

The Medical Module For Disaster Information Systems

[Elif Çalık, Hilal Kaya, Kemal Akyol, Baha Şen, Fatih Vehbi Çelebi, Rıdvan Atilla]

Abstract—The aim of this study is to improve a medical module providing data flow between data center and pre-hospital disciplines like nearby hospitals, field hospital, temporary inhabiting areas such as tent city and vehicles for transportation by using the internet. This study is conducted by using Microsoft Access database and SQL query to inform database applications so that the real-time information flow between health care experts and health care team in the disaster area is provided. System has been created on Microsoft .Net platform using C# language. MMDIS can be used kind of a field like all the pre-hospital processes. Web application enables access to database. On the other hand, the professionals who use this application have different permissions to access this database. The professionals' duties specify those permissions. Interfaces have been created to access the database that enables data entry, data query, data storage, delete data etc. The users' access to the web application is provided by www.afmedinfo.com. The real-users tests are organized to evaluate this application's achievements. These tests include the experiences of 13 users who are volunteers. The body language, hands and eyes movements of the users are being recorded with a camera. It will be measured how much and how long these duties will have been achieved by the end of April. The results obtained from these tests will be used for the reengineering of web applications. After that, these tests will be reapplied and obtained results will give the last form of this web application. Finally, new awareness that how disaster-based information systems are used in the field of health is improved with this study. This awareness provides not only the disaster information system which is an early warning system but also data flow which manages the process about victims in the disaster area. In addition to this, subjects and the differences of the health care practices of disaster information systems are uncovered.

Keywords—Disaster Information System, Medical Module, Disaster, Medical Informatics

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I. Introduction

From time to time disaster has gained currency as a part of a natural life since the existence of human being. Most of the world population is under the risk of natural disasters. Annual reports about kinds, effects and results of disasters developing on Earth, preparation to a disaster with politics and strategic approaches etc. are being prepared. The annual reports published by International Red Cross and Association of Red Crescent Federation can be given as an example. According to the reports, it is informed that what kind of a disaster has happened the community affected by that disaster comes across dramatic results in terms of biological, physical, social and economic sides and it leaves a negative effect on the countries which contribute to demolish this disaster (1-5).

The most important time to save the life in a disaster is the first 72 hour. Therefore, it is crucial that endeavors to save a life are done fast, coordinately and effectively. Voiced and paper based record system is generally used to dispatch rescue teams for health necessities, be able to refer disaster victims according to their circulation. The amount of physical damage in a region affected by the result of a disaster makes the usage of communication technology limited and depending on it the conducting these processes in the frame of limited is being blocked (6). To be able to make the data entry and data flow being essential for fulfilling health necessities real, the usage of information technology and the coordination of processes like disaster victim, logistics, staff and dispatching is projected an important role on information got from the data after the disaster and depending on disaster risk and process about crisis management thanks to registering process stages.

As analyzing the studies about this topic in our country, it can be seen that studies are focused on Geographic Information (GIS)-based systems (7, 8). Also there are some studies about disaster preparedness and disaster management applications (9, 10). Whatever purpose of scale does the information system have, it should be capable of data collecting, editing, analyzing and also communication and data evaluation capacity. Responsibility area of each unit that will collect and manage the information should be identified (11).

It is aimed to store the records in an electronic platform, process and transfer them when required by the help of the developed system, Medical Module for Disaster Information System (MMDIS). In this study the achievement of the system is also tested.

II. Methods

The software applications of this study is conducted at department of Medical Informatics, Health Science Institution of Dokuz Eylül University. The user tests of this study which started at the beginning of February is planned to be completed at the end of April at Emergency Service of Yıldırım Beyazıt University Atatürk Education and Research Hospital in Ankara.

A. Software Development Process

This study is handled within the frame of providing information flow among health care professionals in a disaster, coordination of health care team and transferring complete information to specified people at real time. This study is conducted by using Microsoft Access database and SQL query to inform database applications so that the real-time information flow between health care experts and health care team in the disaster area is provided. System has been created on Microsoft .Net platform using C# language. MMDIS can be used in a field like all the pre-hospital processes.

