development Goals (UN, 2015a) disregarding that countries affected by conflicts are less likely to meet these goals (Garry and Checchi, 2020). Furthermore, conflicts drive 80% of all humanitarian needs and up to two thirds of the world’s extreme poor are estimated to live in areas that are fragile or affected by conflicts (World Bank, 2022). Addressing healthcare during and after conflict is essential to reach the UN Sustainability Goals (Samman et al., 2018). Although healthcare needs during and after natural disasters and conflicts are similar, differences arise from the political complexities of conflicts, in which civilian populations are targets of war and human rights abuses aggravate health and protection needs (Leaning and Guha-Sapir, 2013). Additionally, people affected by conflicts experience severe public health consequences driven by population displacement, food scarcity, and the collapse of healthcare services, which together give rise to complex humanitarian emergencies (Toole and Waldman, 1997; Vass, 2001). Conflicts have been major causes of ill health and mortality for most of human history (Murray et al., 2002).

Conflict is possible as soon as weapons are available (Smith, 2004) and operating a humanitarian organization in a conflict zone poses its own challenges and limitations. Unfortunately, violence and conflict lasts for long period of times and combatants can target humanitarian organizations or prevent them from accessing certain populations (Beamon and Kotleba, 2006). Humanitarian organizations may face a plethora of risks that force them to yield to the demands of a warring side to obtain security guarantees to help the affected populations (Weil, 2001). Healthcare services are one of the daily operations that is affected by conflicts. Also, conflict reduces access to healthcare by damaging transport and communications channels (Urdal and Che, 2013) and the risk entailed by travel deters people from seeking healthcare due to the dangers and cost (Grundy et al., 2008).

To provide humanitarian healthcare relief, non-governmental organizations (NGOs) employ mobile clinics (Du Mortier and Coninx, 2007b). Mobile clinics are an intermittent modality used to provide ambulatory healthcare and improve access to health (McGowan et al., 2020; Du Mortier and Coninx, 2007b). These mobile clinics aim to give access to essential healthcare to populations who are unable to access permanent health struc-

tures (Médecins du Monde, 2017); as such they serve as a temporary solutions for those in need of medical services. Often they consist of vehicles transporting equipment and healthcare providers, who deliver health services at predetermined outreach posts (McGowan et al., 2020). Typically, mobile clinics offer a combination of primary healthcare services, including preventive actions (e.g., vaccination, screening, and health education) and curative services (e.g., obstetric, medical and mental health interventions).

The aim of this paper is to analyze the deployment of mobile clinics in conflict zones from an operations management and logistics perspective. Hence, it addresses three research questions:

RQ1. What are the impact and implications of conflicts zones on healthcare access?

RQ2. What are the benefits and challenges arising from the deployment of mobile clinics in conflict zones?

RQ3. What insights and tools can be developed to support mobile clinic deployments?

Consequently, this study is developed through an integrative literature review and an instrumental case study. The integrated literature review targets both conflicts and mobile clinics. The targeted review on conflicts provides context to how operations and logistic decisions are affected during and after a conflict. In addition, it presents the challenges on the healthcare system and impact on the population in conflict and post-conflict zones. This allows to put in perspective the decisions involved during deployments and the various applications. Then, the case study documents the operations and challenges encountered during the Iraq War by Première Urgence Internationale (PUI), an international non-governmental organization (NGO), that deploys mobile clinics to relief suffering of populations affected by humanitarian crises around the world. Finally, this study highlights the insights derived from the literature review and case studies and it provides directions for future research.

This paper is structured as follows. Section 2 details the methodology used in this study. Section 3 presents the targeted literature review on conflicts and what they entail, highlighting the dreadful consequences on healthcare systems and the health of people living in conflict zones. Section 4 provides the targeted literature review on mobile clinics, practices and standards, while underscoring the role mobile clinics play during conflicts. Section 5 showcases the case of Iraq, a mobile clinic deployment by PUI during and after the Iraq War. Section 6 explores needed tools for practitioners deploying mobile clinics in conflict zones. Section 7 presents the conclusions of this study and synthesizes the proposed direction for future research.

2 Methodology

This study is developed through an integrated literature review and an instrumental case study. The literature review underscores recent or historically significant research studies as well as field reports (Cooper et al., 2006) to provide perspective on mobile clinic deployments and conflict zones. Furthermore, the case study describes challenges faced, and uses multiple data collection methods (Njie and Asimiran, 2014) to expose the characteristics of a particular case of mobile clinic deployment in a conflict and post-conflict zone. The methodological framework is depicted on Figure 1. With the aim of the research being to analyze the deployment of mobile clinics in conflict zones, three research questions were identified. The answers obtained through the methodology described in the following sections (Sections 2.1 and 2.2) aid in deriving insights related to the decision-making process involved and what key insights and support tools would be helpful for practitioners. We also stress the complexities and challenges phased while deploying mobile clinics during conflict and post-conflict.

The methodology allows to answer the three proposed research questions. RQ1 is answered with the targeted literature review on conflict zones presented in Section 3. With the targeted literature review on mobile clinics, presented in Section 4, and the case study, in Section 5, we answer the RQ2. Finally, in Section 6 we answer RQ3.

2.1 Integrated Literature Review

Snyder (2019) has identified integrative literature reviews as the adequate tool for authors to combine perspectives and insights. Since the purpose of this paper is to combine perspectives and information pertinent to the deployment of mobile clinics in conflict and post-conflict zones to answer the research questions, we result to an integrative literature review. In addition, the desired outcome of this study is to provide direction for future research that supports the deployment of mobile clinics. Torraco (2005) stresses that an integrative literature reviews methodology plays an important role in stimulating further research.

Due to the dearth of articles that study the deployment of mobile clinics, the integrative literature review is composed of two targeted literature search (Huelin et al., 2015), i.e., on conflict zones and mobile clinics. The literature search mainly focused on peer reviewed journal publications and, hence, it started by searching for keywords in the ABI/Inform (ProQuest) database. The keywords included “conflict zones”, “war zones”, “armed forces”, “war relief”, “humanitarian logistics”, “mobile clinics”, “mobile health teams”, “mobile hospitals”, and “mobile health units”(Figure 2). This search resulted in 88,729 peer reviewed articles for conflict zones and 49,777 peer reviewed articles for mobile clinic deployment. Title and abstracts of the resulting articles were analyzed to

