

# A Study of Hospital Disaster Preparedness in South Yemen

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#### Abbreviations:

HDP: hospital disaster preparedness  
HICS: Hospital Incident Command System  
MCI: mass-causality incident  
MoPHP: Ministry of Public Health and Population  
WHO: World Health Organization

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#### Abstract

**Introduction:** Despite emphasis by disaster experts on the importance of disaster preparedness, disaster management in Yemen has attracted only a little attention. Most of the efforts have focused on post-disaster relief activities rather than the pre-disaster preparedness and risk reduction. Hospitals have a crucial role in emergency response and should be prepared. Thus, the aim of this study was intended to assess the hospital preparedness of Aden Capital, South Yemen against disasters.

**Method:** A cross-sectional study was conducted in June 2016. The sample was all Aden City facilities with a total number of 10 hospitals: five public and five private hospitals. A survey was done by using the World Health Organization (WHO; Geneva, Switzerland) standards checklist 2011.

**Results:** The overall preparedness of Aden City hospitals to disasters fell at the unacceptable level of readiness, with an average mean of 46.6 (SD = 38.31; range 24-82). Of 10 hospitals, two ranked insufficient while eight hospitals were at unacceptable levels of preparedness.

**Conclusion:** All hospitals were noted grossly unprepared for potential disasters. Therefore, it is recommended that greater efforts be invested in creating a comprehensive strategy and national or local guidelines to establish an emergency management system based on the anticipated hazard and the needed resources.

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#### Introduction

Across the world, the incidence of disasters and the severity of their impact have increased.<sup>1</sup> This development emphasizes the fact that each country is required to create and maintain preparedness for a variety of anticipated emergencies.<sup>2</sup> Hospitals have a central role during disaster response by saving lives and treating the injured victims.<sup>3</sup> It is essential that all health facilities be prepared to serve the community during possible mass casualties with a back-up plan to sustain their response when the available resources are overwhelmed by the disaster.<sup>2</sup>

Yemen is vulnerable to natural disasters. Most of the western and southern regions of the country are on the sea line and at the active seismic zone, which makes it more prone to natural disasters.<sup>4</sup> Earthquakes of various magnitudes struck the Gulf of Aden in recent years.<sup>5</sup> In November 2015, two tropical cyclones tagged “Megh” and “Chapala” hit most of the coastal areas of the Gulf of Aden and caused many deaths due to flooding.<sup>6</sup> Furthermore, man-made disasters have become burdens to Yemeni’s population due to the political unrest, poverty, social conflict, and terrorism. Recently, complex emergency crises were caused by the Civil War of 2015-2016. According to the health facility-based report on deaths and injuries recorded between March and October 2015, there were 26,703 injured and 5,604 deaths, 45.0% of which were tragedies in the South of Yemen in Aden City alone.<sup>7</sup>

On the other hand, in the last decade, there were significant efforts made by the government to expand and improve the standard of health care delivery in the country. However, despite these efforts, the health system is still grossly underdeveloped.<sup>8,9</sup> The total expenditure on health in 2014 was 6.5% of gross domestic product, which is equivalent to 202 dollars per capital.<sup>9</sup> The role of the private sector is increasingly growing. However, this growth is not as an investment to improve the health services for the

communities.<sup>10</sup> It was reported that health services only covered 67.0% of the population, mostly in urban areas, and only 35.0% of rural communities.<sup>11</sup> The last events in 2015–2016 have exposed the inadequacies of the fragile health system in regard to their response to a disaster, with the end result being an increase in mortality and morbidity rates among the population.<sup>12</sup>

Although the socioeconomic status of the country is a drawback in improving disaster preparedness, assessing the capability of the health system, as well as organizing and allocating the available resources based on needs, could improve the outcome of a response to mass-causality incidents (MCIs).<sup>13,14</sup> In South of Yemen, there are limited data about the ability and readiness of the health system against disasters, as opposed to the northern region where some data are available, specifically in the capital city Sana'a. However, data showed all capital hospitals didn't meet the requirements based on World Health Organization (WHO; Geneva, Switzerland) standard guidelines.<sup>15</sup> So the aim of this study was to assess the current hospital preparedness of Aden City, South of Yemen to disasters. Perhaps these findings can assist policy makers and authorities in identifying and strengthening the gaps or weak areas that require improvements and could highlight the basic benchmarks for further works to cover the areas that were not reached by this study.

