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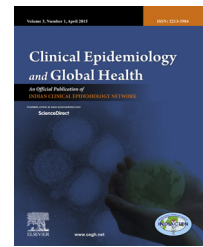
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## Original Article

# The assessment of efficiency and coordination within the Libyan health care system during the armed conflict-2011

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## ABSTRACT

**Background:** In post-conflict situations, there is a clear deterioration and damage of health care system. Libya, the second largest country in North Africa, had experienced a major armed conflict in 2011 that resulted in heavy damage of health system. The objectives of this study were to: assess the damage that affected Libyan health care system during the armed conflict, identify the problems, outline priorities and barriers, and to plan for emergency, sustainable, and long run intervention.

**Methods:** Integrated quantitative and qualitative methodologies system including characterization, observation, and free-response questionnaires were used to identify damage, needs, and problems of the Libyan health care system in the immediate post-conflict period. A total of 216 different health care facilities scattered over four regions in West part of Libya (battlefield of armed conflict) were studied. Different parameters were used to assess the extent of the damage and the quality of health services of studied facilities during the conflict period. The facilities studied include Emergency Hospitals, Primary Health Care Centers, Regional Hospitals, Tertiary Health Care Hospitals, and Private hospitals.

**Results:** A total of 216 health care facilities were studied, and the structural damage was evident among 62 (28.7%) of them. Of those damaged, 11 (5.1%) were completely destroyed and 51 (23.6%) were partially damaged. Primary health care centers accounted for 49 (22.7%) of the damaged facilities followed by Emergency & Accident Hospitals. The extent of the damage varied from one region to another and even among provinces within the same region. The most influential factor significantly hit were short of medical supplies (medical disposables and essential pharmaceuticals), followed by lack of medical staff security, lack of communication (and health care management ( $P < 0.001$ )). Unusual problems emerged including neglected orphans, dead bodies, and emergence of unusual infection, particularly among displaced provinces.

**Conclusions:** The Libyan national health system is a victim of armed conflict, with destruction of clinic and hospital infrastructure. This study highlights the major damage that Libyan

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health care system has experienced and identified the important needs for a successful development and future planning. National and international efforts should be combined to restructure the Libyan health system and long run sustainable strategies have to be implemented.

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## 1. Introduction

Armed conflicts within states have been known as a major cause of ill health and mortality for most of human history. They kill people, destroy property, cut communications and water & electric supplies, disrupt economic activity, and divert resources from health care.<sup>1</sup> Such complications make the health care system at high risk, hampered by disorientation, lack of security to health care workers, and loss of consolation.<sup>2,3</sup> Furthermore, the consequence of wars could last for a longer period after the end of conflict and are likely to affect the caring system and halt the economy, with long-lasting economic consequences.<sup>4</sup> Therefore, assessment of health care system in post-conflict period is important, giving the already limited efficiency of this system within the affected countries.

Many studies have focused on the refugees in western countries rather than the people who stay in the area of conflict. In post-conflict setting, studies regarding health care services within the affected countries are scanty.<sup>5</sup> They concentrated mainly on direct effects of combat, particularly battle death and injury. Immediate catastrophic situation combined with limited medical and pharmaceutical supplies is rarely studied.<sup>6</sup> High rate of mortality, injuries, and population displacement are other burdens that the health care system in conflict areas has not dealt with,<sup>7</sup> in addition to emergence of new clinical and unusual cases that doctors are not familiar with under normal conditions. Armed conflicts have long run complications on health care services with the conflict areas. Davis and Kuritsky reported that severe military conflicts in sub-Saharan Africa cut life expectancy by more than 2 years and raised infant mortality by 12 per thousand.<sup>8</sup> Hence, studies on disorientation of health care system within the effected countries are needed.

Recent Arab uprising, which resulted in armed conflicts, in particular Libya and Syria, provides a clear example of the all-encompassing nature of conflict on national health and the effects on regional development.<sup>9</sup> The middle east conflicts are mirrored by high increase in the crude death, high injury rates, and disabled people, complicated with a massive population displacement to high-density camps in resource-poor settings. Almost all health care personnel left or worked in unsafe conditions, and hospitals are damaged or have no capacity. This reflects the emerging challenges to humanitarian assistance; therefore, efforts should be combined to frame these consequences and outline proper interventional strategies to improve health in current conflict settings.