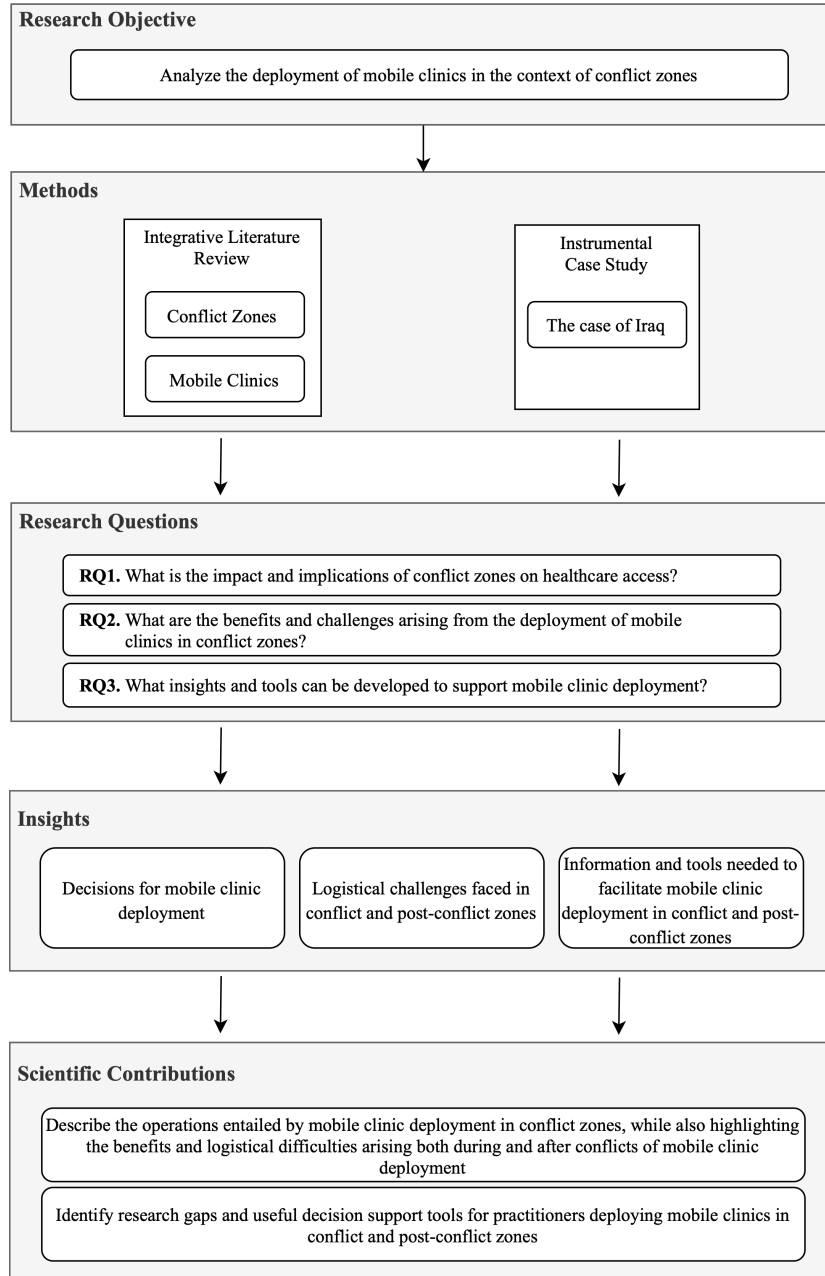


Figure 1: Research Methodology, Insights, and Contributions

determine the relevance. This was followed by reference and citation analyses to find related contributions, known as going backwards (Webster and Watson, 2002). In addition, Google Scholar was used to identify articles that cited the relevant literature, known as

going forward (Webster and Watson, 2002). In total 102 and 56 articles were included for conflict zones and mobile clinics respectively.

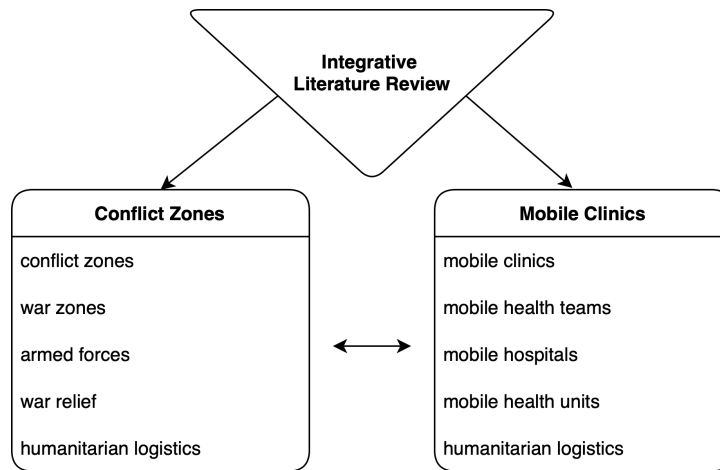


Figure 2: Integrative Literature Review

Benzies et al. (2006) encourage authors to result to grey literature when there is little evidence. Hence, the peer reviewed publications are supplemented and synthesized with the use of grey literature. Not only have purely research-based reviews been criticized for their inability to provide meaningful conclusions (Pawson et al., 2005), but also grey literature has been praised for its relevance and likelihood to be more up to date (Rothstein and Hopewell, 2009). To identify the relevant grey literature, the websites and databases of known nongovernmental organizations such as the World Health Organization (WHO), the United Nations (UN), and the International Federation of Red Cross and Red Crescent Societies (IFRC) were used. By including grey literature this study increased the likelihood of a comprehensive search (Benzies et al., 2006).

The findings of the integrated literature review are used to define the peculiarities of mobile clinic deployments in conflict and post-conflict zones. First, the targeted literature review on conflict zones is presented in Section 3. It begins by providing the definition of conflict zones, post-conflict zones, and the different degrees of conflicts. Moreover, the targeted review present past historical data and summarize the findings of empirical studies that concentrate on the nature, duration, and onsets of conflicts. Findings by various authors related to the toll of conflict on citizens, their health, and the healthcare systems that serve them and its lingering effect when conflict zones transition into post-conflict zones are discussed. Second, in Section 4, the targeted literature review on mobile clinics is presented. Based on empirical studies found in the literature, mobile clinics are positioned as temporary measure to satisfy healthcare requirements of populations affected by conflicts. We also present statistics compiled through the WHO's website on the various deployments of mobile clinics over the years. These statistics serve to further illustrate the importance of research directed towards the development of decision-making tools to support mobile clinic deployments in conflict and post-conflict zones.

2.2 Instrumental Case Study

The main goal of a case study is to extract in-depth details about an event, person or process (Njie and Asimiran, 2014). In this case study, the decision process during the mobile clinic deployment in Iraq by PUI, a non for profit and non governmental organization (PUI, 2016a), is documented and described to uncover insights of challenges faced by practitioners. Stake (1995) classifies case studies into three types: intrinsic, instrumental and multiple case studies. Because the case of Iraq is examined to generalize the logistical difficulties and operations entailed in the deployment of mobile clinics in conflict and post-conflict zones, it can be classified as an instrumental case study. The Iraq War ranging from 2003 to 2011 is the bounded context in which the presented case study is depicted (Miles and Huberman, 1994). The case study arises from a series of exchanges between the in field project managers and head medical staff as part of a collaboration between the authors and the organization. The sources used for data collection included interviews, documents, archival records, and observations (Stake, 1995; Yin, 1994; Leedy and Ormrod, 2005). The collaboration was initiated in 2016 and continued until the deployment was phased out in 2019, for a total of three years. Hartley (2004) highlights that case study research “consists of a detailed investigation, often with data collected over a period of time, of phenomena, within their context,” and additionally aims “to provide an analysis of the context and processes which illuminate the theoretical issues being studied” (p. 323).

3 Conflict Zones

To fully grasp what it means to deploy mobile clinics in conflict zones one must understand the nature and the implications of conflicts. The aim of this targeted literature review, is to provide a general understanding of the characteristics of conflict zones and the effect on the territories they take place in. To answer RQ1, we concentrate on how conflicts affect the access to healthcare and the health of the populations. We start by adhering to the definition of conflicts as presented in the literature and providing a brief historical overview of documented conflicts in Section 3.1. Then, in Section 3.2 we discuss the literature that studies the effects of conflicts. In Section 3.3 the particular healthcare implications of conflicts on the populations affected are exposed. Finally, this information is used to position the role of mobile clinic deployments in conflict and post-conflict zones in Section 3.4.

3.1 Armed conflicts

Pettersson and Wallensteen (2015) define conflicts as the “contested incompatibility that concerns government and/or territory where the use of arm force between two parties, of which at least one is the government of a state, results in at least 25 deaths must be recorded during battle” (p. 536). The same authors defined arm force as the use of any materials (e.g., manufactured weapons, sticks, stones, water) to promote the parties’ general position and resulting in deaths. Herein, conflict zones are the geographical territories in which conflicts take place. Wallensteen and Sollenberg (2000) defined four types of conflicts; minor conflicts, intermediate conflicts, wars, and major conflicts, all defined by the number of deaths (Figure 3).

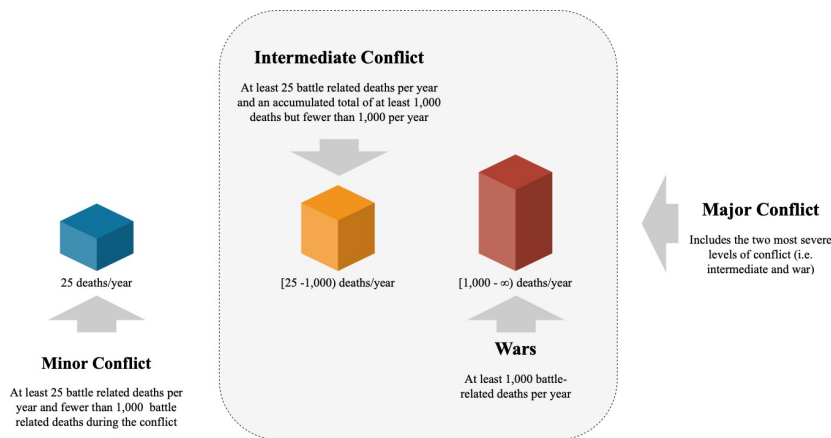


Figure 3: Types of Conflicts, adapted from Wallensteen and Sollenberg (2000)

The historical occurrences of conflicts has been well studied and documented (Smith, 2004; Themnér and Wallensteen, 2011; Cederman and Weidmann, 2017; Pettersson and Wallensteen, 2015; Strand et al., 2020; Strand and Hegre, 2021). Cederman and Weidmann (2017) stress the importance of documenting conflicts and, thus, initiated the movement of the Uppsala Conflict Data Program (UCDP). The UCDP database contains a comprehensive number of data files with historical data on different conflicts around the world starting from the year 1939 registering a total of 2,506 conflicts (see Figure 4). Authors could not find any significant evidence to indicate that conflicts would continue to decrease in upcoming years (Kreutz, 2010; Strand and Hegre, 2021). Cederman and Weidmann (2017) points out that the occurrence, location, frequencies, and termination of conflicts are hard to forecast. Smith (2004) highlights that a combination of poor economic conditions, political repression, and degradation of renewable resources are a catalyst for conflicts.

