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Telenursing: A step for care management in disaster and emergencies

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Abstract:

INTRODUCTION: Unusual impacts of disasters on normal living conditions pose challenges to the health system. Nurses who take care of disaster victims may face situations that make decision-making difficult; hereon, the use of new technologies can be a useful solution. The study aimed to identify the telenursing care during incidents and disasters.

METHODS: The study was conducted at a medical science university in Iran from 2018 to 2019. This was a semi-structured interview-based qualitative study using content analysis. Eighteen nurses, nursing teachers, and emergency medical technicians were included in the study. Data analysis was performed using inductive content analysis and coding with MAXQDA (2010) software. The Lincoln and Guba (1985) trustworthiness criteria were used for the reliability and validity of the data.

RESULTS: Telenursing in critical and supportive care was the main theme identified from data analysis. This theme included six main categories: (1) management of trauma, (2) technical skills, (3) care and decision-making in stressful situations, (4) management of patients with special needs, (5) life-saving intervention, and (6) psychological and emotional supports.

CONCLUSIONS: Telenursing in disasters is the turning point of the care management of victims. In order to achieve this goal, nurses should acquire the relevant knowledge, skills, and abilities.

Keywords:

Disasters, incidents, qualitative study, telenursing

Introduction

Natural and man-made disasters in any form or any reason are the barriers to the sustainable development of communities.^[1] The intensity and frequency of events is a recurring phenomenon throughout the world.^[2] Based on the data from the International Disaster Database (EM-DAT), In 2017, 335 natural disasters affected over 95.6 million people, killing an additional 9,697 and costing a total of US \$335 billion.^[3] The effects and consequences of these events on various aspects of human life are destructive and sometimes have changed people's lives.^[4]

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Asia seemed to be the most vulnerable continent for floods and storms, with 44% of all disaster events, 58% of the total deaths, and 70% of the total people affected.^[3] Iran is susceptible to various geological and climatic hazards.^[5] According to a report by the Centre for Research on the Epidemiology of Disasters (EM-DAT), in 2015, Iran has always been exposed to hydrometeorological hazards including floods, earthquakes that caused a significant loss of life and economic loss.^[6]

When an incident inevitably strikes, people have the right to receive an effective response from health-care teams, and nurses play a vital role as part of disaster response units.^[7] Nurses compose a large

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portion of health-care professionals and have played essential roles in the disaster management cycle since Florence Nightingale provided care to the injured and ill during the Crimean War to the present.^[8] In the face of unexpected events, nurses are considered as important human resources. Therefore, their preparedness with the disaster knowledge and skills leads to the economic, social, and cultural development of societies.^[9-13]

Given the recent incidents of the past decade, there is an emphasis on developing a coordinated and comprehensive strategy to improve medical responses to disaster, and telemedicine is a tool in order to reduce the impact of a disaster and improve medical response.^[14] The fundamental idea of telemedicine is relied on the utilization of information and telecommunication technology for the delivery of clinical.^[15] The use of telemedicine in incidents and disasters in the treatment and triage of injuries can be very helpful.^[16] Information and communication technology (ICT) in health care has become a political priority worldwide.^[17] In recent decades, the advancement of information technology has provided important opportunities for nurses worldwide to be aware of patients' conditions, which has led to new roles for them and increased decision-making power in nursing care delivery.^[18] Telenursing includes all kinds of nursing care and services that can be provided from distance and includes a wide range of communication technologies such as phone, fax, E-mail, internet, and video clips to overcome the time and distance barriers to provide better nursing care.^[19]

The success of the disaster response phase depends on the timely presence and delivery of relief and rescue actions. Therefore, the application of telemedicine technology during incidents has enhanced the quality of care provided.^[20] Over the past several decades, the integration of telemedicine programs into relief and rescue stages has proven effective in supporting populations during disasters.^[21] Organized care in a health system damaged by a disaster is one of the benefits of using telemedicine in incidents.^[22] The first application of telemedicine in major events began in the mid-1980s. In the 1985 Mexico City earthquake, the National Aeronautics and Space Administration provided advanced satellite communications services for the international disaster response.^[23] During the following decade, telemedicine was used in various ways in response to natural disasters, such as earthquakes, tsunamis, and storms.^[24,25] The mean capability of implementing the surge capacity programs by hospitals of Kerman Province in disasters and in four fields of equipment, physical space, human resources, and applied programs was evaluated weak.^[26] Thus, telemedicine can be applied to enhance the surge capacity of the health-care system and the speed and effectiveness of medical responses.^[27] Disasters are inevitable parts of human life^[28] and according to the shortage of specialized

nurses in disaster areas, telenursing program will provide a new window for care. Hence, it is essential for combining nursing care with ICT to provide help to victims of disasters.