Libya is the second largest country in North Africa with the longest coast in the Mediterranean basin and has been considered to be the “gateway to Africa”. The country has been justifiably feted as one of the world’s great success stories

in public health. Its ability to deliver low cost health care with good outcomes is held as a model for other developing countries. The most cursory examination of the evidence from the UN’s Human Development Index (HDI) strongly supports this.<sup>10,11</sup> On life expectancy alone, Libya is ranked 53rd at 74.5 (compared to 59.8 in 1980). This is above Russia (65th) and Brazil (73rd) and well above their neighbors Algeria (84th) and Egypt (101st).<sup>12</sup> Under-five infant mortality rates also illustrate the robustness of the system with a rate of 17 per 1000. In comparison, the under-five infant mortality rate for Egypt is 23, for the most prosperous African state Nigeria, it is 186, and for the conflict-ridden state of DR Congo, it is 199.<sup>13</sup> The public gains by Libya are also particularly noteworthy when one considers that the Arab world, despite its resources, has underachieved in public health terms.<sup>14–16</sup>

But all this is changing, and in 2011, Libya has experienced a major armed conflict that resulted in great human loss and economic cost as well as degrading public health care system.<sup>17–19</sup> This enforced the Libyan health system to deal with great challenges under unusual circumstances. The objectives of this study are to highlight the damages that affected Libyan health care system during the armed conflict. Furthermore, the aim is also to identify the needs and problems, outline priorities and barriers, and plan for emergency, sustainable, and long run intervention.

## 2. Methods

### 2.1. Study field

Libya is a large North African country with a total population 6.5 million, with more than half of them living in the west and middle part of the country. The study used Libyan region breakdown; only regions directly involved and considered to be as a battlefield of the conflict were studied.<sup>20</sup> The study was carried over a one-year period of the armed conflict from February 2011 to February 2012. We divided the West and Middle Part of Libya (i.e. study field) into four regions according to Ministry of Housing and planning system, as shown in [Table 1](#). These include: A – Middle coast region; B – Westward costal region; C – Middle mountain region; and D – West mountain region. These regions were the main battlefield of the armed conflict that escalated in February 2011.

### 2.2. Data collection

The study was designed to assess the exact status of the Libyan health care system immediately after the armed conflict. Qualitative and quantitative assessments were used to collect the data from 216 different health care settings distributed all

**Table 1 – Distribution of health care facilities within the different regions studied – West Libya.**

Region	Health care facility					Total (%)
	PHCCs	RH	TCHs	PH&C	A&EH	
A – Middle coast region	25	12	03	17	04	61 (28.2)
B – Westward coastal region	29	14	05	20	05	73 (33.8)
C – Middle mountain region	22	07	03	08	03	43 (19.9)
D – West mountain region	21	09	00	07	02	39 (18.1)
Total	97	42	11	52	14	216 (100)

PHCCs: Public Health care Centers; RH: Regional Hospitals, TCHs: Tertiary Care Hospitals; PH&C: Private Hospitals and Clinics; A&EH: Accident and Emergency Hospitals.