Kreutz (2010) found that the terminations of conflicts involved peace agreement, ceasefire, victory or others. Conflicts ending in victory had the shortest duration, approximately a year and seven months, while conflicts ending with a cease fire lasted the

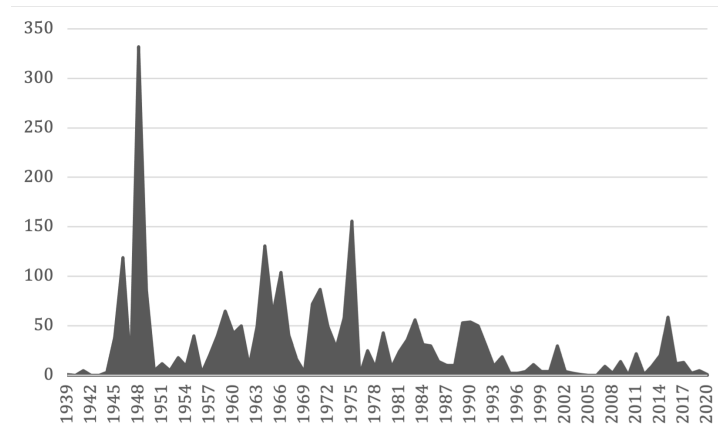


Figure 4: Conflicts Started from 1939 to 2020, source: Pettersson (2021)

longest, approximately four years and nine months. Kreutz (2010) also found that external peace keeping efforts were significant to prevent a resumption of conflict after a continuous year of conflict. This displays the importance of the “Genocide Prevention and Responsibility to Protect” adopted in 2005 by the UN to motivate states to intervene in conflicts that endanger civilians (UN, 2019).

3.2 Consequences of Conflicts and Humanitarian Needs

Conflicts have dreadful consequences on populations. The exposure to conflict zones creates economic, social, ecological, psychological, and nutritional stressors (Clarkin, 2019). Apprehension and exposure often lead to the displacement of population as people seek refuge and help, sometimes moving across borders. The United Nations High Commissioner for Refugees (UNHCR) identified 53.2 million forcibly displaced people in 2020, as a result from persecution, conflict, violence or human rights violations (UNHCR, 2021). Displaced populations often suffer from lost property or social capital, resettlement in less fertile areas, restricted mobility, and are often viewed as a burden for their hosts (Al Gasseer et al., 2004; Hynes and Cardozo, 2000; Salama et al., 2004). Clarkin (2019) remarks that those that remain tend to fare worse than those who cross an international border.

Civilians are subjected to wartime violence during conflicts due to various factors. Hovil and Werker (2005) found that civilians were targeted as a display of commitment to continue fighting. Researchers have observed that groups that receive support from foreign governments have few to no incentives to refrain from attacks against civilians (Salehyan et al., 2014; Toft and Zhukov, 2015; Weinstein, 2006; Zhukov, 2017). Even in a post-conflict context the resentment towards groups that have collaborated with enemies can lead to ethnic violence (Bell-Fialkoff, 1993; Taras and Ganguly, 2015) and towards re-

venge (Weidmann, 2011; Balcells, 2010; Gibbs, 2018). However, Azam (2002) posits that violence against civilians is a byproduct of looting and resource competition. This goes in line with the observations of Koren and Bagozzi (2017), which found higher incidents of violence against civilians in areas with more agricultural resources, as governments and rebel groups compete for access to food. During conflicts fighters engage in sustained looting against their own communities and hold roadblocks for ransom (Englebert and Ron, 2004).

Conflicts often conserve gender roles (Bjarnegård et al., 2015) and have different effects among age and gender groups in the population. For instance, the majority of active combatants are males (Henshaw, 2013), which explains why men are at a higher risk of death (Zwierzchowski and Tabeau, 2010). Women are often subjected to wartime violence such as sexual exploitation (Centre, 2005). Messer et al. (2001) found that during conflicts children are subjected to homelessness and separation from community ties. Most often, “breadwinners’ are the ones who fall victim to landmines (Messer et al., 2001).

The use of landmines can hinder farming, avert economic development, and also lead to casualties even decades after a conflict has concluded (Khamvongsa and Russell, 2009). Moreover, shelling and bombing can disrupt topography, form craters, and alter drainage patterns (Hupy and Schaetzl, 2006). Additionally, in conflict zones there’s a reduction in access to water and sanitation services, which in turns increases poverty (Gleick, 2019). Garfinkel and Skaperdas (2007) found that valuable resources are diverted away from investment and consumption and instead go directly into obtaining arms and, thus, there is a significant reduction in trade and an increase accumulation of productive capital. Moreover, the insecurity posed by conflicts deter trade activities across national borders leading people to participate instead in less productive and more secure activities (Garfinkel and Skaperdas, 2007). Addison et al. (2001) signals that post-conflict economies have weak regulatory authorities, and financial system becomes loaded with unsound loans, this leads to problems that can endanger economic recovery and peace. Hence, conflicts pose development hardships for citizens and a high cost on the international community (Ross, 2003).

The horrific consequences of conflicts, both on soldiers and civilians, have shaped humanitarian aid into the systems we see today, even leading to the conception of the humanitarian principles (Rysaback-Smith, 2015; Macintosh, 2000). During conflicts, foreign donors attempt to alleviate the suffering by sponsoring humanitarian aid (Wood and Sullivan, 2015). To the point where humanitarian aid has become an essential component of the international community’s response to conflicts and humanitarian organizations have taken an active role by providing vital services and security to internally displaced people (Anderson et al., 1999; Duffield, 1997). Although Wood and Sullivan (2015) points out that humanitarian aid may produce short-term instability and increased violence by encouraging both rebel and government forces to engage in violence against civilians, it

remains essential to save lives and help people to enjoy the most basic rights to shelter, water, and enough to eat (Bryer and Cairns, 1997).

3.3 Healthcare Implications

Frost et al. (2017) noted that the most common injury sustained during conflicts was a limb amputation. Severe disabilities can be attributed to landmines during and post-conflicts (Coupland and Korver, 1991). McPherson (2019) noted that traumatic brain injuries among the population suggest they are caused by landmines and explosive devices, and are further associated with mental health concerns. Violence has also major effects on physical and mental health, including injuries from rape, HIV, reproductive health problems, and social isolation (Spangaro et al., 2013; Stark and Ager, 2011). Moreover, the physical injuries and health effects last into older age and are usually worse for older women versus for older men (Ghobarah et al., 2004; Massey et al., 2017). Also, populations affected by conflicts often suffer mental health disorders such as post-traumatic stress disorder, stress, insomnia, anxiety and depression (Garry and Checchi, 2020).

Leaning and Guha-Sapir (2013) posit that the main health implications of internal conflicts are not combat-related injuries and deaths. However, Murray et al. (2002) highlights that quantifying the health implications of conflict is challenging due to the fact that civil registration systems, often cease to function during conflicts. Levy and Sidel (2016) identifies a need for an independent, nonpartisan mechanism, established and maintained by a UN agency or a multilateral organization, to investigate, document, and report on health consequences of conflict. Nonetheless, numerous studies have documented the gruesome implications of conflicts on the health of populations affected with the use of surveys, news reports and external data bases. Ghobarah et al. (2003) found that conflicts deepen the risk of death and disability with increases in homicide, transportation accidents, other injuries, and cervical cancer. Wise and Barry (2017) underscored the prevalence of disease outbreaks in conflict zones. Jawad et al. (2019) found evidence that associates conflicts with an increased coronary heart disease, cerebrovascular and endocrine diseases, in addition to increased blood pressure, lipids, alcohol and tobacco use. Kimbrough et al. (2012) noticed that incidence and prevalence of tuberculosis was twice more as high in conflict-affected populations. The challenging environments, including attacks on health workers, mean that vaccination and eradication campaigns repeatedly fail to achieve sufficient coverage in conflict zones (Bhutta, 2013; Morales et al., 2016; Wise and Barry, 2017). Additionally, poor access to healthcare and lack of continuity of care during conflict has resulted in a disruption to the effective care of cardiovascular and cerebrovascular conditions, diabetes, chronic respiratory diseases, cancers, and other non communicable diseases (Bendavid et al., 2021).

