Designing a model of patient tracking system for natural disaster in Iran

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Abstract:

CONTEXT: Disaster patient tracking consists of identifying and registering patients, recording data on their medical conditions, settings priorities for evacuation of scene, locating the patients from scene to health care centers and then till completion of treatment and discharge.

AIM: The aim of this study was to design a model of patient tracking system for natural disaster in Iran.

MATERIALS AND METHODS: This applied study was conducted in two steps in 2016. First, data on disaster patient tracking systems used in selected countries were collected from library-printed and electronic references and then compared. Next, a preliminary model of disaster patient tracking system was provided using these systems and validated by Delphi technique and focus group. The data of the first step were analyzed by content analysis and those of the second step by descriptive statistics.

RESULTS: Analysis of the comments of key information persons in three Delphi rounds, consisting of national experts, yielded three themes, i.e., content, function, and technology, ten subthemes, and 127 components, with consensus rate of over 75%, to provide a disaster patient tracking system for Iran.

CONCLUSION: In Iran, there is no comprehensive process to manage the data on disaster patients. Offering a patient tracking system can be considered a humanitarian and effective measure to promote the process of identifying, caring for, evacuating, and transferring patients as well as documenting and following up their medical and location conditions from scene till completion of the treatment.

Keywords:

Model, Patient Trcking System, Natural Disaster, IranIran, model, natural disasters, patient tracking system

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Introduction

According to Rothenhaus emergency medicine specialist of the American College of Emergency Physicians, patient tracking refers to tracking physical location of the patient, and its another conceptual domain is related to the patient's treatment progress and tracking his/her medical needs during delivery of emergency services.[1] Fristoe defines disaster patient tracking as identifying patients and registering their names, registering data on them and their medical conditions, setting priority for evacuation of the scene according to the triage color, following up and locating them from the scene till arriving at health-care centers and then completion of the treatment course and discharge.[2] Patient tracking systems are developed and implemented for several reasons, including making the delivered health-care services visible, reuniting family members, managing and allocating resources, guiding distribution of the patients, preventing spread of disease among the patients, and sharing information between prehospital emergency teams and hospitals.[3,4] These systems display the patients' demographic information such as name, gender, location, and health-care services provider (s), clinical data such as the

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patient's main complaint, orders and discharge status, workflow indicators, and the main alerts such as patients with similar name or vulnerabilities.[5] According to the International Committee of the Red Cross, identifying the patients in disasters is one of their legitimate rights, and from humanitarian perspective, their families who seek to know which conditions their family members are facing and in which location they have been evacuated. As well, even deceased people have the right to be identified.[6] Therefore, the need for real-time documentation and management of identifiable and medical information and information on location of patients and the displaced, tracking and organization of these people during evacuation from the scene to specific health-care centers, as well as development of new technologies to meet this need are essential.[7-9] The results of Quinn's study entitled patient tracking using grounded theory and interview with experts led to the development of a national system consisting of 17 nativized modules to be used with collaboration of concerned beneficiaries and organizations.[4] Turcu offered a system, functioning based on radio frequency identification (RFID) and data model, to provide efficient, greatly functional and reliable, low-cost, and user-friendly mediators to implement the management of information in emergency health care.[10] Morres developed an online tracking system based on a wireless network equipped with routers in ambulances and online direct control of registering patients and data on their triage through bar-code cards; this system was tested for its feasibility in a disaster maneuver. The findings indicated that a local radio network of hotspots with portable routers and General Packet Radio Service-based communication equipped with a well-operating central database works well.[11] The current status of Iran's preparedness to deal with natural disasters in terms of identifying, locating, and tracking patients is representative of a wide gap in both emergency preparedness and health management in disasters.[12] Therefore, it is vital to develop an efficient tracking system to document patients' conditions and locations from scene till evacuation and transfer to health-care centers, deployment in hospitals to proceed with treatment, and ultimately complication of the treatment course and discharge from health care system to prepare for and respond to disasters in Iran.[13-16] The aim of the present study was to develop a model of natural disaster patient tracking system for Iran.

Materials and Methods

Study design

This applied and qualitative study was conducted in two steps. First, the available patient tracking systems in the USA, England and Japan, were studied. The data were gathered by a data extraction form whose validity had already been confirmed by three experts on health information management and two experts on disaster and emergency medicinehealth. In this step, the data were analyzed by content analysis. Then, a preliminary model of patient tracking system was developed and validated using Delphi technique.

