

Exploring factors affecting the decision of emergency hospital evacuation in disasters: A qualitative study

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Abstract

Context: Hospitals usually are at risk of potential hazards, which may necessitate emergency hospital evacuation (EHE). Deciding about hospital evacuation is of the critical task and is affected by numerous factors.

Aims: The aim of this study then was to explore the factors behind the decision for EHE in disasters.

Setting and Design: This is a qualitative study that was conducted from May 2014 to February 2015, employing conventional content analysis.

Materials and Methods: This is a qualitative study (conventional content analysis). Data were collected through in-depth semi-structured interviews with 25 key participants, who were selected using purposeful sampling. Data were analyzed using conventional content analysis according to the technique described by Graneheim and Lundman.

Statistical Analysis Used: No statistical methods were used in this study.

Results: Factors behind the decision for EHE in disasters merged into three main categories, including risk assessment and estimation, the possibility of continuing service provision, and the necessary prerequisites for evacuation. The seven subcategories of these three main categories were hospital population density, hospital characteristics, accident characteristics, vulnerability of the hospital, potential capabilities of the hospital, administrative adjustments, and the possibility of safe patient transfer.

Conclusion: Many different factors can contribute to the decision for EHE. The findings of this study can help hospital administrators to develop plans for making better evacuation-related decisions.

Keywords: Decision-making, Disaster, Emergencies, Qualitative research

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Received: 05 March 2020; **Accepted:** 02 September 2020; **Published:** 10 February 2021

Access this article online	
Quick Response Code:	Website: www.jnmsjournal.org
	DOI: 10.4103/JNMS.JNMS_22_20

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How to cite this article: Yaghoubi T, Ardalan A, Ebadi A, Nejati A, Khorasani-Zavareh D. Exploring factors affecting the decision of emergency hospital evacuation in disasters: A qualitative study. *J Nurs Midwifery Sci* 2021;8:27-33.

INTRODUCTION

As healthcare providing organizations, hospitals play significant roles in human health.^[1,2] Currently, around 70% of health budgets in different countries are spent in hospitals.^[3] Hospitals are responsible for continuously providing therapeutic and care measures throughout days and weeks.^[4] Consequently, any disturbance in the functions of hospitals can make health-care system vulnerable.^[5]

Hospitals are at risk of potential hazards, the prevalence of which is progressively increasing.^[6] Hazards, such as natural and human-made disasters, may necessitate emergency hospital evacuation (EHE). The World Health Organization reported that from 1979 to 2009, in total 69 hospitals were damaged and immediately evacuated due to natural and man-made disasters.^[7] For instance, in the 1994 Northridge earthquake in California, six hospitals were partially or completely damaged and evacuated. Similarly, in the 1999 Chi-Chi earthquake in Taiwan, four hospitals were evacuated as a result of nonstructural damages. In the Bam earthquake in 2003, Iran, three hospitals and about 130 health-care facilities were totally damaged and their function is totally affected, and my collapsed.^[8] Different studies have shown that many health care centers have been evacuated.^[9-14] Safe EHE is exceedingly more difficult and complex than the evacuation of other buildings.^[15,16] One main reason is that transferring hospitalized patients, of which some may be critically-ill, from the damaged hospital to safe health-care facilities is extremely risky and life-threatening.^[17] Studies also reported several cases of death during EHE.^[18] For instance, EHE after the 2011 Japan tsunami caused the death of five patients.^[19] Moreover, two patients died in Iran during the EHE after a hospital fire in 2016.^[20,21] Moreover, it is important to note that the EHE incurs enormous costs. Results of studies showed that the direct costs of using extra workforce and equipment for an EHE and the indirect costs related to canceled surgical operations that were around \$18,000 and \$35,000,^[22] respectively. On the other hand, EHE is highly stressful to health-care workers, patients, and family members.^[22]

The improvement of a harmless evacuation plan for hospitals is extremely complicated.^[23]

EHE is associated with different challenges, so much so that it is considered a game of death, and thus, most managers are unwilling to do it.^[24,25] The most challenging aspect of EHE is to make the evacuation decision^[16,24] and even in other emergency situations.^[26] During primary phases of disasters, decisions need to be made in very short periods

and based on limited amounts of data. These decisions are critical and may life-changing and thus, if made unwisely, can result in catastrophic and life-threatening consequences.^[27] For instance, the early decision for hospital evacuation can cause patients undue pressure, while the delayed decision for evacuation may result in the evacuation of patients in nonstandard conditions.^[28]

Despite the fundamental importance of the timely decision for EHE, only a few studies have been conducted in this area.^[28,29] Most previous studies mainly focused on describing EHE instances or reporting health-care providers' and patients' EHE-related experiences.^[9,30-33] Thus, developing definitive decision-making and operational plans for EHE are reported in many studies.^[33] The study also about decision-making in EHE in the Sandy hurricane highlighted the need for study in decision-making to promote managers' competence for EHE-related decision-making.^[34-35] Yet, to the best of our knowledge, factors which may affect EHE decision in disasters have not yet thoroughly explored. Therefore, this study was conducted to explore factors affecting the decision for EHE with all-hazard approach in disasters, employing qualitative study design with an interview by stakeholders.