The healthcare implications on women and children have been extensively studied. Rai et al. (2019) documented that conflict and emergencies contribute to the mortality

and long-term health deterioration for females. Wagner et al. (2019) observed an increase in maternal mortality that is directly correlated to the intensity of the conflict. Bendavid et al. (2021) saw an increase in the probability of dying in women of childbearing age when exposed to conflict. This could be attributed to the reduced access to maternal and newborn health services, especially for the poorest and least educated women (Gopalan et al., 2017; Akseer et al., 2020). It was observed that conflict exposure decreases fertility based on studies in Angola, Ethiopia, and Eritrea (Agadjanian and Prata, 2002; Lindstrom and Berhanu, 1999; Blanc, 2004). Additionally, two studies observed the unmet need for family planning in conflict settings (McGinn et al., 2011; Ivanova et al., 2018). Maternal mortality tends to worsen in conflict zones (Alkema et al., 2016; Kotsadam and Østby, 2019). When it comes to children, Wagner et al. (2018) found that infants exposed to conflict in their first year had a higher chance of dying before their first year. Keasley et al. (2017) points out the significant relationship between exposure to conflict and a detrimental effect on birth weight. Four studies demonstrated a statistically significant increase in premature births due to conflict exposure (Arnetz et al., 2013; Bodalal et al., 2014; Skokić et al., 2006; Keren et al., 2015). Additionally, Bendavid et al. (2021) noted that chronic malnutrition in children are more pronounced among children near conflict zones. Qadri et al. (2017) attributed the cholera outbreak in Yemen to the bombing of water facilities. All these implications obviously lead to a need for humanitarian healthcare.

3.4 Humanitarian Healthcare in Conflict Zones

Since the adoption of the UN’s “Genocide Prevention and Responsibility to Protect”, efforts to send humanitarian aid to conflict zones has increased (Bellamy, 2015). Leaning and Guha-Sapir (2013) states that public health is a major component of the larger operational framework of international relief. Public health encompasses disease control, reproductive health and maternal care, psychosocial support, short-term or emergency medical and surgical interventions, and sanitation and nutritional services (Leaning and Guha-Sapir, 2013). Evidence has been found that supports the role of public health measures for peace building (Sen and Faisal, 2015) and social cohesion (Kruk et al., 2010) in the after-math of a conflict. Authors have documented cases where access to healthcare services has improved compared with pre-conflict due to humanitarian and international aid (Gordon et al., 2010; Gates et al., 2010). Devkota and van Teijlingen (2010) state that the international community should continue and increase their support to strengthen the health sector of territories affected by conflicts.

During a conflict, the infrastructure, including buildings, medication stores, laboratories, electricity and water, may be directly targeted or looted (Gordon et al., 2010; Guha-Sapir and van Panhuis, 2002; Gates et al., 2010; Zwi and Ugalde, 1989; Levy, 2002). Health services are often severely interrupted by the destruction of infrastructure and management systems (Ahamadani et al., 2014). Continuity of care is especially

difficult in the face of health system disruption and health outcomes are sensitive to healthcare continuity (Buvinic et al., 2013; Aebischer Perone et al., 2017; Isreb et al., 2016). Rubenstein and Bittle (2010) found that despite international humanitarian laws, medical personnel and wounded are targeted during conflicts and some countries have laws that allow the attack of medical facilities if it guarantees a military advantage for the government. Also, they highlight that the non-governmental party involved in the conflict often targets medical personnel to gain grounds on the government. Coupland (1994) posits that medical personnel in conflict zones face stressful situations that demand experience and seasoned judgment beyond medical skills. Stressful exposure often leads the medical personnel to flee the country (Rubenstein and Bittle, 2010).

Humanitarian organizations are challenged with how to effectively tackle the need for healthcare to treat diseases during conflicts and into post-conflict (Jawad et al., 2019). Practitioners are constantly faced with a lack of historical information on chronic illnesses of the people affected by conflicts (Aebischer Perone et al., 2017; Massey et al., 2017; Owoaje et al., 2016). The personnel also faces political and military barriers that hinder the delivery of humane and appropriate care (Weindling, 1998). In the midst of a conflict, international standards are difficult to adhere, due to risks of those who provide information and who collect it (Ford et al., 2009). Morgan et al. (2006) noted that while delivering aid broader societal issues related to humanitarian response can be neglected, such as the need to maintain respect for cultural practices regarding death and grief. Also, Iseron and Moskop (2007) signal that delivering medical aid can require population-based triage decisions that are technically complex and morally challenging. Training healthcare professionals to deliver interventions during and post-conflict and ensuring continuity in the supply of common medications are key priorities (Jawad et al., 2019). In sum, conflict zones have negative health consequences and implications on populations. Due to the barriers in conflict zones and a lack access to a permanent healthcare facility mobile clinics are a suitable resource to provide humanitarian relief.

4 Mobile Clinics

Based on the complexity conflict zones inflict on humanitarian healthcare delivery, mobile clinics are a valuable resource. Understanding how mobile clinics fit into humanitarian healthcare delivery in a conflict zone requires to know what a mobile clinic is and how practitioners have used them. Hence, this section, as part of the integrative literature review, presents a general definition of mobile clinics, discusses practitioner's materials and guidelines designed to facilitate the decision making process, and provides a general overview of various deployments that have taken place in conflict zones. Due to the dearth of literature documenting mobile clinic deployments in conflict zones, we supplement the overview with literature pertaining to deployments outside conflict zones. First, we describe what mobile clinics are based on the available academic and grey literature in

Section 4.1. Then, we discuss the benefits and challenges of mobile clinic deployment in Section 4.2, and more specifically in conflict zones Section 4.3. This allows to answer RQ2 and RQ3 and derive specific insights on mobile clinic deployments.

4.1 What are mobile clinics?

Mobile Clinics (*a.k.a.* mobile health units, mobile health teams, or mobile hospitals) are an intermittent modality used to provide ambulatory health services and improve access to the healthcare (McGowan et al., 2020; Du Mortier and Coninx, 2007b). Malone et al. (2020) further defined mobile clinics as customized motor vehicles that travel to communities to provide healthcare. However, this vehicle does not necessarily have to be customized as long as it can transport equipment and healthcare providers to a predetermined outreach post where services will be delivered (McGowan et al., 2020). We present different mobile clinics that have been deployed by various organizations throughout the years in Figure 5. From the examples showed one can conclude that mobile clinics can take various shapes or forms.



Figure 5: Mobile Clinic Examples

The intent of deploying mobile clinics is to promote the access to healthcare (ICRC, 2006; Du Mortier and Coninx, 2007a) by providing primary healthcare services, with the possibility of referral to nearby fixed structures for conditions not manageable with the resources of a mobile clinic (McGowan et al., 2020). McGowan et al. (2020) also state that mobile clinics are better suited to offer preventive services, such as vaccination or antenatal care, or outpatient-level case management of chronic conditions, including mental health problems, high-burden non-communicable diseases, among others. Yet, mobile

clinics should be used as an exceptional modality, only deployed as a “last resort” to reach populations cut off from health services (Du Mortier and Coninx, 2007a). In some cases, mobile clinics are the only way to deliver humanitarian healthcare (Du Mortier and Coninx, 2007b; Blackwell and Bosse, 2007; Gibson et al., 2011; Fox-Rushby and Foord, 1996). The WHO has referred to mobile clinics as an exemplification of the tension between equity of healthcare access and the efficient utilization of scarce resources (Roodenbeke et al., 2011). Mobile clinics through the literature and documented deployments have been shown to be an effective method to deliver healthcare interventions and outreach activities (Shaikh, 2008). Hence, why mobile clinics are a common modality for delivering health services in humanitarian emergencies, including conflict zones (McGowan et al., 2020).