Population study

In the first step, the population of the study was the printed and electronic materials from library and databases, government reports and documents, websites of Ministry of Health, Red Cross, and related agencies of health disaster management in the selected countries. In the second step, the study population consisted of emergency medicine specialists, emergency nurses, medical and administrative personnel of Red Crescent and Emergency and Disaster Management Center, and experts on health information management and health information systems in Iran. The sampling was done according to nonrandom purposive type. Twenty key informants participated in the first and second Delphi rounds and 16 of them in the third round. In this step, the data were analyzed using descriptive statistics.

Results

The results of the first step of the study yielded the components of currently used tracking systems in the selected countries. These components were categorized into three themes, i.e. data, function, and technology [Table 1].

In the second step, Delphi technique was implemented, and overall, 127 components were agreed on by domestic key informants with consensus rate of over 75%.

The three domains were confirmed. The only change was that data were renamed from data to content. Table 2 shows the changes and corrections in the relevant components recommended by the experts' panel.

Discussion

The present study was conducted to provide a model of patient tracking system for natural disaster in Iran. Analysis of the participants' viewpoints in the third

Table 1: Conceptual model of patient tracking components in the selected countries

Themes	Sub-themes	References
Content	Demographic data	[2,8,16-25]
	Medical data	
	Location data	
Function	Locating, tracking, and regulating	[1,16,17,21,23-30]
	Reporting and informatics	
Technology	Software equipment	[11,16,22,26,30-43]
	Hardware equipment	

Table 2: Recommended domains and components of patient tracking system in the first round of Delphi

Domain	Components and characteristics
Content	Minimum data set: Demographic characteristics, appearance specifications, medical information, and location information
	Other data: More elaborate medical data and demographic characteristics of patients and location information
	Secondary data
Function	Locating, tracking, and regulating
	Statistical reporting and informatics
Technology	Tagging
	PDA
	Laptops including GPS and PAN
	Web portal
	Software capacities and capabilities

PDAs=Personal digital assistants, PAN=Personal area network, GPS=Geographic positioning system

round demonstrated that all three themes, i.e., content, function, and technology, are vital to develop this model.

The minimum dataset, other data, and secondary data were derived to be among the most important components of the model. The minimum dataset was assigned to four categories – demographic characteristics, appearance specifications, medical information, and location information. Other data consisting of more elaborate medical data and demographic characteristics of patients can be registered in the system after the patients' evacuation from the scene and deployment in a health-care center such as a field hospital or other types of hospitals. Besides that, the secondary data were assigned to this category. These findings are consistent with studies conducted by the AHRQ entitled recommendations for disaster patient transfer tracking and organization system,[8] Advanced Health and Disaster Aid Network collaborating with prehospital emergency services, and Johns Hopkins University Applied Physics Laboratory,[17] common project of University of California San Diego and California Institute for Telecommunications and Information Technology funded by the National Library of Medicine,[18] Report of Ministry of Defense of the England,[19] Report of Ministry of Health, Labour and Welfare (MHLW) issued by Kyushu University Hospital, Fukuoka, in collaboration with the Osaka General Medical Center[20] and Software Engineering Department, Faculty of Engineering, Bahcesehir and Kyungsung University, Turkey, and Department of Industrial and Management Engineering, Kyungsung University.[21]

In the studies conducted on emergency and disaster patient tracking system, the function theme of this system has already been highlighted. The most important subthemes of this theme are locating, tracking, and organizing disaster patients, which has been clearly mentioned in the AHRQ recommendations for disaster patient transfer tracking and organization system,[8] Battlefield Medical Information System-Joint/Tactical Army's Telemedicine and Advanced Technology Research Center,[22] Integrated Patient Tracking Initiative (IPTI) George Washington University,[23-24] Next Generation Electronic Triage supported by the USA, National Library of Medicine, Washington DC Metropolitan area,[25] and optical pattern recognition-based health information management system of Department of Medical and Welfare Management, Koshien, and Seibi Universities, and Institute of Nursing Care for People and Community, University of Hyogo.[26]

The findings of the present study were consistent with the above-cited studies regarding locating and determining the medical conditions of the patients by authorized users, exchanging the information between prehospital emergency and responsive hospitals' emergency departments, updating the location of the patients' residence or treatment, updating the information on the patients' health conditions at place of their residence or treatment, locating ambulances and destinations, and tracking the patients' discharge or transfer.