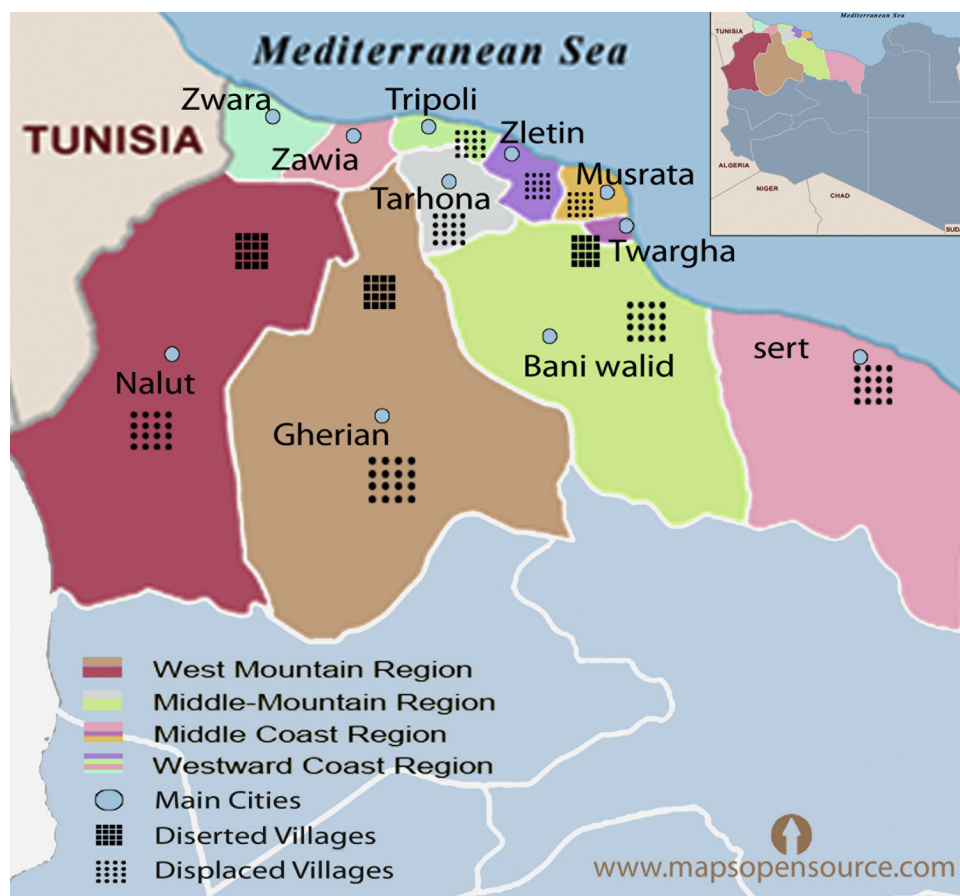
over the four different regions involved in the study as shown in Fig. 1. Key informant interviews were conducted with doctors, nurses, managers, war-injured/admitted patients, and army combat leaders linked directly to these health care facilities. Subsequently, a document review was carried out, based on documents regarding the medical and pharmaceutical supplies and incidence of unusual infectious diseases. The data collection intended to document how the Libyan health care system evolved during the armed conflict and after and further to what lessons can be learned and be used to guide future interventions. Data entry and descriptive statistics were calculated using Microsoft Excel and SPSS version 12.0 as previously described.<sup>20</sup>

### 2.3. Categorization and definitions

Basically, the Libyan health care system is categorized into five different sectors as stated by Ministry of health defined as follows:

**Public Health Care Centers (PHCCs):** Center that offers basic health care requirements such as check-up and vaccination. Primary referring points to regional hospitals. Services within PHCCs are available free to all patients.

**Regional Hospitals (RH):** Referring hospitals within the region where patients referred to and/or admitted for hospitalization either for specific treatment or operations. Services within these hospitals are available free to all patients.



**Fig. 1 – Map of Libya illustrating the different regions and provinces where health care facilities studied are located.**

**Tertiary Care Hospitals (TCHs):** National Hospitals/facilities where patients referred from regional hospitals for complicated cases, as special care or operation may be needed. Services within these hospitals are available free to all patients.

**Private Hospitals and Clinics (PH&C):** Hospitals run by the private sector. Services within these hospitals are not free. Patient's charges are paid by the patients or covered by health insurance.

**Accident and Emergency Hospitals (A&EH):** Hospital specialized in trauma accidents and burning. Services within these hospitals are available free to all patients.

#### 2.4. Assessment of health care system

The assessment was performed using a multimodal approach to determine the catastrophic damage, needs, problems, and obstacles related to the Libya health care system (LHCS) in immediate post-conflict of 2011. The approaches were determined by: 1 – field visit combined with a surveillance program to all health care facilities included in the study; 2 – assessing the damage related directly to the armed conflict and collecting evidences and information from key officials in each region; 3 – characterization of LHCS through the collection of demographic information and observational data; 4 – free-response questionnaires filled by directors and senior physician by taking their

opinions regarding the needs, obstacles, and potential barriers. Details of the methods, approaches, and principles used to estimate, degree of consistency, coordination, and the extent of the damage to health care facilities involved in the study have been described.<sup>20-23</sup>