4.2 Mobile Clinic Deployments: Benefits and Challenges

In order to provide an understanding of the activities of mobile clinics in conflict zones for humanitarian healthcare, we explore practitioner’s materials and guidelines. Although practitioner’s material on mobile clinic management is readily available, it mainly focuses on medical interventions. In an effort to sets out directives relating to the use of mobile clinics, the International Committee of the Red Cross (ICRC) put forward a document in 2006 with specific guidelines for mobile clinics. In this document they go beyond specific health program considerations and discuss general management, which include logistics issues (ICRC, 2006). The document highlights the difficulties faced by practitioners due to standards imposed by local authorities and the necessity to correctly estimate needs at the locations mobile clinics will be deployed. Later on, in 2007, the Humanitarian Practice Network at the Overseas Development Institute commissioned another document to aid practitioners when deploying mobile clinics in emergency contexts (Du Mortier and Coninx, 2007a). Other guides have been developed by health ministries, health clusters, and practitioners in the international community, such as Gui (2014), Health and NUT Cluster - Iraq (2014), National Health Mission Manipur (2012). However, these offer specific guidelines addressing the communities and adhering to the respective Ministry of Health (MoH) regulations. Hence, in this section we concentrate on the ICRC’s and Overseas Development Institute’s guides.

In their guide, the ICRC states that mobile clinic interventions are: “[...] an exceptional strategy, to be used only as a last resort with the aim of providing health services to population groups which have no access to a health-care system.” (ICRC, 2006, p. 6). Du Mortier and Coninx (2007a) state that mobile clinics “are often used to provide healthcare in unstable situations, such as conflicts, where fixed services cannot function for reasons of security” (p. 1). Moreover, the ICRC states that the temporary nature of mobile clinics mixed with logistical challenges (e.g., distances to be traveled, the time required, rises in water levels, weather conditions) and security challenges (e.g., agreements, checkpoints) restrict practitioners to a very limited decision time frame.

Throughout both guides the importance of planning (e.g., mode of action, human and material resources, time frame and logistics) and selecting services that will be offered (e.g., vaccination, health promotion, preventive activities, transfer of patients, curative care), is stressed. Additionally, both guides breakdown the decision process of mobile clinic deployments into eight key questions. These questions aim to find answers to strategical, tactical, and operational decisions (Figure 6). During the strategic phase, decision makers must select areas (i.e., conflict or post-conflict zones) that will receive healthcare services. They must also determine the appropriate number of mobile clinics, healthcare practitioners, and medical equipment, as well as the available budget (ICRC, 2006; Du Mortier and Coninx, 2007a). As for the tactical decisions, practitioners must schedule the mobile clinics, and also decide on the frequency of visits, the days, and the time of day to deploy the mobile clinics to each location in accordance to the strategical decisions. Additionally, depending on the healthcare condition of the patients, more than one visit may be needed to provide the required healthcare. Finally, the operational phase consists of implementing the plan and evaluating the performance, i.e., action reports (ICRC, 2006; Du Mortier and Coninx, 2007a).

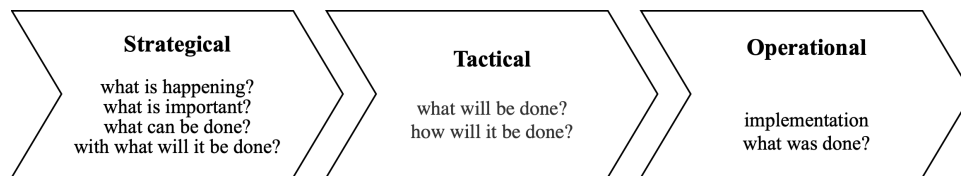


Figure 6: Questions to Answer During the Decision Process for Mobile Clinic Deployments, adapted from Du Mortier and Coninx (2007a)

Du Mortier and Coninx (2007a) also provide some insights and guidelines when deploying in conflict zones. They state that mobile clinics are a way of gaining protection for the populations as part of the organizations' activities by virtue of the Statutes of the ICRC Movement (Article 5.2, paras c and d) (ICRC at Geneva, 1986). In addition to providing healthcare, mobile clinic deployments in conflict zones can be used to document alleged abuses and make contact with armed groups involved in the conflict. It is important that healthcare workers are well-informed of both the health and the protection objectives of their work in conflict zones. Furthermore, the WHO refers to mobile clinics as an alternative to provide healthcare in their guide for medical care in insecure environments (WHO, 2021). The WHO's guide highlights the importance of coordination to ensure equity across communities, with no missed or under served communities, and easy to reach communities not over served by multiple and potentially contradictory medical visits. It also states the importance of logistics to ensure mobility during conflicts to avoid targeted attacks to the personnel and beneficiaries in conflict zones.

Authors have documented how mobile clinics can be used to overcome common access barriers such as time, geography, system complexity, and trust, and how they result in improvements in health outcomes and reductions in costs (Oriol et al., 2009; Malone, 2010; Song et al., 2013; Brown-Connolly et al., 2014; Drake et al., 2015; Taylor et al.,

2016; Malone et al., 2020). McGowan et al. (2020) points out that mobile clinics can be efficient, effective, and can be used to increase service coverage. Authors have also studied contexts in which mobile clinics play an integral part in a healthcare system, providing accessible and sustainable care with quality that matches traditional healthcare settings (Edgerley et al., 2007; Guruge et al., 2010; Iredale et al., 2011; Guruge et al., 2010). Other studies have also shown that mobile clinics can produce both cost savings and improved health outcomes (Chen et al., 2020; Hill et al., 2014; Song et al., 2013; Yu et al., 2017). Mobile clinics are also associated with cost savings generated by effective prevention (Ali, 2022). They allow for quick response and flexibility due to their ability to change locations (Wray et al., 1999), and they can be equipped to respond to several issues (Blackwell and Bosse, 2007). Campos and Olmstead-Rose (2012) have highlighted the fact that mobile clinics are extremely effective in offering urgent care, providing preventative screenings, and initiating chronic disease management. Krol et al. (2007) sustain that another advantage of mobile clinics lies in the ability to provide a diversity of services for various groups, such as people with social problems in both urban and rural areas, at all levels and for acute and chronic diseases. Patients have reported that mobile clinics as an alternative to other healthcare models help them navigate the more convoluted systems of the wider healthcare system and allow them to connect with the medical and social resources in their communities (Aung et al., 2015; Rodriguez et al., 2007). Also, mobile clinic patients have reported an increased sense of self-confidence and ability to manage their chronic conditions (Aung et al., 2015; Hill et al., 2012; de Jesus Diaz-Perez et al., 2004; Jani et al., 2012). The use of mobile clinics can improve the overall quality of medical services and access to basic medical needs (Aljasir and Alghamdi, 2010). Mobile clinics can improve health situation in locations where they are used for screening and prevention (Prasad et al., 2008). They also have been effective in preventing hospitalizations (Guo et al., 2001). Moreover, they provide underprivileged patients with access to better healthcare and medical equipment (ICRC, 2006). In rural areas, due to the quality and conditions of roads and lack of proper transportation, there is a need for mobile clinics to provide healthcare to populations that need constant medical attention, such as elderly patients, pregnant women, and children (Aljasir and Alghamdi, 2010). Hence, the main customers of these mobile clinics include people living in areas that lack proper healthcare infrastructure, such as conflict and post-conflict zones, or those who are not able to seek medical attention at a different location (Aljasir and Alghamdi, 2010). Mobile clinics can also encourage vulnerable populations to seek their needed healthcare by removing the difficulties of scheduling an appointment, long waiting lines, and a complex administrative process (Campos and Olmstead-Rose, 2012; Diao et al., 2016; de Jesus Diaz-Perez et al., 2004; Dasgupta et al., 2015; Kennedy et al., 2014; Harris et al., 2011). Furthermore, the literature supports mobile clinics as a successful and cost-effective model of healthcare delivery uniquely positioned to assess and fulfill the needs of under served populations (Yu et al., 2017).