While some studies have been carried out on telemedicine in disaster, to date, no study has investigated telenursing care during disaster. Therefore, this qualitative study aims to identify the telenursing care in incidents and disasters.

Methods

Study design, sample, and setting

The research was part of a larger mixed-methods study designed to identify telenursing care in disaster relief. The qualitative approach has been done for extracting the participants' viewpoints on telenursing care in incidents and disasters. The sampling method was purposed as a nonprobability sampling technique. Sampling methods mean the purposeful selection of samples for the acquisition of knowledge and information.^[29]

Data were collected through semi-structured interviews. This kind of interview was appropriate because of the flexibility and depth of qualitative research. Participants were 18 nurses, nursing teachers, and emergency medical technicians. The selection of participants was determined using a purposeful sampling method. Individual Interviews were performed in Iran between November 2018 and May 2019.

After identifying the eligible individuals and consultation with the supervisors, the participants were interviewed. The time and place of interviews were arranged according to the participant's preference. At the beginning of interviews, written informed consent was obtained from the participants. In order to maximize diversity in the selection of participants (in terms of age and years of experience), the researcher selected individuals who have experiences of the medical response to disasters and they have not.

The interview guide was designed based on the theoretical foundation of the research and review of literature as well as the study objectives to conduct a semi-structured interview. The questions were reviewed and finally approved by the researcher and the supervisors. Each interview began with the general question, "please tell me about telenursing?" and "care types that can be delivered by telenursing in disasters?"; participants' responses were clarified and expanded upon by follow-up questions. Interviews were recorded using a digital voice recorder, and the notes were also taken simultaneously. The interviews continued until thematic saturation was achieved, or no new ideas surfaced from subsequent interviews.

Data analysis

All interviews were transcribed verbatim and compared with the original audio-recorded digital files for accuracy. Data were analyzed using qualitative content analysis. The analysis started by identifying units of meaning that were essential to the participants' experiences and were extracted from the statements. The codes were compared based on differences and similarities and sorted into categories and subcategories that were discussed within the research team; the appropriate theme was then extracted from the data.^[30] Maxqda 10 (VERBI Software. Consult.Sozial forschung GmbH, Germany) was applied for coding and content analysis.

Credibility was established through field notes and memos, prolonged engagement with the participants, and revisions by the participants using member check and peer check. The use of a wide range of informants (male/female and in different health positions) is one way of triangulating via data sources that can help trustworthiness. The triangulation of researchers in the research team helped to take into account different perspectives when analyzing the data. The findings and interpretations of the study were reviewed by the research team as an expert revision. The maximum variation of sampling established the credibility of the data.^[29]

Ethical considerations

The study was approved by the Ethics Committee at Kerman University of Medical Sciences (The Ethic Approval Code: IR.KMU.REC.1397.473). Moreover, written permissions were signed from participants for recording interviews and participation in the study. For all participants, it was made clear that they could withdraw from the study at any time. The raw data, including transcripts, were stored securely and were accessible only for the research team.

Results

The mean age of the participants ($n = 18$) was 38 years, and nine were male. Participants had between 7 months and 28 years of work experience and 66% exposure to work in disaster relief. Most of the participants held BSN.

Analyzing participants' experiences resulted in the extraction of one main theme, and six categories are shown in Table 1.

Theme: Telenursing in critical and supportive care

Most of the participants declared that the use of telenursing in critical and supportive care. This theme included six main categories: (1) management of trauma, (2) technical skills, (3) care and decision-making in stressful situations, (4) management of patients

with special needs, (5) life-saving interventions, and (6) psychological and emotional supports.

Management of trauma

This category was one of the main categories of telenursing care in disaster. It is divided into three subcategories: "management of physical injuries," "management of comatose patients," and "special events (Chemical, Biological, Radiological, Nuclear, and Explosive)." One of the participants stated that: "In case of fractures in lower limbs, sometimes you do not feel the pulse. If there is a far distance, how we can survive the limb; how the position of the fractured limb should be; its movement; its maneuver? They need to contact somewhere" (Interview #5).