MATERIALS AND METHODS

Design

Qualitative research provides an in-depth, socio-contextual, and detailed description and interpretation of the research topic.^[36]

This is a qualitative study that was conducted from May 2014 to February 2015, employing conventional content analysis.

Participations and setting

In total, 23 participants among health-care professionals (Emergency medicine, Health care management, nursing, disaster, and emergency health) who had the experience of hospital evacuation or disaster management were recruited from different health-care settings that located in Tehran University of Medical Sciences. Inclusion criteria were participate willingness in the study and the experience of EHE. Participant selection was made purposively.

Measures

The main data collection strategy was in-depth semi-structured interview. This strategy helps qualitative researchers profoundly explore their intended subject matters.^[37] Each interview was opened by asking the following broad questions: "Can you explain about your experience regarding EHE?" "How did you make the

EHE decision?,” “What was your challenge in making the decision?,” “What questions did you have in deciding?”

Based on participants’ reflection, probing questions were used covering, “What do you mean by...?” and “Can you explain more about...?”

The time, place, and length of the interviews were arranged based on the participants’ preferences. Accordingly, the interviews lasted from 40 to 75 min. All interviews were digitally recorded and then immediately transcribed verbatim in Persian. Data collection was continued up to the point of principle data saturation, i.e., when no new data was obtained through data collection. Data saturation was reached after doing 23 interviews. Moreover, two more interviews were done to ensure full data saturation.

Data analysis

Study data were analyzed through systematic seven-step conventional content analysis approach Graneheim and Lundman as follows.^[36-38]

Step 1

Preparing the data: In this step, all recorded interviews were transcribed and typed word by word using the Microsoft Office Word 2007 software. Then, the principle investigator (TY) completely and carefully read the transcript of each interview to identify relevant concepts and patterns.

Step 2

Deciding about the unit of analysis: The units of analysis were each interview. Accordingly, the transcript of each interview was entered into the Microsoft Office Word software and read repeatedly to get familiar with its content. Then, meaning units were identified and coded. Any explanations about the codes were written as memos.

Step 3

Categorizing: This step was taken to further develop the codes and to create categories. Accordingly, based on similarity and differences in conceptual meanings, codes were grouped together to form subcategories. In other words, subcategories were developed inductively. Then, subcategories related to similar subjects were grouped into larger categories. We constantly compared the generated subcategories and categories with each other and frequently revised them to ensure their internal homogeneity and external heterogeneity.

Step 4

Testing the coding scheme on sample: In this step, the

first author coded an excerpt of an interview under the supervision of two experienced qualitative researchers (i.e., the third and the fifth authors). Then, the authors started discussing the inconsistencies in coding and categorizing to correct them.

Step 5

When the consistency of coding and categorizing was ensured, the coding process was applied to the rest of the data. In this step, we checked the congruence between the generated codes and the shared experiences of participants.

Step 6

Assessing the consistency of coding: After coding a whole interview transcript, we asked experienced qualitative researchers to re-assess the consistency of coding and categorizing.

Step 7

Concluding from the coded data: In this step, we employed thematic analysis to identify main themes in the data. Accordingly, we moved backward from the generated categories toward the subcategories and the raw data, repeatedly compared the results of the analysis with the data, and searched for the essence of the data. Subsequently, the main themes were identified and labeled.

Rigor

The credibility of the findings was established through peer checking, member checking, and recruiting a maximally-varied sample from health-care professionals who had different EHE-related experiences.^[37,38] During peer checking, the first, third, and fifth authors independently coded half of the data. There was a general agreement among the codes sets that generated by them. Any disagreement in coding or categorizing was resolved through discussion among all authors. On the other hand, to ensure the dependability of the findings, we attempted strictly adhere to the aim of the study throughout its course and create a detailed record of all phases of the study. Then, a qualitative researcher, who was external to the study, was asked to assess the soundness of the phases and the findings. Moreover, transferability was ensured through recruiting a maximally-varied sample and providing thick descriptions about the phases of the study, our analytical activities, study participants, sampling procedure, and the time and place of data collection. Finally, we ensured the conformability of the findings through preventing our mentalities and assumptions from affecting the processes of data collection and analysis. Writing an audit trail as well as investigator triangulation also helped ensure confirmability.

Ethical statement

Ethical approval was obtained from the Ethics Committee of Tehran University of Medical Sciences, Tehran, Iran (IR.TUMS.REC.1394.2228). At the beginning of each interview, participants were provided with information about the aim and the methods of the study, voluntariness of participation, and confidentiality of their personal data. Then, their informed consent was obtained. All of the interviews were audiotaped with the consent of the participants.