#### 2.5. Ethical approval

The study received advance ethical approval from the Faculty of Medicine, Tripoli, Libya and from the Libyan National Ethical Committee/Approval No. LC/33625S. A written consent was filled by each person involved and credited and approved by senior epidemiologist responsible as previously stated.<sup>20</sup>

### 3. Results

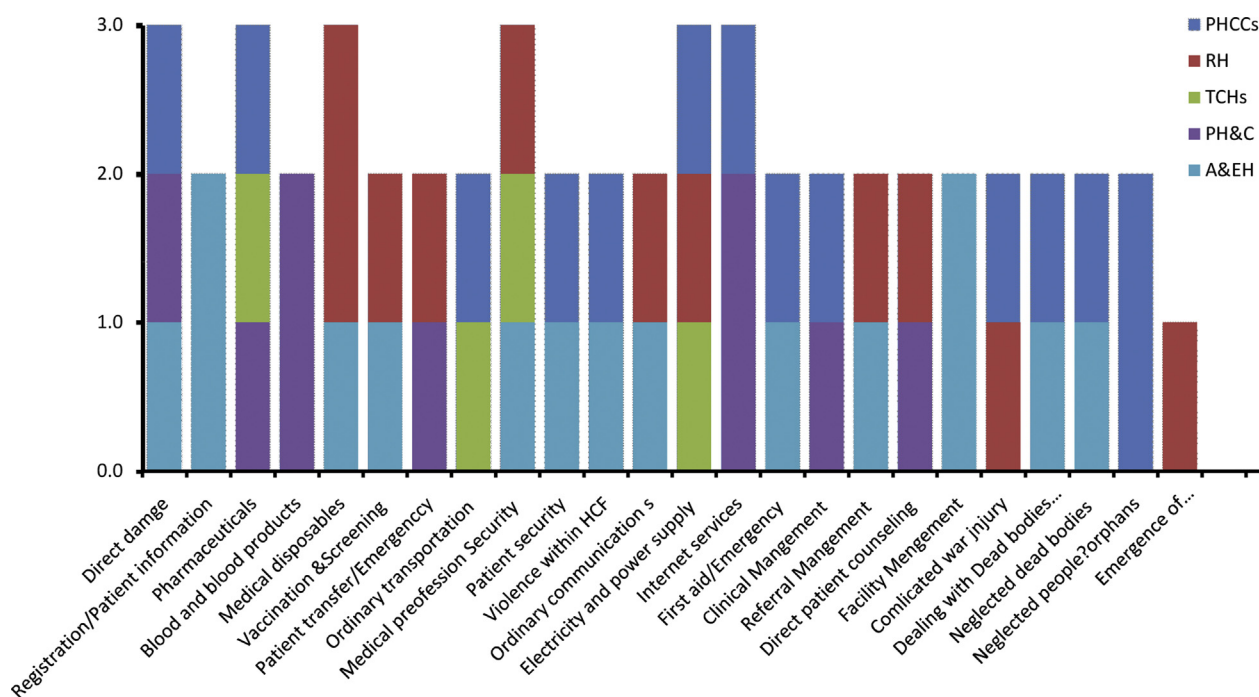
The geographic areas covered by this study uniformly fall within western part of Libya, which was the main ground field of fighting groups involved in the Libyan conflict of 2011 as shown in Fig. 1. Two hundred and sixty-one different health care facilities both in rural and urban public health were covered by this study. The structural damage was evident in 62 (28.7%) of the facilities studied. Of those damaged, 11 (5.1%) were completely destroyed as they were hit directly with army

