Disaster Safety Assessment in Primary Healthcare Facilities: A Cross-Sectional Study, Kurdistan, Iran

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Abstract

Background: Primary healthcare facilities in Iran deliver health services at all levels nationwide. Resiliency and flexibility of such facilities is important when a disaster occurs. Thus, evaluating functional, structural, and non-structural aspects of safety of these facilities is essential.

Methods: In this cross-sectional study, using the safety evaluation checklist of primary healthcare centers provided by the Ministry of Health and Medical Education, 805 health centers in Kurdistan Province were evaluated in terms of functional, structural, and non-structural safety.

Results: The levels of total, functional, structural, and non-structural safety were equal to 28.7, 23.8, 20.2, and 42.3 out of 100 respectively. Regarding the functional preparedness, the highest score was related to rapid response team, while the lowest score was belonged to financial affairs. Nevertheless, in structural and non-structural areas, the scores of different items were almost similar to one another. Both Iran and Kurdistan Province are disaster-prone areas.

Conclusions: This study concluded that the safety score of primary healthcare facilities in total was unsatisfactory. Thus, promoting preparedness, resilience and continuity of service delivery is essential during disasters and emergencies. The finding of this study could be beneficial for national and provincial decision-makers and policymakers in this regard.

Background

World Health Organization (WHO) considers public health as a set of organized actions which attempt to prevent disease, improve health, and increase the longevity of populations [1]. The focus of Primary Health Care (PHC) is on delivering essential services to improve the health condition, and by providing resiliency for the society, emergencies can be dealt with efficiently [2]. The occurrence of disasters in societies causes serious damage and influences them severely. Since the approval of Hyogo Framework for Action by 2015, thousands of people have lost their lives and millions of people have become homeless because of disasters [3]. Natural disasters, emergencies, and other crises have a direct effect on people and society’s health and influence it through causing trouble for health systems, equipment, and services [2]. Due to the vital role of primary healthcare facilities in emergencies, in order to save people’s lives, it is essential that they remain stable and deliver services when disasters occur [4, 5].

Disaster risk management prevents or reduces deaths, accidents, diseases, disabilities and mental problems [2]. Therefore, policies and strategies should focus on equipping and preparing PHC because they can reduce the vulnerability of families, societies, and public health systems which is caused by disasters and emergencies [2]. According to WHO, certainty about the availability of appropriate and affordable care such as improving the health and disease prevention services to all populations is one of the principal actions of public health in order to reduce disaster risks [1]. On the other hand, when disasters occur, continuity of public health services depends on reducing disaster risks from prevention to recovery [6]. Countries are encouraged to improve health systems in line with international commitments.
in order to improve preparedness for disasters. In this regard, the World Health Assembly of WHO approved a resolution on strengthening national health emergency and disaster management capacities and resiliency of health systems in May 2011 [7]. Some examples of the aims of negotiations on disaster risk reduction in January 2015 have been as follows: increase in health system flexibility, incorporation of disaster risk reduction into healthcare programs, and capacity building especially at a local level [6]. One of the expected outcomes from Sendai framework in addition to reducing casualties due to disasters is to lessen the damage to basic infrastructures and service-delivery facilities [3]. Therefore, evaluating disaster risks is essential in the public health area in order to mitigate disaster risks and manage disasters effectively [6]. Indeed, in order to ensure that PHC facilities are resistant enough to disasters and emergencies, evaluating the safety and risk of centers in terms of functional preparedness as well as structural and non-structural safety is essential [5].

Since Iran is a disaster-prone country, one of the public health concerns in the country is related to the consequences of disasters [8]. This country with 24000 PHC centers across all urban and rural areas has the ability to deliver health services in four phases (prevention and mitigation, preparedness, response, and recovery) of disasters to the population. Notably, it can be claimed that the first respondents to disaster are PHC centers in the Iranian health system [8]. However, in the earthquake of Bam in 2003, more than 90% of health facilities were demolished [9]. The focus of this study, Kurdistan Province, has an area of 28235 square kilometers accounting for about 1.7% of the country’s area. This province is located in the west of Iran and neighbors Iraq [10]. Due to topographical, geographical, and political conditions, it is one of the provinces prone to various disasters such as earthquake, floods, fires (especially on forests), terrorist attacks, war, avalanche, blizzard, drought, and other risks. Further, the Zagros fold-thrust belt crosses over this province and large earthquakes are expected to occur due to this fault in the province. Kurdistan Province is divisible into eastern and western areas in terms of seismicity, with more than 60% of the western area in this province including the towns of Kamyaran, Sanandaj, Marivan, and Baneh located in the high-risk zone [10]. Therefore, due to the disaster-proneness of this province and the importance of PHC centers in delivering health services after the occurrence of disasters, it is crucial to evaluate the safety of PHC facilities in line with precautionary measures, the promotion of preparedness, and continuity of services. The aim of this study is assessing the safety and relevant risks for disasters in 805 primary healthcare facilities of Kurdistan province in Iran. The healthcare facilities under assessment were from all existing types across the province including health house, urban health posts, urban-rural, rural and urban health centers, district health centers and the deputy of health. All mentioned healthcare facilities deliver the governmental health services to population in different levels of health system in Iran.