Reporting and information release were a concept found to be confirmed by the model in the present study. This finding is consistent with IPTI George Washington University,[23,24] tracking the patients' at England's Ministry of Health,[19] Emergency Medical Information System of MHLW,[20] Disaster and Mass Casualty Information Management System of Tokyo Electronic Systems Corporation in collaboration with the Osaka General Medical Center of the Osaka,[27] project on information-support solution in Emergency Medical services of Fukuoka Medical Association[28] which confirms the components drawn from the model in this study.

Regarding technology theme, in the present study, tagging, personal digital assistants (PDAs), laptops available at scene equipped with GPS and personal area network, web portal, and software capacities and capabilities were derived, which is consistent with other studies. Electronic triage tags such as smart tags and other sensors to determine triage level and identify the patients, confirmed in the present study, are in agreement with Tactical Medical Coordination System Department of Energy's Pacific Northwest National Laboratory and the Naval Aerospace,[28] trauma patient tracking system,[29] also the measures of Advanced Health and Disaster Aid Network collaborating with Washington's public health and prehospital emergency services,[17] Study of three groups of Washington's public health and prehospital emergency services supported with National Medical Library,[25] electronic patient record

at John's Mercy Medical Center at the USA,[30] Wireless Internet Information System for Medical Response in Disasters in common project of University of California, San Diego School of Medicine and California Institute for Telecommunications and Information Technology Funded by the National Library of Medicine,[18] Disaster and Mass Casualty Information Management System collaborating with Tokyo Electronic Systems Corporation in collaboration with the Osaka General Medical Center of the Osaka[27] that have reported use of radio-frequency identification RFID tags, standard tags IEEE 802.11, bar-code, and smart triage tags.

A component derived from the model in the present study regarding technology theme was the use of PDAs in triage and secondary triage of the patients in the scene by rescuers and emergency medical services team, identifying the patients, taking photographs of the patients for subsequent identification, monitoring vital signs, recording the patients' main complaints and vital information, medical care, and status of evacuation from the scene, mapping for planning for the scene, observing and rapidly transferring the resources to different zones. This is consistent with wireless medical system for triage of advanced aid disaster network,[31] study of three groups of Washington's public health and prehospital emergency services supported with National Medical Library,[25] electronic patient record at John's Mercy Medical Center at the USA,[30-54] Wireless Internet Information System for Medical Response in Disasters in common project of University of California, San Diego School of Medicine and California Institute for Telecommunications and Information Technology Funded by the National Library of Medicine,[18,44] Patient at a Glance and Emergency Vital Signs Tracking' project in England,[32,56] Disaster and Mass Casualty Information Management System collaborating with Tokyo Electronic Systems Corporation in collaboration with the Osaka General Medical Center of the Osaka,[27] project on information-support solution in Emergency Medical services of Fukuoka Medical Association.[28-58]

There are some significant hints in the current study that distinguished it from the other studies. Some other studies including government report or common projects done by the different universities or research centers, also the various developed systems which deployed in the exercises or in the real scenes, encompass rarely the three domains which our study identified and focused them, so that in the projects such as Recommendations for a National Mass Patient and Evacuee Movement, Regulating, and Tracking System from Agency for Healthcare Research and Quality,[8] also the government's report entitled Challenges and Recommendations Towards a National System for Patient Tracking,[2] Joint Patient Tracking Application/Veterans Tracking

Application: A Joint Platform for Interdepartmental Data Exchange,[33] and the England patient tracking system.[19] The most emphasis was on the content and function of the patient tracking system. In contrast, the other studies such as trauma patient tracking system,[29-31] wireless medical system for triage of advanced aid disaster network,[31] and Efficient health information management systems using wireless communications technology to aid disaster patients[51] were emphasized on required technology capabilities, software and hardware in developing a patient tracking system for natural disaster.

Conclusion

Some recommendations, guidelines, and regulations, particularly in terms of content and technology have been offered by the above-cited studies to develop a national patient and evacuees tracking system. In contrast, a wide spectrum of the studies have adopted a technological approach, and the researchers, with universities' or information technology and telecommunication research centers' collaboration, took measures to develop different systems that have been implemented mainly in maneuvers but rarely in real disaster scenes. However, the present study has elaborately addressed the main infrastructures of this system including content, function, and technology. Besides that, the methodology of our study was completely different from those of other studies.

Conflicts of interest
There are no conflicts of interest.

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