## Methods

The study design was a cross-sectional, descriptive study conducted in June 2016. The sample was all Aden City facilities that had a functional emergency department working 24/7 and inpatient care based on the Ministry of Public Health and Population (MoPHP) standards, ranging from university hospitals to general hospitals of the MoPHP/Defense and private hospitals (Table 1). The total number of studied hospitals was 10: five public (including one military hospital) and five private hospitals. They were invited by official letters enclosed with a copy of the evaluation checklist. The evaluation tool used was a valid checklist developed by the WHO Regional Office for Europe, a hospital emergency response checklist of all hazards 2011.<sup>16</sup> The exclusion criteria were the primary health care centers and the private polyclinic centers that were without emergency departments or the total number of beds was less than 50 beds.

## Survey

Targeted hospitals were surveyed by visiting the selected facilities individually and interviewing face-to-face the key informants in each hospital. The interviewed hospitals' representatives were hospital directors or hospital personnel appointed by the director who had experience and knowledge about MCIs and hospital preparedness, so most personnel interviewed were the heads of the emergency departments. The tool used for the assessment interview was a valid instrument of the WHO called the hospital emergency response checklist of all hazards 2011.<sup>16</sup> It consisted of 92 recommended actions assembled in nine key components: (1) command and control; (2) communication; (3) safety and security; (4) triage; (5) surge capacity; (6) continuity of essential services; (7) human resources; (8) logistics and management supply; and (9) post-disaster recovery.

## Ethical Considerations

Written consent to conduct and clarify the purpose of the study had been submitted to the health authority. The MoPHP agreed and provided official letters to all selected hospitals requesting

Hospital Categories	n of Hospital	n of Beds	Affiliation
University Hospital	2	>200	Public
General Hospital	2	100 - 150	
Military Hospital	1	100 - 150	
Private Hospitals	5	50 - 200	Private

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**Table 1.** Hospitals Participating in the Study

their cooperation for evaluation. The invitation letters were discussed with each hospital director during the site visits and they agreed to an assessment after they were assured that the results would be just facts for educational purposes; the anonymity of the hospitals and names would be maintained and kept confidential.