**Table 2 – Level and strength of damage within the Libyan health care facilities due to the armed conflict-2011.**

Nature of damage/deficiency	Level of damage on				
	PHCCs	RH	TCHs	PH&C	A&EH
Direct damage	■	■	●	■	■
Registration/patient information	■	■	●	■	■
Medical supply					
Pharmaceuticals	■	■	■	■	●
Blood and blood products	■	■	■	■	●
Medical disposables	■	■	■	■	■
Vaccination and screening	■	■	■	■	■
Transportation					
Patient transfer/Emergency	■	■	■	■	●
Ordinary transportation	■	■	■	●	●
Security					
Medical profession security	■	■	■	●	■
Patient security	■	●	●	●	■
Violence within HCF	■	●	●	●	●
Communications					
Ordinary communications	■	■	■	■	■
Electricity and power supply	■	■	■	●	●
Internet services	■	■	■	■	●
Health care management					
First aid/Emergency	■	■	●	■	■
Clinical management	■	■	●	■	●
Referral management	■	■	●	●	■
Direct patient counseling	■	■	●	■	●
Facility management	■	■	■	■	■
Specific difficulties					
Complicated war injury	■	■	●	●	●
Dealing with dead bodies (cadavers)	■	■	●	●	■
Neglected dead bodies	■	■	●	●	■
Neglected people/orphans	■	●	●	●	●
Emergence of infections/unusual infection	■	■	●	●	●

■ – High; ■ – Intermediate; ■ – Low; ● – Not reported/or/services not available.





**Fig. 2 – The extent of the damage among Libyan health care system. 0.0 denotes no damage reported; 1.0: low damage; 2: intermediate damage; 3.0: high damage.**

artilleries and 51 (23.6%) were partially damaged. Primary health care centers accounted for 49% of the damaged facilities followed by E&AH (7), PHC (4), and RH (2). The extent of the damage varied from one region to another and even among provinces within the same region. It was higher in Middle coast region, followed by West mountain, and middle mountain regions, though it was less in the Westward coastal. A total damage was reported in province of Tawerga in Middle coast region and in Gawalish and Shegag in the West mountain region (Fig. 1).

Table 2 shows the extent of the collateral damage that the Libyan health care facilities experienced during the conflict period. Nine parameters were used to analyze the level of damage among the facilities studied including direct hit, patient information, medical supply, transportation, security, communication, level of management, unusual difficulties, and others. The level of damage and the parameters varied greatly from one sector to another, as illustrated in Fig. 2. They are universally high among the primary health care centers followed by Regional Hospitals and Accident and Emergency services ( $P < 0.001$ ), though they were low in Tertiary and Private hospitals. The most influential factor significantly hit were shortage of medical supplies (medical disposables and essential pharmaceuticals), followed by lack of medical staff security, lack of communication (internet services), and poor health care management ( $P < 0.001$ ). Transportation is also disoriented for both normal and emergency services. Facility mismanagement was noticed at most health care facilities studied, followed by lack of patient counseling and referral process to other centers. First aid and clinical management were influenced in primary health care and less affected at other centers. Doctors and health staff were facing unusual

clinical cases of gun shots, wound injury, and dead bodies. Spread of unusual microbial infection was reported within neglected patients and orphans, particularly at the primary health care and emergency services among deserted and displaced provinces.

#### 4. Discussion

Armed conflicts have serious devastating effects for the countries that experience them; these consequences can last long after the conflict has ended. Among these effects is the de-configuration of the health care system and how it was affected by war.<sup>20</sup> Iraq is probably the best described recent case. The Iraq living conditions survey documents the extent to which health infrastructure was damaged by war, and how clinical and community practices were disoriented.<sup>21–23</sup> By the end of the Libyan conflict in 2011, the situation of the health system became challenging. Data and documentation are rarely available,<sup>24</sup> as those involved were concerned with the urgent needs of the early recovery and little time was available for reports and data analysis and even less for academic research. The present study is nonetheless the only one that seeks to look at the impact of the war as a whole on the Libyan health care system and highlights the precarious situation that the system is facing after the armed conflict.

According to the UN development program, more than 80% of Libyan population are urbanized with an HDI of  $0.80 \pm 0.02$ .<sup>12,25</sup> This captures how conducive conditions are for residents to enjoy long, healthy, and creative lives. Ranking the country on the top of African and Arab nations mimics that of former Eastern European countries and Russia.<sup>13,26</sup> This has

been halted as a consequence of the Libyan armed conflict. In this study, over 28.7% of health care facilities have been damaged and major shortage in essential pharmaceuticals, medical disposable, and blood screening was reported. Unusual problems are emerging, particularly among the injured patients and displaced population. A recent study, carried out by Daw et al., showed that towards the end of 2011, after the end of the major military operations, over 21,000 people were killed, 19,000 injured, and 14,000 missing.<sup>20,27</sup> Moreover, the war and its repercussions caused internal and external population displacement. Hence, Libyan health care system has to be reupholstered and emergency intervention policies have to be implemented to overcome such consequences.