**Methods**

**Design and setting**

This cross-sectional study was conducted at healthcare facilities in Kurdistan Province located in the west of Iran accommodating 10 towns in 2018 [11] (Fig. 1). The sampling method was census and 805
existing healthcare facilities were included in this study.

**Collecting Data Instrument**

The using checklist in this study developed based on Hospital Safety Index (HSI) instrument that has been first introduced for hospital safety assessment by PAHO in 2008[12]. This checklist was adopted for applying in the healthcare facilities with the purpose of safety assessment and was confirmed by specialists as the collection data instrument [13]. This instrument has the capacity for measuring the disaster safety assessment in health facilities via recognizing threatening hazards, assessing the functional preparedness as well as structural and non-structural safety assessment.

The section of hazard recognition included 55 questions in five areas including geological, climatic, social, biological, and technological and man-made. Also, the probability of risk occurrence was categorized to four levels: improbable, low, moderate and high. We assigned scores of 0 or < 1, 1, 2 and 3 to each category, respectively.

The section of functional preparedness included 241 questions in 34 areas. Some of these areas were as follows: organization and structure, preparedness programs, risk assessment, insurance, risk reduction measures, firefighting, and exercise. Preparedness level was categorized to three levels: acceptable, moderate and unacceptable. We assigned scores of 3, 2 and 1 to each category, respectively.

The section of non-structural safety included two sections: general with 44 questions and technical with 110 questions. In the general section, the safety of general equipment found typically in most offices is measured, while in the technical section, the safety of specialized equipment of health facilities was measured. The safety level of non-structural components was categorized to three levels: safety rules have not been observed (low safety), safety rules have been partially observed (moderate safety), and safety rules have been fully observed (high safety). We assigned scores of 0, 1 and 2 to each category, respectively.

The section of structural safety includes five questions and scoring of this section is as the same as non-structural section.

After finalizing the checklist, some health staff at different levels of health system was trained about safety, risk and disaster concepts, data collection methods including field investigation, observation and interview, and scoring of checklists during two courses. Each course was organized in three days. The participants were monitored and evaluated at the end of second course by research team.

**Data analysis**

The completed checklists were entered to the Excel software and the pre-prepared excel completed for each healthcare facility under assessment. If there was no data or no variables were measured, the research team would follow up and found data from the person who completed the checklist. Overall, the
score of each section was calculated from 100-point scale and in order to homogenize the results, the score of all questions was considered from 0 to 100.

Results

According to the results of this study, the total safety score of primary healthcare centers under assessment was equal to 28.7 from 100 in Kurdistan Province. This total safety score was the average scores of assessed sections in functional, structural, and non-structural areas. The highest safety score was related to the non-structural area, while the lowest ones belonged to structural safety area (Chart 1). In the section of hazard recognition, the most threatening hazard type of healthcare facilities throughout the province were related to climatic, biological, geological hazards with 34.5%, 31%, and 24.3% respectively (Chart 2).

The average score of assessing functional preparedness in all assessed healthcare facilities was equal to 23.8 from 100. The highest score of functional preparedness items were related to organize rapid response team (41.8 from 100) and also, environmental health services delivery (33.7 from 100). The lowest score of functional preparedness items were related to financial affairs, water and food supplies, and providing appropriate Personal Protective Equipment (PPE) for staff with the score of 16.5, 18.5, and 18.7 from 100, respectively (Chart 3). According to the type of healthcare facilities, the highest rate of functional preparedness belonged to the deputy of health (34.8 from 100). Also, the comprehensive urban health centers obtained the lowest score in this area of assessment (25.8 from 100) (Table 1).