On the downside, mobile clinics are expensive compared to other delivery strategies, logistically onerous, time-inefficient (due to medical resources remaining idle through-

out a substantial travel time), and in addition they rarely demonstrate a lasting impact (Du Mortier and Coninx, 2007a; ICRC, 2006; Roodenbeke et al., 2011). Due to sustainability issues and typically low frequency of visits, mobile clinics may not be capable to fully address chronic diseases and acute illnesses (McGowan et al., 2020). Kohli et al. (2012) observed that mobile clinics do not perform better than fixed facilities and, thus, highlight the importance of only using them as an exception in the absence of a permanent healthcare facility (ICRC, 2006). Krol et al. (2007) also point out that sometimes the population may show unwillingness to use the services provided by mobile clinics. In remote communities (e.g., conflict zones, refugee camps), mobile clinics attract large numbers of people, which in turn creates a considerable risk of more infections (McGowan et al., 2020). Other weaknesses of mobile clinics include repeated changes in macro level of medical policies, lack of sufficient feasibility evidence, presence of interfering factors (e.g., other healthcare institutions), potential lack of government’s commitment in funding and improper distribution of resources, absence of planning about periodical evaluation, insufficient equipment for disabled patients, scarcity of dedicated funding and professional personnel (Song et al., 2013; Prasad et al., 2008; Al-Attar, 10). Also, it is costly to train the medical personnel of a mobile clinic (Fox-Rushby and Foord, 1996). Lehoux et al. (2007) point out that since mobile clinics tend to be temporary there is a dearth of documentation. In addition, authors have observed that there can be clashes of authority between nurses and doctors due to the lack of documented procedures for mobile clinics (Fox-Rushby and Foord, 1996; Lehoux et al., 2007). Additionally, after deploying mobile clinics for various decades, WHO practitioners believe their weaknesses arise in the reliability, with humanitarian intervention experts expressing concerns regarding the fact that mobile clinics tend to break down and run out of gas (Ali, 2022), depending on the setting (e.g., in a conflict zone) this can be an insurmountable complication. Regardless of these drawbacks, the WHO endorses the use of mobile clinics for humanitarian crises by agencies and donors who are eager to support their implementation (WHO, 2016b).

4.3 Deployments in conflict zones

Despite decades of humanitarian healthcare delivery with mobile clinic deployments (Ali, 2022), there are limited studies on the use of mobile clinics in humanitarian responses (McGowan et al., 2020). Most studies found relating to mobile clinics take place outside conflict zones and the majority of the peer reviewed literature is on mobile clinics deployed in the United States (Yu et al., 2017). In recent years mobile clinics have become increasingly visible due to the COVID-19 pandemic as they are well suited to fill healthcare needs during an epidemic (Ali, 2022; Alcendor et al., 2022; Levy et al., 2021; Leibowitz et al., 2021). Authors have also documented the usefulness of mobile clinics to target under privileged populations (Wray et al., 1999; Blackwell and Bosse, 2007; Whelan et al., 2010; Aljasir and Alghamdi, 2010; Gibson et al., 2011; Limaye et al., 2018; Beks et al., 2020; Guillot-Wright et al., 2022; Breve et al., 2022) . Mobile clinics are suitable for

various uses and situations (Samakouri et al., 2022; Murphy et al., 2000; Phillips et al., 2017) with the necessary equipment and medical personnel (Hill et al., 2012). McGowan et al. (2020) highlight that they may function in tandem with, and in support existing provider (i.e., community health workers, hospitals, clinics) to further extend access to services. Mobile clinics have become increasingly visible in less fraught settings they are a familiar sight in conflict zones (Ali, 2022). They can be used to provide a plethora of healthcare services that are needed by population in conflict and post-conflict zones.

Despite a paucity of peer-reviewed articles documenting and studying mobile clinic deployments in conflict zones, international humanitarian organizations continue to report the use of mobile clinics to serve populations affected by conflicts. In 2020, MSF reported mobile clinics deployments in 23 countries with 13 of these deployments in countries being affected by conflicts (MSF, 2021). In 2021, the ICRC reported a total of 21 million doses of COVID-19 vaccines administered by mobile clinics in areas impacted by conflicts (ICRC, 2022).

Table 1: Healthcare Services Delivered by Mobile Clinics

Service	Number of Projects
General health services	98
Outreach	53
Primary healthcare	113
Preventive action	51
Health promotion	23
Curative care	17
Sum of Referrals	22
Mental health	37
Food security	19
Social services	41
Emergency health services	6
Staff training	169

In order to analyze the mobile clinics practices by humanitarian organizations in a conflict setting, a data extraction of projects plans submitted by humanitarian organizations for funding, which included mobile health clinics, was made using the database of the Financial Tracking Service (FTS) of the UN’s Office for the Coordination of Humanitarian Affairs (FTS, 2022). The search was conducted on submissions made between 2009 and 2021, for a total of twelve years. The inclusion criteria included the keywords: “mobile health team*” or “mobile clinic*” or “mobile hospital*”. This led to a first selection of 395 projects. Further coding was done to keep only projects that were involved in conflict zones for a final selection of 209 projects. Of these projects, only 93 projects focused only on mobile clinics as the only exclusive type of aid delivery with all other projects including another type of medical activities along with the mobile clinics. This confirms the notion put forward that mobile clinics in a health response need to be used

in conjunction with a fixed facility (ICRC, 2006). The WHO also highlights the importance of using fixed medical facilities to support mobile clinics in creating sustainable outreach services (SOS): “The logistics base of these teams, or the “hubs” of SOS, will have to be equipped for transport and equipment maintenance and for supplies storage. SOS Hubs may be established at district or regional health offices or at strategic points, such as rural hospitals where there is electricity for the cold chain, secure storage and transport maintenance facilities, and reliable telecommunications” (Department of vaccines and biologicals, 2000, p. 18). The projects’ activity descriptions were further coded to identify the characteristics of services offered by mobile clinics in the project plans. Table 1 highlights the type of healthcare services linked to mobile clinics according to the number of projects for which they are found.

5 The case of PUI in Iraq

This instrumental case study aims to derive insights pertaining to logistical difficulties and operations entailed in the deployment of mobile clinics in conflict and post-conflict zones by examining the deployment of mobile clinics by PUI in Iraq. Mobile clinics have been deployed by the MoH and their partners, including PUI, in response to the Iraq War since 2014 (Iraq Health Cluster, 2014). To understand the motivation and reasoning behind PUI’s deployment in Iraq, we must explore the nature of the Iraq War as well as the foundations and decision making process of PUI. Therefore, in this section we start with an overview of PUI’s organization and presence in humanitarian relief. This is followed by an briefing of the origins and events of the Iraq War and it’s effect on the health. Then, we fully describe the mobile clinic deployment in Iraq based on the exchange between the authors and PUI’s staff. By describing PUI’s deployment during and after the Iraq War we provide a complete description of the operations entailed in mobile clinic deployments in conflict zones. Hence, this section seeks to complement the answer to RQ2.

5.1 Mobile Clinic Deployment in Iraq by PUI

For more than 20 years, PUI has carried out humanitarian work in 38 countries, in areas affected by conflicts, natural disasters, and forgotten crises (PUI, 2022). As of 2022, 15 of their missions included the deployment of mobile clinics that directly benefited populations affected by conflicts (PUI, 2022) including missions in Ukraine, Mali, Libia, Niger, Yemen, and Iraq. In 2014, the deteriorating humanitarian situation resulting from an ongoing conflict, internal displacement of population, and an influx of Syrian refugees, forced the health cluster in Iraq to address the lack of healthcare access in hard to reach areas and the added burden on existing healthcare facilities with mobile clinics

(Iraq Health Cluster, 2014). PUI was one of various non-governmental organizations that participated as a partner of the health cluster and took on the delivery of primary healthcare and mental health services in various regions of Iraq (PUI, 2016a).

Iraq had suffered 40 years of continual conflict that has had severe consequences on the population’s health and the Iraqi health systems and infrastructure (Lafta and Al-Nuaimi, 2019). On top of the immediate casualties, the widespread violence in Iraq created long-term circumstances that affected the population’s health through disruption of access to healthcare, as well as the availability of medicines, transportation, safe water supply, sewage disposal, electricity and other infrastructure components (Lafta and Al-Nuaimi, 2019). The invasion by a US led coalition in March 2003 overthrew the government of Saddam Hussein and temporarily replaced it with a Coalition Provisional Authority that was slow to address healthcare needs and struggled to provide security (Medact, 2008). The Iraq War officially ended in 2011 (Britannica, 2022), however it was not until 2018 that the humanitarian logistics cluster commenced the closure of their operation with the Logistics Cluster deactivation scheduled between 2019-2020 (Logistics Cluster Iraq, 2019). Iraqi civilians have borne the consequences of war and violence over the last decades suffering adverse effects on their health, wellbeing, basic needs, and years of life lost (Lafta and Al-Nuaimi, 2019).