Management of physical injuries

According to participant experiences, since there are a variety of traumatic injuries in disaster area, taking care of the wound and control of bleeding are of great importance. These services can be delivered by telenursing. One of the nurse participants stated that: "For example, an open wound can help; if it is bleeding, it can help be compression dressing, intravenous therapy, and fluid therapy; they are greatly helpful" (Interview #10).

Another participant quoted: "For example, close top of the bleeding site tightly. Put the limb in the straight line; do not move it; check the pulse in the limb extremity, and fix it in the same position. I can also repeat it on phone for an experienced nurse" (Interview #3).

Management of comatose victims

Determining consciousness level from distant was one of the important categories that emerged through data analyses. One of the participants stated that: "For example, check the patient's GCS. Well, maybe he cannot check it at that moment; for example, he says the patient opens his eyes, opens them with sound stimulator, opens with pain stimulator; does the patient has reflexes? He measures the patient's GCS and it helps him. It can help a lot in measuring GCS" (Interview #2).

Special events (Chemical, Biological, Radiological, Nuclear, and Explosive)

The care of modern war victims (nuclear, chemical, biological, etc.) requires special expertise that many nurses lack related knowledge and skills. A nurse said: "In nuclear care, we first should say wear gloves and boots, wear scrubs, take which one off, keep what distance, how to wash them, about 80%–90% of the points can be taught in this way" (Interview #13).

Technical skills

According to the majority of participants, technical skills are one of the important topics in disaster scene. This

Table 1: Theme, main categories, and subcategories

Main theme	Category	Subcategory
Critical and supportive care	Management of trauma	Management of physical injuries
		Management of comatose patients
		Special events (CBRNE)
	Technical skills	Implementation of treatment orders and specific capability
		How to work with medical equipment
		Prioritizing victims and Incident management
Care and decision-making in stressful situations	Initial assessment of patients	
	Chronic care and vulnerable groups	
	Management of life-threatening conditions	
Management of patients with special needs	Psychological and emotional support	Stress management
Life-saving interventions		

CBRNE=Chemical, Biological, Radiological, Nuclear, and Explosive

category has two subcategories: “implementation of treatment orders specific capability” and “how to work with medical equipment.”

Implementation of treatment orders and specific capability

According to participants’ ideas, fluid therapy and calculate the dosage of medications by telenursing was feasible. A participant stated that: “For example, the nurse says: “I cannot find the patients’ vein. One from far distance in the headquarter replies: “Give these drugs in these doses through a tracheal tube!” (Interview #2).

How to work with medical equipment

The lives of some disaster victims depend on medical devices. According to nurses’ viewpoints, guidance of nurse at the scene to work with medical equipment such as setting a ventilator using audio-visual communication devices plays a critical role in treatment management. One of the nurses stated that: “It can help in setting up a ventilator. It should be set by an anesthetist, but at that moment, the nurse in the headquarter can guide the nurse at scene; for example, look at patient’s breathing; is it spontaneous or not? In case of spontaneous breathing, for example, set the device to SIMV mode. The nurse can ask for help in such things” (Interview #2).

Another participant also said: “For example, it can help in using the Ambu-bag. The nurse may not know how to put it on patient’s face; we should say: “Look at patient’s chest, it is OK if goes up; but if it does not go up, it means that the Ambu-bag was not put properly and its position have to be changed” (Interview #2).

Emergency medical technicians stated: “The lessons learned from the Sarpol-e Zahab Earthquake were that the university had sent several teams; nurses, technicians, etc. They were sent to a field hospital or clinics. As soon as a patient arrived, medical team was asked to take electrocardiography (ECG), but they did not know how to work with devices; they were old fashioned models or modern ones. I remembered that if at that time we had

an access to a person who was familiar with the device, he could guide them” (Interview #3).

Care and decision-making in stressful situations

Guidance of nurses in disasters from far distance in order to help them may elevate confidence in the medical team and reduce injuries and outcomes of the incidents. The category included two subcategories. A nursing teacher stated: “It is a very complicated situation that I cannot figure out the exact problem. Maybe I am wrong. As a first response person; maybe I wasted my time with a patient; there should be someone to give me help in triage” (Interview #1).

Another participant also stated that: “At the scene of the disaster, even if there is an expert nurse, she really needs someone to help her” (Interview #2).

Prioritizing victims and incident management

Prioritizing victims, triage, guidance in pediatric triage, and management of transportation of injured patients were the points stated by participants. A participant stated that: “... Or number of injured patients are high; I can say arrange them in groups and triage them; prioritizing was done; now manage them in order” (Interview #3).

Another participant said: “It is important in transferring victims; when people are stressful and want to get victims out of rubble in any way” (Interview #11).