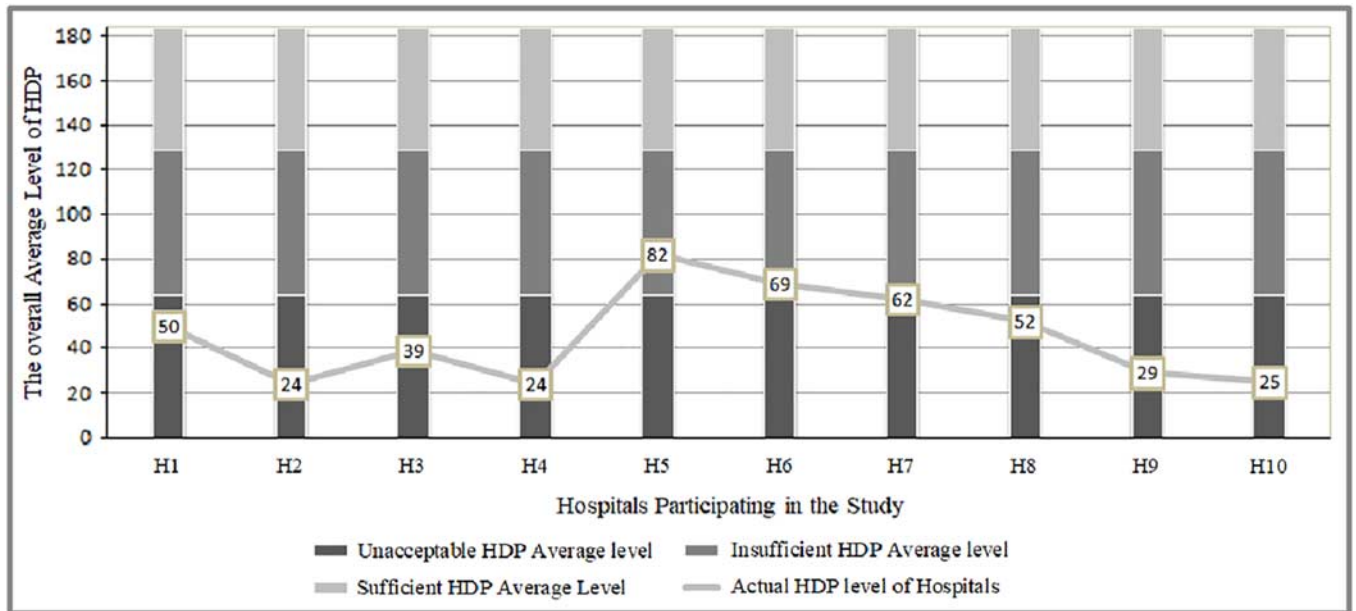
## Data Analysis

After obtaining the data from the targeted hospitals, the 92 action items of the WHO checklist were transferred to an Excel Spreadsheet 2010 (Microsoft Corp.; Redmond, Washington USA). The outcome of each stated action ("due for review" action not existed; "in progress" existed but still not completed; or "completed") coded to numbers by using a Likert Scale of zero, one, and two, respectively.<sup>13,14</sup> The total score based on the answer status of all actions ranged from zero to 184, and the average level of hospital disaster preparedness (HDP) categorized as unacceptable (0–64), insufficient (65–129), or sufficient level (130–184).<sup>14,15</sup> Then the data of variables were introduced into Statistical Package for the Social Sciences (SPSS) software program of IBM (Armonk, New York USA; trial version 24) to get descriptive statistics of the mean and standard deviation of hospital preparedness.

## Results

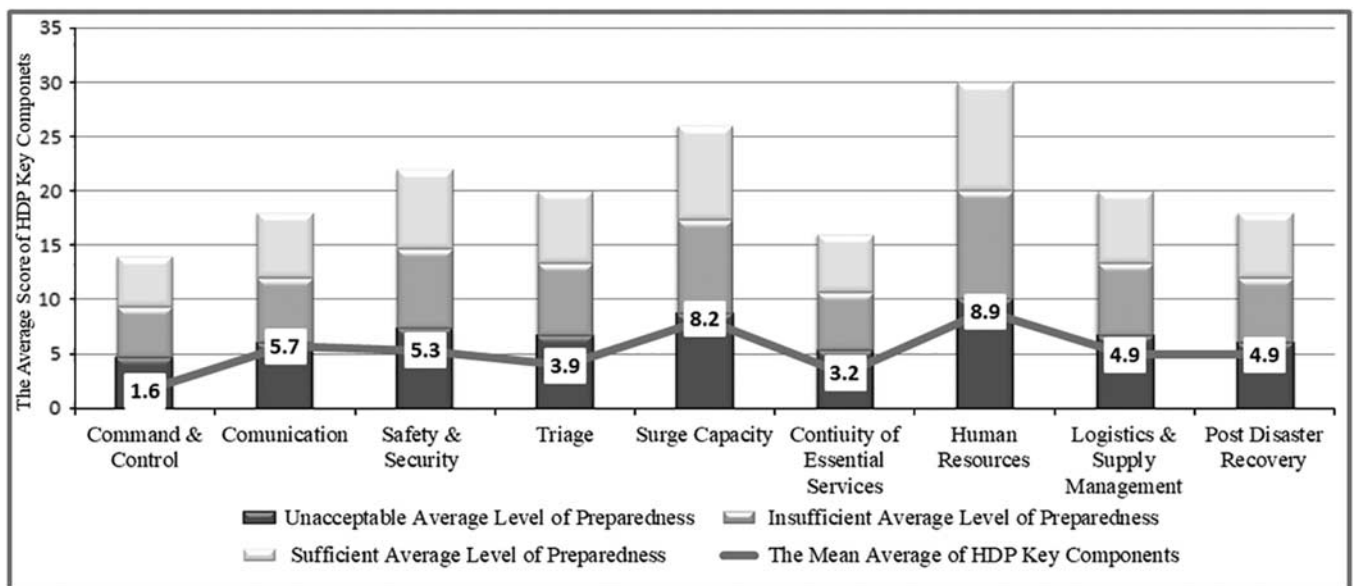
All invited hospitals responded to the study. The relevant informants declared to present a written emergency plan in advance; however, no emergency plan existed or no Hospital Incident Command System (HICS) was implemented in all studied hospitals. The study results showed the overall preparedness of the health system of Aden City to any potential disaster fell far from the recommended level of WHO standards. All facilities ranked under the required level of readiness with an average mean of 46.6 and (SD = 38.31; range 24–82). Of 10 hospitals, two hospitals were at the insufficient state while eight hospitals were at the unacceptable level of preparedness (Figure 1). Regarding the key components of HDP enquired in the checklist, all nine keys were found at an unacceptable state. Command and control, continuity of essential services, and triage earned the lowest recommended level of preparedness (Figure 2).