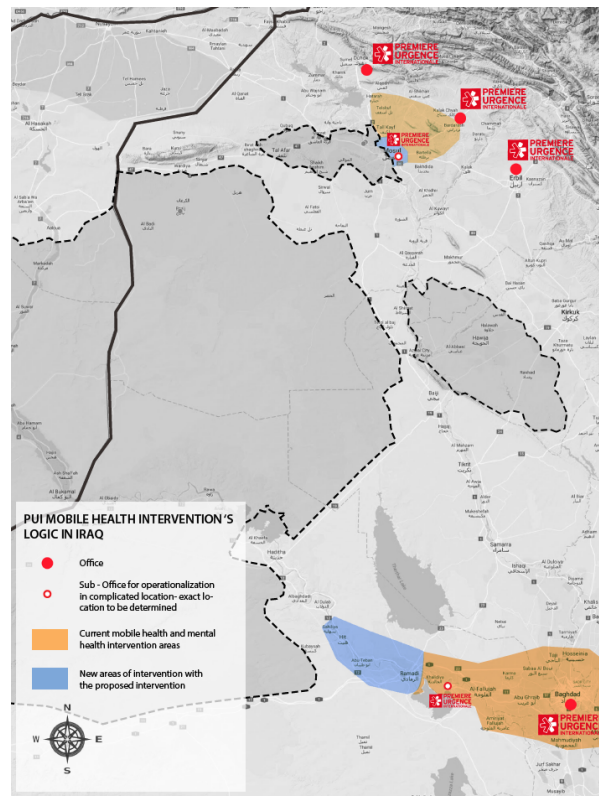


Figure 7: PUI Deployments in Iraq (PUI, 2017c)

From 2014 to 2018 PUI deployed mobile clinics in the regions of Mosul, Erbil, Duhok, Baghdad, Al-Fallujah, and their population settlements as depicted in Figure 7. These mobile clinic deployments were intended to serve citizens that otherwise would not have easy access to healthcare in their regions and served as a temporary solution for those with chronic diseases and in need of medical services (Iraq Health Cluster, 2014). A representative from each NGO deploying mobile clinics in Iraq would attend the monthly health cluster meeting, along with the MoH's and WHO's representatives, where regions identified by the MoH would be assigned to NGO's partners according to the services provided (PUI, 2017a). In the case of PUI, they offered the following services with every mobile clinic deployments in Iraq: patient triage (i.e., vital signs assessments), general primary healthcare consultations for uncomplicated acute conditions and acute conditions in children, oral rehydration solutions, screening for chronic non communicable diseases for diabetes and hypertension, treatment of chronic diseases, stabilization and immediate referral for secondary care for emergency cases, nutrition for children 6 to 59 months and pregnant lactating women, health education, assessment of immunization status of all children and pregnant women, and reproductive health (PUI, 2017g). Also, some mobile clinics were equipped to provide mental health services, testing, and dispense medications as prescribed by the medical staff (PUI, 2017g).

During the deployments PUI had between four and five mobile clinics (PUI, 2016b). In addition, PUI oversaw the operation of two primary healthcare facilities and several offices and sub offices from where clinics could depart from (PUI, 2016b). These clinics consisted of a pickup truck and a subcontracted driver that served as a security personnel, medical personnel, and the required medical and set up equipment (PUI, 2017a,b). The mobile clinics would often be installed in abandoned residencies, communal spaces, or the residence of the contact person (PUI, 2017a). Figure 8 presents two examples of the mobile clinics set up at the locations. It can be observed that the clinics were set up with the use of folding tables, chairs, tents, and dividers. This means that deployments by PUI in Iraq required set up and clean up times for every location visited.



Figure 8: PUI Mobile Clinic Set Up in Iraq, source (PUI, 2022, 2017c)

The human resources required to deploy PUI's mobile clinics in Iraq varied based on the type of clinic (i.e., primary health or primary health and mental health). To oversee the deployment each office or departure point had a deputy project manager and a health officer. The deputy project manager was responsible for ensuring the effective, safe and timely implementation of mobile primary healthcare activities (PUI, 2017d). The health officer was in charge of ensuring standards were respected in all deployments as well as coordinating with health, civil, and security actors on the field (PUI, 2017f). All mobile clinics had a nurse, a doctor, a pharmacist, and a health assistant (PUI, 2017a). When the mobile clinic provided mental health services it would have in addition a team leader, psychosocial worker, and a psychologist (PUI, 2017b).

For their deployments PUI designed a weekly schedule for the mobile clinics, in which based on the number of available clinics and the vulnerability they would select locations that can be visited and in an equitable way distribute the load between the available clinics (PUI, 2017a). They also had to comply with the standards established by the MoH such as the maximum number of patients each clinic could serve (Iraq Health Cluster, 2014). PUI deployed mobile clinics in conflict zones and post-conflict zones. A location is considered a conflict zone if it is located eight kilometers from the front lines, has been affected by a security incident within the previous three days, or presents difficult access due to insecurity or checkpoint restrictions (PUI, 2017j), whereas post-conflict zones do not adhere to these criteria. Despite clinic healthcare service operations similarities in both contexts there were additional security protocols for the personnel when it is deployed to a conflict zone.

5.2 Specificities of Deployments in Conflict Zones

To ensure the safety of personnel and people seeking healthcare PUI had in place a standard operating procedure based on guidelines established by the MoH (Iraq Health Cluster, 2014). When clinics were to be deployed to a conflict zone the project manager and health officer must ensure that appropriate documentation is obtained to pass security checkpoints, constant monitoring is maintained on the security situation, as well as guarantee that the driver assigned had an appropriate knowledge of the roads and locations (PUI, 2017j). Either the project manager or the health officer must make contact with their contact at the location 24 hours prior to the visit, to confirm the zone is still secure for health delivery (PUI, 2017j). The day of the scheduled visit teams deployed to conflict zones had to report earlier to the departure point and depart at earlier times than teams deployed to post-conflict zones (PUI, 2017c). Through their deployment they had to maintain constant communication, i.e., security checks at departure, checkpoint arrival, location arrival, every 60 minutes while providing services, when leaving the location, at return to checkpoint, and return to base (PUI, 2017j). When arriving to a security checkpoint, it is possible that access is denied and the team has to return to the departure point (PUI, 2017c,j) but when possible the team could be reassigned to a different loca-

tion for that day. This change of plan ran the risk of low demand due to an unplanned visit (PUI, 2017a). The health officer and the project manager highlighted the fact that the main challenges faced during the deployment to a conflict zone was related to the change in security status without warning, that the information regarding the needs at the location can be misleading (i.e., needs might have been underestimated), and that the locations for set up might be contaminated (e.g., mines bombs) (PUI, 2017b). Although, post-conflict zones do not present the same security threats during deployments they still presented an uncertainty in the demand and access to the location from where services would be provided. Hence, deploying mobile clinics in conflict zones requires more time invested in security verification and it also comes with the added uncertainty of not knowing that the location can be serviced.

The resources assigned to a mobile clinic must tend to administrative tasks, which takes time away from healthcare services. Teams deployed to post-conflict zones still had to report at the departure point before and after their deployment (PUI, 2017a). Once they arrived at the location where services would be provided they must set up prior to providing services and clean up after at every location (PUI, 2017e,c). The needs at post-conflict location could also be misleading as internally displaced people may be returning to their previous homes (PUI, 2017b). Also, if an abandoned residence was selected as the point of service and the family members returned to the location the clinic would be relocated to another public location or an occupied residence (PUI, 2017b). Additionally, pharmacists had to do an inventory before and after a deployment (PUI, 2017h). The medical doctor and psychologist were responsible to provide an after action report when returning to the departure point (PUI, 2017e,i). These reports were used to report incidents (i.e., injury and mortality) to the MoH and health cluster (PUI, 2016b).

Based on the insights gained from PUI's operations in Iraq we can conclude that deployments of mobile clinics in conflict and post-conflict zones require additional time from resources. Also, both conflict and post-conflict zones add an extra uncertainty in demand, availability of set up location, fund availability, and access. Additionally, the availability of funds is out of the hands of practitioners as this is supplied by donors and sponsorship (PUI, 2016b, 2017a). This presents a hurdle when deploying mobile clinics in any context, as practitioners need to correctly manage the funds available to maximize the impact of their deployment. These complications demonstrate that when planning a mobile clinic deployment in a zone affected by conflict practitioners must thoroughly design and evaluate their plan to ensure it is robust (i.e., alternate set up location and a replacement location).