Transportation, communication, and patient information systems within the Libyan health care system have been badly hampered, particularly among primary and emergency services. This combined with direct damage to the buildings and the infrastructures. Such damages could influence the ability to accurately quantify the impacts on the population affected by the armed conflict leading to great uncertainty in the

magnitude of mortality and disability. The public health care facilities were more affected comparable with the private sector both in the extent of damage and slow recovery, though it is not statistically significant ( $P > 0.01$ ). Similar observation was reported within the Bosnian conflict which leads to misrepresented information.<sup>28,29</sup> Hence, further assessments are needed to highlight the indirect and long run effects of the armed conflicts.

Libya is one of the rare countries in Africa that implants all the needed vaccination. Libyan children often have never had or frequently miss childhood immunizations, a gap that threatens control of vaccine-preventable illnesses in Libya, particularly polio and tuberculosis.<sup>30</sup> The Libyan armed conflicts add a disproportionate burden of infectious disease morbidity and mortality. The sudden surge in cases of tuberculosis, diarrheal diseases, and parasitic infections has been often reported within the health care facilities studied, particularly among the internally displaced villages. Recently, 23 different patients have been reported to be infected with viral hemorrhagic virus in North West of Libyan; 13 of them were killed, though no confirmed cases of polio or tuberculosis