Initial assessment of patient

Participants’ statements indicated that measuring vital signs of victims and reporting them via a communication tool can play an important role in saving the lives. One of the nurses stated that: “Look, maybe the nurse does not have the sphygmomanometer at scene; one should say: “check the pulse.” For example, the nurse replies: “The patient does not have radial pulse”; check his femoral pulse; he does not have femoral pulse, check his carotid pulse; in this way you can measure his blood pressure at least. If the patient has radial pulse, his blood pressure is above 9 mmHg, but if he has not, the patient is going into shock” (Interview #13).

Management of patients with special needs

Elderly, children, and pregnant women are the most vulnerable groups in disasters, and the interpretation of participants' statements played an important role in the formation of this category. This category has one subcategory: one of the participants stated that: "For example, regarding a pregnant victim, she is already known as a high-risk mother. If the rescuer is being informed about her pregnancy, for example, he can help the mother contact a midwife or a midwife technician; if the patient reports bleeding or amniotic fluid leakage, for example, the midwife guides the rescuer to check her contractions; are they continuous or not? He even might help her with the normal vaginal delivery" (Interview #2).

Another participant stated that: "With telemedicine in disasters, many problems would be solved. For example, regarding the Varzaghan earthquake, when we went there, many old men and women even did not receive adequate first medical care. They were just visited and since they were old and did not manifest problems seriously, health-care services were not properly delivered to them. But further examinations revealed that they were injured, but did not exaggerate them like younger ones. The person in place should carefully assess all the patients and if cannot diagnose, he should contact headquarters" (Interview #5).

Chronic care and vulnerable groups

According to participants' ideas, in disaster, signs and symptoms of chronic diseases make acute, and the use of telenursing is a valuable help in medical practices such as ECG interpretation. A participant stated that: "Look, I have the experience of emergency management. Several times I visited old men, there are usually the elderly people who have a complicated condition and an emergency technician, nurse, or even an experienced physician cannot exactly detect their problem and the service that should be delivered to them. Patients with diabetes should inject insulin; well, under such circumstances what shall I do for such a patient who developed hypoglycemia shock or diabetic ketoacidosis shock? I do not have required facilities or even I might not have the related education; well, what shall I do? I can make a voice call immediately and ask a guide" (Interview #1).

Life-saving interventions

It is divided into one subcategory: management of life-threatening conditions.

Management of life-threatening conditions

Guidance on life-saving care, step-by-step implementation of resuscitation guidelines, the way of positioning an airway injured victim, and removal of a foreign object

from the airway of a victim trapped under the rubbles were the points noted by the participants in order to provide services that reduce mortality. Two participants stated: "Check the patients' airway. For example, the rescuer says the patient's airway is open and breaths comfortably. Then, check whether is it cyanotic or not. Such guidance can be given step-by-step. However, he may say it is not cyanotic" (Interview #13).

"Give everyone a position. Take the patient's jacket out and put it under his head; it opens his airway and can breathe comfortably, or put a bag under her shoulders; her airway opens. Such guidance can be given" (Interview #3).

Psychological and emotional support

It is divided into one subcategory: stress management.

Providing psychological care to disaster victims through telenursing was one of the points highlighted by the participants.

Stress management

The findings of the study showed that, undoubtedly, in chaos resulting from the disasters, such services play an undeniable role in recovery of the community and emotional rehabilitation. One of the nurses stated that: "Patients experiencing stress resulting from disaster have no physical damage, but since they were the witness of relatives' death they might experience a nervous shock. And now, if it keeps communication can help to the victim in the acute phase" (Interview #11).

One of the nursing teachers stated that: "Mental distress after earthquake is so high that may result suicide, especially in the ones with a history of depression. Under such conditions, although some studies were conducted in this regard, a nurse with no working experience in the department of mental health to know what to do what? using telenursing or telemedicine can be very helpful" (Interview #1).

Discussion

A shortage of specialized clinicians, such as physicians and nurses, at the time of an incident, is a challenge for health-care systems. Therefore, telenursing program will provide a new window for care. In the present study, we focused on the telenursing care in incidents and disasters. Telenursing in critical and supportive care was the main theme. From the viewpoint of the study participants, according to shortage of expert nurses at the scene of disaster, providing telenursing can be a noble and useful idea. Few studies have been conducted in this area, and according to the research aim, our discussion of this study can be categorized as follows.