6 Research Gaps

The WHO and its partners often resort to mobile clinics to provide healthcare services to isolated and vulnerable groups during crisis responses, including conflicts (WHO, 2016a). Despite the numerous benefits and endorsements of mobile clinics deployments for humanitarian healthcare, their usage involves several logistics challenges (e.g., limited resources and security issues) and they are costly to operate (ICRC, 2006). Not to mention the additional complications added when providing humanitarian healthcare in conflict zones (Department of vaccines and biologicals, 2000) that enhance the “logistical nightmare” of mobile clinic deployments (Du Mortier and Coninx, 2007a). This motivates the need for the development of decision support tools to facilitate the deployment and management of mobile clinics by humanitarian field practitioners in conflict and post-conflict zones. In this section we identify and suggest empirical and support tools studies that can prove useful for mobile clinic deployments in conflict and post-conflict zones. It aims to answer RQ3 and provide related practical insights.

Empirical Studies and practical guidelines

Due to the scarce academic literature that studies mobile clinic deployments in conflict zones, authors should further document them. Empirical studies should aim to shine light on the best practices and suggest directions for standardization. Also, such studies should analyze further the differences between conflict and post-conflict zones to justify practices and services offered. Moreover, a study that documents the demands for specific services provided by mobile clinics can aid practitioners at the time of selecting the services offered and resources allocated. As pointed out by Du Mortier and Coninx (2007a) there are studies documenting health operations of mobile clinics, but the logistic element is lacking in the literature, specially in conflict and post-conflict zones. Studies should focus on frameworks that are easy to use and implement by practitioners and that would serve both to plan and justify deployments and resources needed. Finally, once there are more studies and insights derived from the academic literature researchers can strive to consolidate knowledge and provide a complete framework for mobile clinic deployments in conflict and post-conflict zones.

Strategic Decision Support Tools

The strategic decisions practitioners are forced to make, after the deployment of mobile clinics are identified as a viable and the only solution (Du Mortier and Coninx, 2007a; ICRC, 2006), is the appropriate number of mobile clinics, healthcare practitioners, and medical equipment, as well as the available budget (Du Mortier and Coninx, 2007a).

As pointed out by Leseure et al. (2010) “unfortunately, in a world of scarce resources, although humanitarian action has no price, it obviously has a cost, and an improved management of this cost has an influence on the ability to send relief [...]” (p .337). Therefore, tools that concentrate on maximizing the outreach or potential for humanitarian health-care relief based on limited budgets will prove useful for practitioners, specially in conflict zones where there is a limited availability of resources (Garfinkel and Skaperdas, 2007). Such tools can be developed in the form of a mathematical model, a simulator, or even a cost-effectiveness analysis framework to support budget allocation. Not only will these tools be useful in the strategic decision process but also when elaborating the proposals or annual reports to sponsors as the organization will be able to justify the needs for specific quantities based on a scientific method and concrete evidence.

Moreover, the allocation of the available budget results in constraints for the number of mobile clinics, healthcare practitioners, and medical equipment. Although, the mobile clinics (i.e., vehicles) and medical equipment can be in kind donations and healthcare practitioners can be volunteers there will still be a cost associated to the maintenance and per diem that will constrain the available resources. Practitioners can benefit from a tool to evaluate different scenarios of varying resources in the deployment. Said tools could take the form of simulators with which decision makers can make educated decisions and correctly plan the number of resources that can be maintained throughout the deployment based on the organizations goals and status of the conflict. Additionally, by measuring the effectiveness of healthcare resources, such as mobile clinics, healthcare practitioners, and medical equipment, it will result in a transparent and consistent decision making (Eichler et al., 2004).

The remaining decision at the strategical level would be the selection of locations that will receive healthcare services by the mobile clinics. Based on the capacity of the deployment dictated by the resource allocation practitioners may be forced to select a subset of the locations that are in need of healthcare. At this phase, optimization models can aid practitioners to identify the set of locations that can offer access to within a one hour walk for at least 80% of the affected population in order to comply with humanitarian standards (Sphere Association, 2018). Coverage maximization problems, facility location problems, among others can be adapted to support the location decision of mobile clinic deployments while considering the healthcare needs and the vulnerability of the population. A detailed framework or assessment tool for location selection based on the community needs and available resources is another alternative.

Tactical Decision Support Tools

At the tactical phase, practitioners are bounded by the strategical decisions made a priori. Decision makers must schedule the mobile clinics, and also decide on the frequency of visits, the days, and the time of day to deploy the mobile clinics to each location

(Du Mortier and Coninx, 2007a; ICRC, 2006). Practitioners must take into account the frequency with which the same communities can be visited as this will determine whether the mobile clinic should offer care or referral for acute illnesses (McGowan et al., 2020). McGowan et al. (2020) underscores that infrequent or unpredictable visits can discourage communities from seeking early care, and by consequence worsen acute illness outcomes. Efforts have already been directed towards decision support tools to determine the frequency of visits offered by mobile clinic deployments (De Vries et al., 2021b,a). This tool however does not consider the additional complexity conflict and post-conflict zones pose. Further consideration must be given to the uncertainty during conflicts and the dangers of medical personnel being targeted (Gordon et al., 2010; Guha-Sapir and van Panhuis, 2002; Gates et al., 2010; Zwi and Ugalde, 1989; Levy, 2002). Scheduling and routing decision support tools for mobile clinics have also been addressed in the literature (Hodgson et al., 1998; Doerner et al., 2007; Santa González et al., 2020). But the uncertainty or security risks faced in a conflict zone when transporting mobile clinics and medical personnel (Rubenstein and Bittle, 2010) and the fact that civilians seeking healthcare are targeted (Hovil and Werker, 2005) have not been addressed. Even though the WHO has provided a guide for medical interventions with mobile clinics in conflict zones (WHO, 2021), there is no decision support tool or framework that considers the risks of transporting medical equipment and personnel in insecure areas.

Operational Decision Support Tools

At the operational level practitioners must implement their plans and afterwards they must also evaluate the outcome, producing after action reports (McGowan et al., 2020; ICRC, 2006). There is a dearth of standardized guides to explicitly guide the implementation of mobile clinic deployments. Hence, practitioners can benefit from more literature that seeks to detail and standardized procedures (Leibowitz et al., 2021). More empirical research, such as case studies, longitudinal studies, or delphi analyses, can provide more understanding and seek to standardize practices or highlight the directions towards standardization. Moreover, McGowan et al. (2020) highlights the need to develop standard indicators for evaluating the use of mobile clinics in conflict zones and complex emergencies. Therefore, researchers can contribute by developing a framework for practitioners to standardize the performance indicators and metrics during mobile clinic deployments in conflict and post-conflict zones.

Although the decision support tools suggested in this study have been broken down by decision level (i.e., strategic, tactical, and operational), authors can still strive to develop decision support tools that address all three levels. Ideally a framework that encompasses all levels would provide practitioners all the required support. However, developing a one size fits all for conflict and post-conflict that consolidates all three decision levels can be an arduous task and might require more literature.

7 Conclusions

There is a dearth of literature documenting mobile clinic deployments (McGowan et al., 2020) and practitioners material to support mobile clinic deployments (Du Mortier and Coninx, 2007a; ICRC, 2006). Despite various humanitarian organizations created to ease the suffering of the victims of conflict (Rysaback-Smith, 2015), researchers have ignored the contexts of conflict zones (Altay et al., 2021). This study illustrates the operations entailed by mobile clinic deployments in conflict zones and post-conflict zones. It also highlights logistical difficulties arising both during and after conflicts for practitioners deploying mobile clinics. Mobile clinic deployments in conflict zones are faced with the same logistical challenges and decisions as those deployed in areas where conflict and violence are not present (Du Mortier and Coninx, 2007a). However, deployments in conflict zones are faced with additional security risks, economical constraints, and uncertainty (Gordon et al., 2010; Guha-Sapir and van Panhuis, 2002; Gates et al., 2010; Zwi and Ugalde, 1989; Levy, 2002; Garfinkel and Skaperdas, 2007).

The literature on mobile clinic deployments in conflict zones is lacking documentation and development of decision support tools to aid practitioners. This paper can serve as a road map for researchers that want to contribute to the literature on mobile clinic deployment in conflict zones. Studies should further document mobile clinic deployments in conflict and post-conflict zones, as well as develop decision support tools for practitioners. At the strategical, tactical, and operational decision levels there is a need for tools to identify feasible solutions and a framework to evaluate the performance of different alternatives. Further developing tools to evaluate performances will not only contribute to a more efficient delivery of healthcare but it will also aid practitioners in justifying strategical decisions. Once there are more studies and insights derived from the academic literature researchers can strive to consolidate different tools and provide a complete framework for mobile clinic deployments in conflict and post-conflict zones.

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