In the structural safety area, the average score of structural safety was equal to 20.2 from 100 in all healthcare facilities while the highest average score allocated to the non-structural safety area. The average score were approximately equal to 42.3 from 100 in both assessments of technical and general sections of the non-structural safety area (Table 2).
The Level of Structural and Non-structural Safety Components of Healthcare Facilities against Disasters and Emergencies, Kurdistan, Iran.

| Type of Healthcare facility | Number | Functional Preparedness | Structural safety | Non-structural safety | Total safety |
|-----------------------------|--------|-------------------------|-------------------|----------------------|-------------|
| Deputy of Health            | 1      | 2.4                     | 30                | 72.3                 | 34.8        |
| District Health Centers     | 10     | 41.7                    | 33.6              | 27.3                 | 34.2        |
| Comprehensive Urban Health Centers | 33 | 14.8                    | 17.4              | 45.2                 | 25.8        |
| Comprehensive Rural Health Centers | 42 | 27.9                    | 20.7              | 46.1                 | 31.6        |
| Comprehensive Urban-Rural Health Centers | 40 | 28.9                    | 27.5              | 43.8                 | 33.4        |
| Urban Health Posts          | 31.5   | 32.6                    | 20.5              | 32                   | 29.4        |
| Health House                | 616    | 23.5                    | 19.6              | 41.8                 | 28.3        |
| Total                       | 805    | 23.8                    | 20.2              | 42.3                 | 28.7        |

**Category**

| Scale                                      | Score (%) |
|--------------------------------------------|-----------|
| Structural safety                          | 21        |
| Coordination for structural safety assessment |          |
| Change of structural resistance after the accident | 19.6     |
| Assessment of structural vulnerability after the accident | 21.3     |
| Structural Vulnerability                   | 19.6      |
| Measures after structural evaluation       | 19.6      |
| Total Structural safety                    | 20.2      |

| Non-structural safety                     | 41.6      |
| General Section                           | 43        |
| Technical Section                         |           |
Table 1- Functional Preparedness, Structural, Non-Structural and Total Safety Score(%) according to Healthcare Facilities Type, Kurdistan, Iran

| Total Non-Structural safety | 42.3 |

Figure 1: Kurdistan Province in Iran and 10 County of Kurdistan Province

https://en.wikipedia.org/wiki/Kurdistan_Province

Discussion

Our study indicated that the greatest hazards threaten the healthcare facilities included climatic, biological, and geological hazard. However, according to the studies conducted in Iran, the most common natural hazards of the country have been geological and climatic [14, 15]. Specifically, the results of our study correspond with the increase in climatic [16] and biological [17] hazards in the world due to climate changes. This growth in this hazard groups profoundly influence people's health and health systems [17]. A 10-year retrospective study about safety assessment of 1401 PHC centers in Iran, 2013 indicated that more than 140 PHC centers are annually influenced by natural disasters [9]. In another study by Vesela Radovic in 2012, it was stated that many healthcare facilities are influenced by climatic hazard [18].

The general safety of healthcare facilities in this study was equal to 28.7%, out of which 4.9% were in high safety, 53.9% were of moderate safety, and 41.2% were categorized in low safety. Therefore, only a very small percentage of healthcare facilities were highly safe. In this study, the average safety score of the assessed healthcare facilities was approximately 30 out of 100. Although this finding correspond with the average safety score of 16078 healthcare centers that measured in Iran, 2015 [19], but it is lower than the obtained safety score of PHC centers in the study in Ahwaz [20] and also, the hospitals across the country [21].

The functional preparedness of healthcare facilities in this study was not acceptable and was low in comparison to the functional preparedness of healthcare facilities in Ahwaz study [20] and the study that was done across the country [19]. In spite of the financial preparedness of healthcare achieved the lowest score (16.5 from 100) but it was higher than the financial preparedness rate across the country (11.9 from 100) [19].

These findings obtained in the normal situation but the occurrence of disasters heavily influences the performance of healthcare facilities in continuity of health services delivery to affected population [22]. Since 2001, the US has considerably invested in promoting the preparedness of public health systems when disasters or emergencies occur [23]. This investment plays an essential role in improving the resilience of PHC centers when disasters occur [24].
One of the elements of preparedness programs against disasters is to supply equipment [25], and the results of this study assessed the weak preparedness of province's PHC centers in this scope. While, in a study conducted on evaluating the preparedness of Jordan hospitals, all the evaluated hospitals were well prepared in terms of equipment [22].