Private hospitals consisted of 50.0% of the total sample; the data showed the overall status of preparedness of the private hospitals was slightly higher by 1.6% than of public hospitals. The private hospitals ranked 25.8% (237) while public hospitals 23.9% (220) of the recommended total scores of preparedness (920; Figure 3). The surge capacity and post-disaster phase elements were found insufficiently prepared in public hospitals, and at the unacceptable level of preparedness in private hospitals. Conversely, human resources preparedness was noted to be slightly higher in



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Figure 1. Average Level of HDP of Hospitals in South Yemen. Abbreviation: HDP, hospital disaster preparedness.



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Figure 2. Average Score of HDP Key Components in South Yemen Hospitals. Abbreviation: HDP, hospital disaster preparedness.

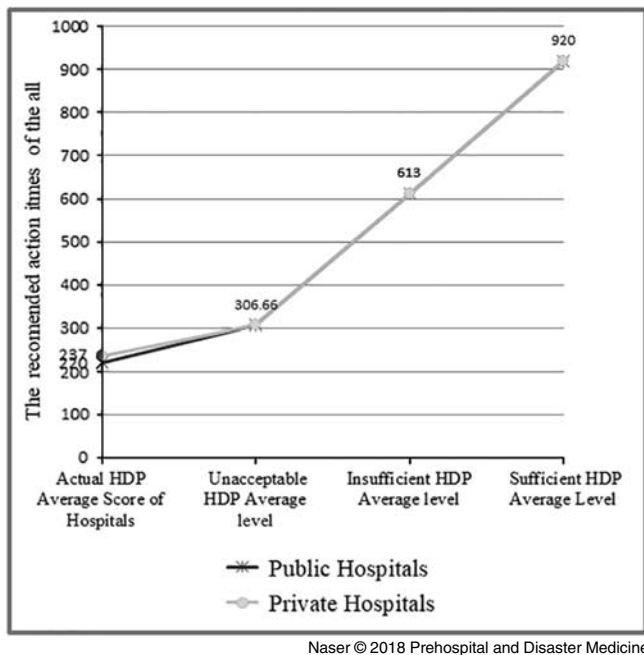
private hospitals, but still at the insufficient level when compared to public hospitals, which were found unacceptable. Other key components shared the same unacceptable level of preparedness in both public and private hospitals (Figure 4).

**Discussion**

Since the hospitals have an important role in all disaster management phases, there was an increased public awareness concerning disaster planning, and many research studies assessing HDP were conducted in many countries in the last few decades.

However, most of these studies showed that HDP were limited or still not prepared.<sup>13-15,17-19</sup> There is no known standardized, comprehensive, and reliable tool to measure hospital preparedness.<sup>20</sup> Thus, the WHO addressed this debate and developed a valid standard tool for this purpose that was comprehensive for all hazards.<sup>16</sup>

The current study tried to assess the preparedness of Aden City hospitals, South of Yemen by using the WHO checklist.<sup>16</sup> The study revealed that the overall HDP of Aden City against disasters was grossly unprepared and that most enquired checklist keys were



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**Figure 3.** Public versus Private Hospital Levels of HDP. Abbreviation: HDP, hospital disaster preparedness.

in the “due for review” stage. These findings were consistent with another study conducted earlier in Sana’a City, North of Yemen and other countries.<sup>14,15,17</sup> However, in contrast to this study, HDP was within the accepted to intermediate level in some reviewed international studies.<sup>21,22</sup>

The majority of Aden City hospitals (80.0%;  $n = 8$ ) were found unprepared and 20.0% ( $n = 2$ ) were insufficiently prepared. All nine key components of preparedness were in an unacceptable state; among them, command and control, triage management, and continuity of essential services were found to be the most affected keys. Of the two insufficiently prepared hospitals, one was a general hospital operated by the Government Oil Company and the other was one of the biggest private hospitals in the city. When comparing the public to private hospitals, the study showed that the overall preparedness of the private hospitals was slightly higher than in public hospitals by 1.6%. This variation was mostly due to human resources, while other keys such as triage and command and control also played a contributory role.

Disasters are sudden and require quick decisions and responses, but chaos and un-unified responses were the most common scenarios seen in the hospitals.<sup>23,24</sup> Thus, an appropriate HICS and effective emergency plan can organize and minimize the confusion during responses.<sup>24</sup> All Aden hospitals were found without HICSs or emergency plans. Similar results were met in other studies.<sup>14,15</sup> However, in contrast to the results, this area was sufficiently prepared in other published studies.<sup>14,19,21</sup> It can be said, the lack of standardized national or international guidelines for health care delivery led to the poor status of commanding system preparedness.