RESULTS

From a total of 25 participants, 19 were male. They mean age was 41.5 and had a work experience of 11–31 years as hospital managers, faculty members, emergency medical service staffs, attending physicians, and clinical care providers [Table 1].

Factors behind the decision for EHE in disasters came into three main categories, danger of life and death (with three subcategories including population density, hospital characteristics, and incident characteristics); the feasibility of continuing service provision (with two subcategories including vulnerability of the hospital and capacity assessment of the hospital); and the necessary prerequisites for EHE (with two subcategories including administrative adjustments and the feasibility of safe patient transfer).

Danger of life and death

Commanding to evacuate a hospital is a very difficult task, of which decision-makers need to have strong, convincing reasons. The most significant factor behind this decision is the likelihood of physical threat to patients and staffs. The main mission of hospitals is to restore its clients' health. Thus, if an environmental factor in the hospital threatens patient health or life, then, the hospital needs to be evacuated. The risk assessment and estimation main category had three subcategories, namely population density, hospital characteristics, and accident characteristics.

Table 1: Participants' information based on demographic characteristics, education degree, and job experience

Demographic	characteristics
Age (years), range (mean)	31-54 (35)
Sex (%)	
Male	17 (68)
Female	8 (32)
Education level (%)	
Master of science	4 (16)
General physician	6 (24)
Doctor of philosophy	7 (28)
Specialist physician	4 (16)
Master of public health	4 (16)
Job characteristics (years), range (mean)	
Work experience	11-31 (14)
Crisis management experience	6-12 (8)

Population density

As an organization, a hospital has numerous patients, the number of whom widely varies in different time points in a day and night and in a year. Thus, the main component of risk assessment is the number of people (including both clients and staffs) who are at physical risk.

The number of patients who are at risk and the type of their health problems are important factors (P. 2)...Another important point is that other clients such as visiting family members or the clients of hospital laboratory or MRI center shouldn't be ignored (P. 11).

Hospital characteristics

A key component of decision-making for EHE is to collect adequate data about the subject of decision. Having complete information about the hospital, its building map(s), geographical position, history of previous hazards, and the reasons behind previous evacuations, if any, is crucial to make wise decisions for EHE.

You need to know the number of wards in the hospital, the number of its previous evacuations, as well as the geographical position of its elevators and emergency stairs. Moreover, you need to know whether it is located on an earthquake fault or not (P. 15).

Incident characteristics

The level of risk and the severity of outcomes largely depend on the type and the place of the incidents. There are different consequences in natural and human-made disasters. The EHE is affected by duration, time, and severity of disaster.

"The first thing I can say is the type of the accident. For example, when there is a fire, evacuation is very likely. The second item is the severity of the accident. For example, in case of an earthquake, its magnitude is a determining factor" (P. 7).

The feasibility of continuing service provision

As mentioned earlier, the main mission of hospitals is to provide health-care services to patients. When a hospital is unable to provide health-care services due to an incident, it should be evacuated. Failure to maintain care continuity can sometimes threaten the physical health of patients, particularly those hospitalized in critical care units.

"When we say emergency evacuation, it means that there is a situation in which the hospital cannot continue care provision" (P. 7).

"We should assess how much the accident has affected the main functions of the hospital or what have been the outcomes of the accident for the hospital" (P. 5).

This main category consisted of two subcategories which are explained in what follows.

Vulnerability of the hospital

The hospital is getting professional medical services to the patients in order to cure them and improve their quality of life. Any damage to the vital infrastructures of the hospital can impede care provision, interrupt care continuity, and thereby demand EHE. Thus, vulnerability assessment should be done at the shortest possible period.

“After an accident, we need to assess whether the hospital is able to provide care or it has damaged so severely that even electrical power and water system are down” (P. 18).

Capacity assessment of the hospital

The potential capabilities of the damaged hospital, i.e., its ability to provide care despite the incurred damages, can determine the possibility of maintaining care continuity and the need for EHE.

“You need to properly evaluate the potentials of your hospital and determine the available resources, the number of staffs you can recall to work, and the time period the hospital generator can provide electrical power” (P. 16).

The necessary prerequisites for emergency hospital evacuation

EHE has many prerequisites which can affect different aspects of EHE such as the appropriate time for EHE and safe patient transfer. These prerequisites include proportionate staff-patient ratio, staff competence in EHE, adequate patient transfer equipment and facilities, and access to emergency exits.

The first thing is to consider the possibility of evacuation and safe patient transfer. For example, our hospital has six floors and its critical care units are not in the ground floor. In my opinion, the possibility of patient transfer is a very important factor; perhaps, the most important one (P. 8).