The score of training personnel to be prepared for disasters in the healthcare facilities under assessment were very low (22.1 from 100) in this study. This result is similar with the study that was conducted on evaluating the safety of nine health and treatment centers in Indonesia in 2011. Only the personnel of two centers had been trained to be prepared for disasters and the heads of these centers were totally unaware of this training in the mentioned study [26]. Another study on evaluating the preparedness of hospitals in Jordan in 2017 showed that one of the problems was the discontinuity in implementing training programs [22]. However, one of the strategies of improving response in PHC is continuous training of personnel and volunteers. Accordingly, in Eastern Europe, implementation of the training programs of rescue and emergency evacuation when disasters occur has become obligatory in their health systems [18]. The preparedness of rapid response team in healthcare facilities was equal to 48.1 from 100, which was higher than the preparedness at the national level (23.6 from 100) [19]. Having professional, experienced, active, and up-to-date teams at the scene of disaster is one of the key aspects of checking the quality of service delivery and protecting PHC centers when disasters occur [27]. Therefore, training rapid response teams is necessary and having such teams is one of the components of measuring functional preparedness of these healthcare facilities [28]. The preparedness of health centers in the environmental health area in this study gained an acceptable score (33.7 from 100). According to the key role of environmental health in health facility preparedness, the more score in this area will result in preparedness improvement and effective health facility response when disasters occur [29].

The average score of structural safety in this assessment did not achieve an acceptable score, and it was even lower than the structural safety rate of hospitals in Iran [21]. This result confirms the findings of the study conducted by Ardalan et al. about the vulnerability of health facilities with focus on incomprehensive rural health centers at time of disasters [9]. In the safety evaluation of health facility in Eastern Europe in 2010, one of the major challenges of hospitals was the structural safety which was mainly related to the oldness of buildings and not taking renovation measures [18]. Specifically, structural safety represents the structure's resistance to external forces [27] and it is one of the essential elements in the increase of health facilities preparedness when disasters occur [28].

The strength point of this assessment was in the area of non-structural safety that obtained a higher score in comparison to structural safety and functional preparedness. The non-structural safety of healthcare facilities under assessment was classified in the moderate safety category in this study. The reason might be attributed to the fact that the non-structural safety can be improved by taking measures with low cost such as moving or removing the objects from unsafe place. Although the non-structural safety score of healthcare facilities in Kurdistan Province was lower than the assessed hospitals in this area in Tehran [4]. The aim of improving non-structural safety in healthcare facilities is to guarantee people's safety and equipment and continuing service delivery and emergency rehabilitation measures in
disasters and emergencies [28]. Inappropriate level of non-structural safety can impose heavy cost to the health system and even result in paralysis of the service provision, when it is strongly required [27, 28].

**Conclusion**

Due to the high proneness of Kurdistan Province to disasters, the safety of healthcare facilities has an unavoidable effect on preparedness and resilience against disasters and emergencies. Inappropriate level of healthcare facilities preparedness influence the continuity of service delivery to affected people from disasters and the majority of population only access to these PHC centers for receiving governmental health services.

Due to the safety score of evaluated PHC centers in different areas in this province, national and provincial decision-makers or policymakers should make right decisions for improving the preparedness of healthcare facilities. Adopting appropriate policies for improving the structural safety such as setting a sufficient budget or investing in constructing new healthcare building or retrofitting the existing facilities are recommended. Additionally, strengthening the intersectional and intra-sectional coordination, training the personnel and people in charge of the management programs of disaster risk mitigation, and organizing the periodic exercises are suggested for increasing the functional preparedness of healthcare facilities.

**Abbreviations**

WHO  
World Health Organization; PHC:Primary Health Care

**Declarations**

**Ethics approval and consent to participate**

Not applicable. Because no human or even animal samples were recruited for the study. In this study, health facilities buildings and premises were evaluated with the permission of the highest health authority in the Kurdistan province.

**Consent for publication**

Not applicable.

**Availability of data and materials**

The datasets used during the current study are available from the corresponding author on reasonable request

**Competing interests**
The authors have no competing interests to declare.

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Authors’ contributions

AY was responsible for the analysis of the data as well as for writing the initial draft of the manuscript’s sections of methods and result. AA participate in analysis of the data and design of the initial project. YZ and FB were responsible for writing the initial draft of the manuscript’s sections of introduction and discussion. MZ, MSB and NSH were responsible for data collection, data cleaning and data entry form 10 city, they were also responsible for coordinating project implementation. SV was responsible for designing the project, overseeing the study, and finalizing the manuscript. All authors read and approved the final manuscript.

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**Figures**

![Kurdistan Province map](https://en.wikipedia.org/wiki/Kurdistan_Province)

**Figure 1**

Kurdistan Province in Iran and 10 County of Kurdistan Province