Communication problems are common during emergency response.<sup>25</sup> This area of preparedness was seen as unacceptable in all Aden hospitals. These findings are consistent with other studies findings.<sup>14,15,17</sup> In Aden hospitals, there were no back-up systems and the landlines and personal cell phones were the main modes of communications within and outside of these facilities. Hence, a communication system with sustainable back-up resources is

necessary for all facilities. Prioritizing of victims based on the severity is important in a crisis.<sup>24,26</sup> All studied hospitals were noted without specific triage system for MCIs. Likewise, this area was found unaccepted in one published study,<sup>15</sup> while, in contrast to this study, it was found sufficiently prepared in another study.<sup>14</sup> Thus, to improve this area, it is better to use triage protocols for MCIs in all hospitals. Regular training on this protocol can improve staff performance during the response.

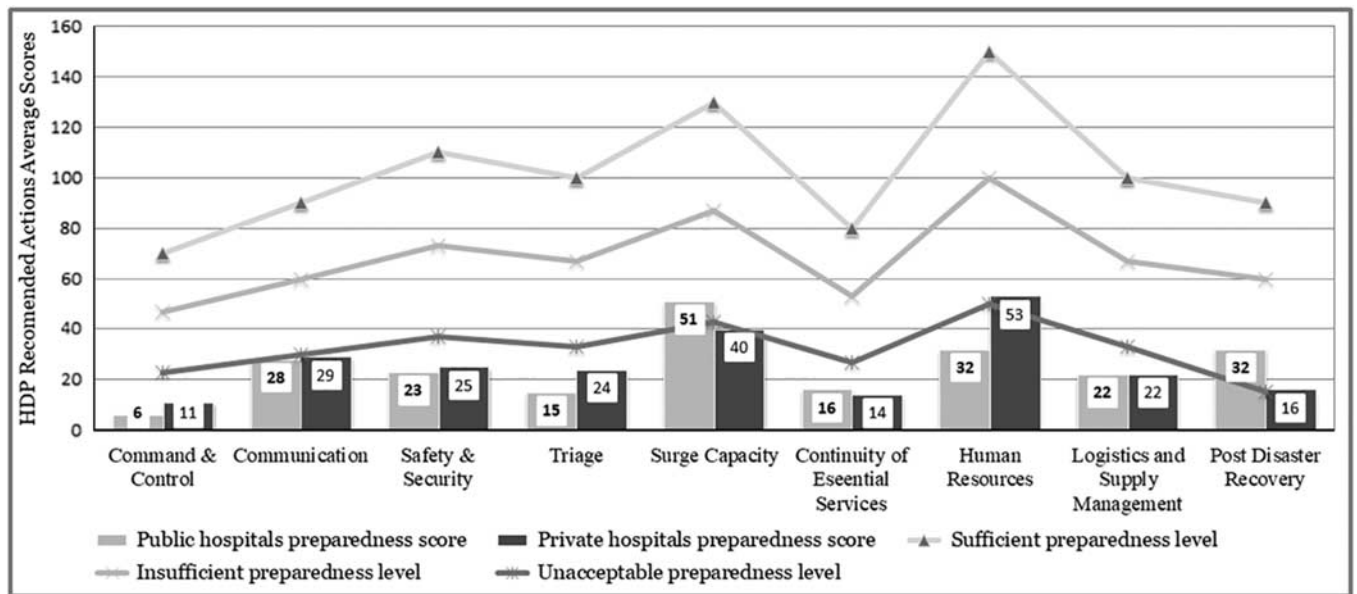
Reports said that safety and security measures have been linked to an effective response to MCIs.<sup>13</sup> Safety preparedness was unacceptable in Aden hospitals and at-risk to internal emergencies, like fires or the spread of infectious agents and functional collapse. However, these measures, to some extent, were still not satisfied in other studies.<sup>13-15,17</sup> This study showed one general hospital noted insufficiently prepared in this area while the remaining nine hospitals were unacceptably prepared. Early warning, surveillance, and ventilation systems were not found in most hospitals. Therefore, an immediate action must be taken by authorities and stakeholders to ensure the safety and security of the staff, clients, and facility infrastructures.