Management of trauma, technical skills, and care and decision-making in stressful conditions

The findings of the study showed that the management of trauma, technical skills, and care and decision-making in stressful conditions can be managed from far distance during disasters. Most of the participants stated that nurses do not have sufficient knowledge and skills in trauma-specific care and need to be guided at the scene. Management of neck trauma and hypovolemic shock, taking care of a comatose patient, prioritizing and triage of injured patients, calculating medication doses, nursing care in prescribing blood products, ventilator settings, the way of using Ambu bag for victims, and special care according to the type of event can be provided by utilizing appropriate infrastructures to reduce physical, mental, and spiritual damage. In the study by Meade and Lam after the 2005 Pakistan earthquake, victims were consulted in infectious diseases, burns, trauma, and intensive care.^[31] Furthermore, in the study of Moughrabieh *et al.*, it is possible to provide a variety of consultation for multiple trauma victims of war with the deployment of a tele-intensive care unit (ICU) program in more than ten Syrian hospitals. Furthermore, the victims of the chlorine gas attack in Idlib (Syria) were cared for acute respiratory distress by a tele-ICU program.^[32] In other studies, telemedicine was used to provide consultation for victims in trauma, burns, ophthalmology, doses of drugs, radiology, and infectious diseases.^[33-35] The results of this qualitative study showed that telenursing played a crucial role for triage of injured patients and management of referral cases. The results of Cicero *et al.* study showed that the role of telemedicine in disaster triage. The timing and accuracy of triage were also compared between two groups of victims with and without telemedicine care along with a maneuver in 2014.^[36] Furthermore, the results of the Ziadulo study showed the advantages of utilizing telemedicine in disasters such as reduced medical errors and unnecessary referrals, increased hospital readiness, timely and accurate treatment, and increased chance of survival.^[34] The study by Jamal *et al.* showed that telemedicine could reduce the rate of unnecessary referrals after natural disasters by approximately 43%.^[37] Furthermore, the study of Xiong *et al.* showed that telemedicine was very useful in reducing the number of referrals and time required to transfer victims to specialized centers.^[28] According to participants, providing guidance for properly assessing the patients' health status, assisting in the diagnosis and care of victims, and guidance on taking care of victims according to the location and condition of the event were perfectly highlighted the importance of establishing telenursing in disaster. The study by Meade and Lam showed that the provision of medical services in humanitarian missions in Angola as well as after earthquake in Pakistan led to changes in the diagnosis

and treatment of victims.^[31] The final diagnosis was changed in 21% of victims in Najaf Shoahal Hospital after Pakistan earthquake by receiving telemedicine^[37] and in the Spacebridge project between Russia and Armenia, providing that telemedicine services after earthquake greatly helped physicians present at the scene and made a significant change to the treatment and clinical diagnosis of victims.^[38]

Special needs, life-saving interventions, and emotional and psychological support

Another finding of this study was the care of patients with special needs, life-saving interventions, and emotional and psychological support. Although such cares were less frequently noted by the participants, step-by-step guide to perform resuscitation, giving a position to patients with airway trauma, care for pregnant women, nursing for children and elderly people, and psychiatric support to victims were among the most important issues stated by the participants. In the study Meade and Lam following the Pakistan earthquake, teleconsultation was provided for children with malnutrition and tetanus, diphtheria, malaria, or sepsis.^[31] Furthermore, in the study, Moughrabieh *et al.* showed that the management of postoperative care, patient transfers, giving treatment orders to nurses over phone, and disconnecting the patient from the ventilator were among the services provided by nurses in the Syrian war using a tele-ICU program.^[32] In the study, Kim *et al.* reported that telepsychiatry had used for postdisaster Gulf Coast recovery,^[39] which is consistent with the present study findings.

Study limitations

The relatively small sample size limits the general applicability of the results. Some of the participants were not familiar with the concepts and applications of telemedicine and telenursing. The selection of samples from diverse groups and singularity of the study in Iran extended its applicability.

Conclusions

Telenursing care in incidents and disasters is a new and applicable topic in disaster management. The present study extracted these cares to provide better health-care services for victims in high-risk conditions such as disaster. According to the present study findings, telenursing by safe and incident-specific communication technologies in critical and supportive care such as management of traumatic victims, technical skills, care and decision-making in stressful situations, management of patients with special needs, life-saving interventions, and psychological and emotional support is feasible. According to the shortage of specialized nurses in disastrous areas, telenursing is a precious step in

reducing physical, mental, and spiritual damage of the affected community.

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Conflicts of interest

There are no conflicts of interest.

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