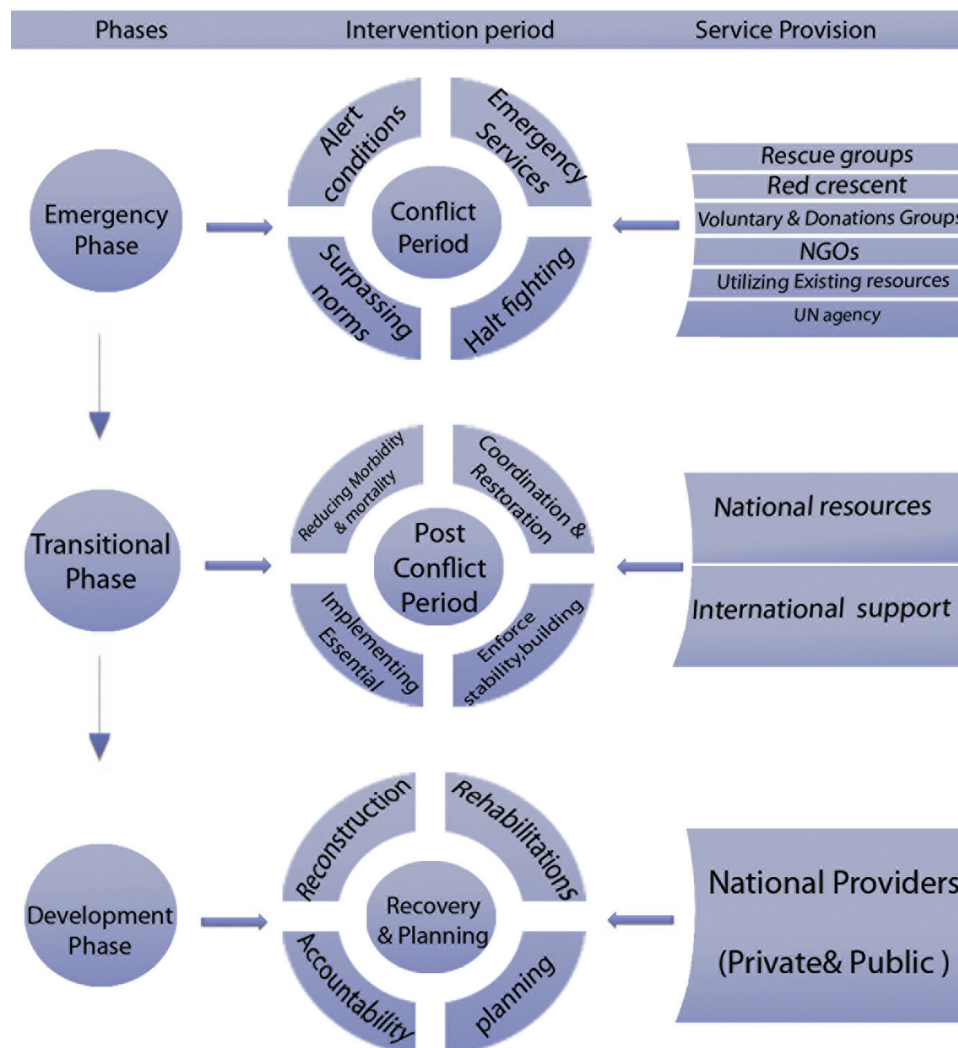


Fig. 3 – Framework setup of Libyan health care system in post-conflict period.

were reported.<sup>31</sup> Similar but more devastating results were reported in Iraq and Syria. Oral polio vaccination coverage (OPV 3) among children under five years dropped from 91% in 2010 to 68% in 2012, resulting in a poliomyelitis outbreak that emerged in Deir Ez Zur province in eastern Syria and Aleppo and spread to Iraq.<sup>32–34</sup>

Libyan conflict has caused massive population displacements, particularly in Middle coast region, some villages and displaced other are completely deserted and never allowed back both in the Middle-coast and West mountains regions. Population health was severely deteriorated either due to war-related trauma or chronic diseases, particularly among those displaced. This was complicated by poor performing practice and lack of efficiency within the health care system including poor management and lack of medical supply. Further to unusual difficulties such as dealing with dead bodies, neglected patients, and orphans, insecurity and violence against health workers have led to closure of some primary health care providers and private clinics. Some doctors left their jobs while others left on their own accord. Continuing insecurity and political instability hamper both public and private investments in health infrastructure in Libya and thus pose major challenges to health system recovery complicated by lack of readiness to change. This highlights the complications of the conflict and the way in which it should be interpreted.

Yet, despite acknowledged limitations in our study regarding the search we adopted and the difficulty of collecting original data over the post-conflict setting, where information is scarce and difficult to retrieve,<sup>35,36</sup> the study intended to quantify impact of Libyan conflict on the population and on a nation's development. The damage caused by an armed conflict is seen to not only have an immediate impact on peoples' lives but also a long-term negative impact on a country's economic development.

Our study could be used as a vehicle for illuminating the problems that the Libyan health care system is suffering from and be taken as basic foundation in formulating planning and long run intervention strategies in strengthening health infrastructure, as it is deemed to be a critical component for health system recovery in Libya. The data allow the national and international community to collaborate with researchers in designing, implementing, evaluating, and diffusing solutions to serious problems that the Libyan health care system was enforced to be in. Guidelines and specific mandates to monitor the health situation and implement appropriate measures to prevent and control health care problems are needed in addition to legislation, activities coordination, and building up proper management infrastructure based on well-trained and qualified personnel.

## 5. Conclusions

The future of Libyan health care system depends on its capacity to refrain, manage, and resolve the consequences of the conflict. This requires articulation and rebuilding which could be easily achieved, if the wealth of the country is put in good hands and guided by right strategies.<sup>37,38</sup> Fig. 3 illustrates the requirements and the different stages that the system

should surpass to achieve a healthy life for the Libyan people. Post-conflict assessment and rehabilitation can be divided into three phases: (1) Emergency phase which is associated with an initial response to the conflict period aimed for immediate health needs; (2) Transitional phase which is associated with post-conflict period aimed for coordination and restoration needs; and (3) Development phase which is composed of upgrading and long run planning. These three phases are completely integrated and cannot be segregated from each other.

## Conflicts of interest

The authors have none to declare.

## Dissemination of results

Results from this research study were shared with staff members at regional hospital emergency center through an informal presentation. The results were also published in the hospital's newsletter.

## Author's contributions

MD designed the study, wrote the draft of the paper, and approved the final version of the manuscript. AB and AD analyzed the data, carried out the literature search, and revised the manuscript. All authors have read and approved the final manuscript.

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