Administrative adjustments

Like other organizations, all aspects of decisions made in hospitals need to be assessed carefully. Making necessary adjustments with senior managers is an important factor in making good decisions about EHE.

EHE necessitates top managers' permission. We need to make necessary adjustments even with the city officials, police, and the army in order to get their help and support (P. 13).

The feasibility of safe patient transfer

Most patients may be unable to move quickly and thus, competent staffs and standard equipment (such as

stretchers and ambulances) are needed for safe patient transfer. Moreover, the eligibility of the destination hospital(s) needs to be assessed. All these factors need to be taken into account to protect patients' lives and reduce negative transfer-related outcomes.

I need to assess and know the percentage of stable, critically-ill, and vulnerable patients. Moreover, I need to know the characteristics of our patients (i.e., whether they are elderly, disable, child, or pregnant) as well as the characteristics of our staffs (i.e., whether they have received adequate EHE-related training or not) (P. 9).

DISCUSSION

The results of this study showed that the most important factor in EHE was to assess and estimate the risk and physical threat. The administrators of nursing homes and found risk assessment as the most important factor behind the wise decision to evacuate.^[34] Similarly, other studies concluded staff and patient safety as two main factors in the process of an emergency evacuation.^[39] Moreover, a study into hurricane evacuation and sheltering and highlighted that any threat to clients' lives is a significant factor for emergency evacuation. In fact, emergency evacuation is a risk management strategy and needs to be considered in case of any serious threat to patients' and staffs' lives.^[40] As the perceived threat is a significant factor behind the decision for EHE, the probable effects of disasters should be simulated through simulation programs to predict the level of possible risk and also to develop an effective plan for its management.^[41] Developing and using data collection checklists can facilitate rapid risk assessment and wise decision making for EHE during disasters.

Another main factor behind the decision for EHE was the possibility of continuing service provision. The decision for EHE largely depends on the ability of the afflicted hospital to continue service provision and maintain care continuity.^[42] Wise decisions about EHE necessitates assessing whether the staffs of the afflicted health-care center can provide standard patient care or not.^[24] Assessing the vulnerability of the afflicted hospital can help estimate the possibility of continuing service provision. EHE necessitates considering many factors such as the vulnerability of vital infrastructures, the availability of electrical power for life support equipment, the accessibility to hospital surrounding roads, and the accessibility of safe pathways for patient transfer.^[43] Hospital infrastructure assessment should be performed before disasters to estimate the degree of vulnerability of the hospital and the potential consequences of an imminent disaster for the hospital and the adjacent areas.^[44] To improve effective

hospital management during disasters, managers need to be provided with quality in-service continuing educations about the importance of hospital vulnerability assessment in making a wise decision for EHE.

The third main factor behind the decision for EHE was the necessary prerequisites for EHE such as the capacity of the destination hospital(s), the pathways for EHE, and the availability of adequate ambulances, equipment, staffs, and communication systems. A successful emergency evacuation largely depends on effective communications both within the hospital and between the hospital and other settings. The main challenges of EHE are the problems related to the hospital internal communication system (i.e., the congestion of phone lines), nonfunctioning elevators, shortage of resources, and the need for negotiating with the destination hospitals.^[45] Therefore, inter-organization coordination and negotiations should be made before experiencing disasters to improve the collaboration of organizations during disasters.^[34] Communication and information management are also among the key elements of managing chaotic situations. Standardized checklists and worksheets can facilitate effective communication. Hospitals to develop emergency evacuation packs, which can include worksheets, phone numbers, transfer equipment and facilities, and disposable patient care instruments.^[22] Hospital administrators need to estimate the amount of time needed for the safe evacuation and transfer of all patients. Using well-designed evacuation in order to improve the quality of EHE-related decisions, comprehensive assessment and data collection forms, checklists, and worksheets need to be developed based on the specific conditions of each hospital. Providing assessment tools with aims for the decision of hospital evacuation is critical need related forms, checklists, and worksheets can help guarantee patient safety during EHE.

There are some limitations in the present study that need to be addressed.

CONCLUSION

The results of this study provide a broad range of context-specific factors that can contribute to the appropriate decision-making for EHE. The emergency evacuation decision-making process is very complex. These factors are the quick and careful assessments of risk, equipment, facilities, infrastructures, hospital vulnerability, and the feasibility of continuing service provision. Without such assessments, making a wise decision would be difficult and may result in unsafe evacuation. Future studies are recommended to focus on developing and validating such assessment tools.

Limitations

Recall bias from the study participants during the data collection and lack of generalizability of the findings to other geographic due to the small sample size and participants characteristics are the limitations of this study.

Conflicts of interest

There are no conflicts of interest.

Authors' contribution

All authors contributed to this research.

Financial support and sponsorship

Nil.

Acknowledgment

We hereby acknowledge the assistance all the dear ones who contributed to this research.

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