During a time of emergencies, each hospital imposed to surge its service to 20.0% of the total normal daily activity.<sup>14,15,24</sup> Moreover, it is expected to handle a sudden patient influx up to 96 hours.<sup>27</sup> The vast majority of the Aden hospitals were unprepared in this area. Similarities to these results were met by other studies.<sup>13,14</sup> It is recommended to classify the hospitals into categories based on their ability to provide acute care and convey the scanty resources in order to maximize the efficiency of service during the response.<sup>24</sup> The human resources were found unacceptably prepared in all assessed facilities. Similar to this study, this area was poorly prepared in other studies.<sup>13,14,17</sup> The lack of training programs was the major concern in this area. Most Yemeni health professionals prefer private hospitals for a financial reason. These issues have to be addressed by the local authority and corrective actions must be taken. Training with drills, workshops, and simulation exercises are required to improve disaster management.<sup>24</sup>

Reports observed that hospitals were evacuated or operationally collapsed due to failure or damage of lifeline services and logistics from disasters.<sup>14,28</sup> Aden hospitals were found unprepared in this area. However, these challenges were still encountered in other studies as well.<sup>12,15,24,28</sup> After a disaster, each hospital assumed to return to the usual activity. Most Aden hospitals were seen as not prepared in the disaster recovery phase. The findings of this area are consistent with other studies.<sup>13,14</sup> Mental health support is needed to mitigate the long-term squeals of disaster impact in this phase.<sup>15,24</sup>

The overall preparedness of the private hospitals in Aden City was scored slightly higher than in public hospitals regarding MCIs. In contrast to this study, the results were reversed in one published research.<sup>21</sup> Despite that sufficient spaces and personnel had been seen in two teaching hospitals, however, they were operated with limited funds, logistics, and equipment. No contact list or call-in/call-back plan was implemented there. On the other hand, the two biggest private hospitals were found with more financial resources, logistics, and manpower, and they still needed space and security measures. Both public and private hospitals were lacking in the safety, commanding, communication systems, and training programs.

While the hospital organizations were found grossly unprepared to manage the disaster, the government health system had a major contributable role in these negative outcomes. Yemen’s approach to managing disasters began in 1997, since the Supreme Council of Civil Defense authorized by a law to lead the disaster management.



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**Figure 4.** Public versus Private Hospital Average Component Scores. Abbreviation: HDP, hospital disaster preparedness.

However, this attempt did not focus on planning and risk reduction; instead, it concentrated only on reactive responses and post-disaster relief.<sup>29</sup> In 2005, dozens of people were killed by a flood due to heavy rains in Hudramout, South of Yemen. This failure triggered the government to have a national plan to face disasters.<sup>30</sup> Nonetheless, there wasn't declared a specific budget to operate this plan and stayed dependent on the financial support of the national communities. Prehospital Emergency Medical Service is still not available to date of the study, and ambulances are mostly used for inter-facility transportation.

Apart from the low-income state of the country, the centralization of political decisions and financial resources made most of the local health authorities disabled to face disaster crisis. Therefore, a reform of the centralization of authority and revision of the legislation regulating the national and local disaster management plan is suggested to grow the disaster planning. Establishing national or local emergency plans based on the potential hazards with specific and sufficient funding is recommended. Creating prehospital networking systems, integrating with the hospital emergency plans, is necessary to improve disaster management in the country as well.

### Limitations

One limitation of this study is the limited sample size. The study was conducted in June 2016 at a time most parts of Yemen were still at war and only some parts were just recovering from the battles. Some areas were still unsecured and could not be visited; thus, the study sample was only hospitals of Aden City, which was only 10. Hence, another research study is advised to cover all non-surveyed areas in South Yemen. However, the health system of

Aden City is considered as a referral system for most of the southern regions; therefore, the study findings can be safely generalized to all South of Yemen. Another limitation is the validity of the surveying tool since there is no standardized instrument for assessment of hospital preparedness; as such, these findings have to be compared with results of studies that assessed the level of preparedness with different checklists. Furthermore, the lack of disaster planning specialists in the entire hospital professional representative was seen to be a problem. This issue was considered by the authors in clarifying some action items that were not under their scope of the specialty.

### Conclusion

Overall, health system preparedness of Aden City against anticipated disasters was noted to be grossly unacceptable in relation to the international recommendations of preparedness, and most enquired keys were in the "due for review" stage. Therefore, it is recommended that greater efforts be invested in creating a comprehensive strategy and national or local guidelines to establish an emergency management system based on the anticipated hazards and the resources needed. A sufficient budget and legislative support are required to promote, allocate resources, as well as the provision of training programs to enhance staff performance.

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