A system is a combination of the related components that are brought together in order to accomplish an objective, have predetermined restrictions and have input and output parameters. On the other hand, an information system is a combination of related objects that are designed in order to collect, store and process data for correctly made decisions as ensuring organizational coordination. One of the golden key of competitiveness in the globalized world is the speed of accessing to information. In the health care sector, speed and efficiency of access to information is a vital issue. According to the results of system analysis, general process steps of health services in case of disaster was obtained. They can be summarized as follows;

- Determining the triage code and the victims
- Physical examination of the victims
- General medical intervention of the victims
- Prescription of drugs and medical supplies for the victims

Continuity of information about the victims in case of a disaster must be ensured on the basis of the personal health records' continuity. Continuity of personal health data will be possible when the data produced during execution of health services in the disaster area is correctly directed to where the victim has been transported according to his/her triage case.

Data transferred by disaster zone triage teams, field hospital information, ambulances information, tent city information and district hospital information can be collected in disaster data center and also communication of data/information between the units can be provided via internet. Health care information flow in case of disaster can be followed in Figure 2.

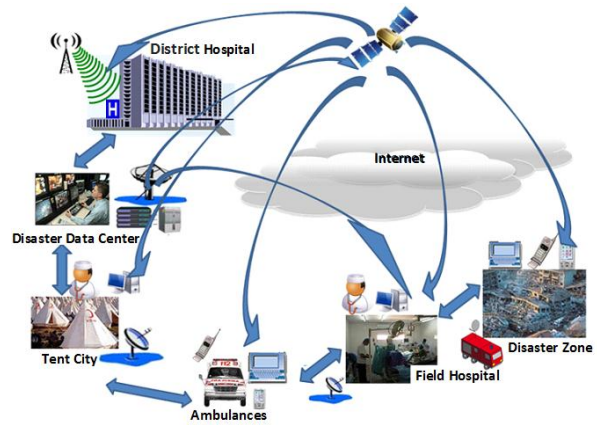


Figure 1. Health care information flow in case of a disaster

B. User Tests

User tests are composed of three stages. These stages are as follows:

1st Stage: This stage covers the real user data entry test made of 13 volunteers. Users have been chosen from the health professionals working at Hospital Emergency Service. User names and passwords equipped with the necessity authorization to use MMDIS which is appropriate for each health professionals' real life duties have been identified to themselves and have been provided to the system entry.

2nd Stage: System Usability Scale composed of 10 questions which are in the types of 5 Likert developed by John Brooke who worked for Digital Equipment Firm in 1986 is applied immediately after using this system (12).

3rd stage: This stage covers the real user tests of new MMDIS got by the results of recruitments which can be done to remove potential malfunctions in the existing MMDIS in the light of the data attained by 1st and 2nd stage. It also includes the repeat of 1st and 2nd stages. After test stages finishing at the end of April, the real user test of MMDIS will be analyzed.

III. Results

Findings cover the results which have been attained until the level of application since this study is basically an application improving project.

Tables related with the data that will be stored in the database are designed as shown in Figure 2. With established relationships between entities, it's guaranteed that data is stored more structured and more efficient.

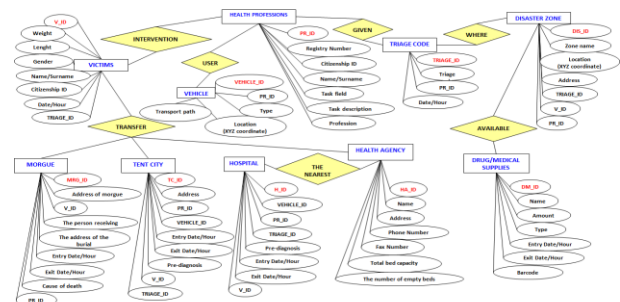


Figure 2. MMDIS entity-relationship diagram

On MMDIS's homepage, user must give a valid user name in Latin letters except Turkish characters in order to log into the system. In password section, numeric and/or character information that is approved by the system administrator including Latin characters except Turkish characters is required from the user. On the left side of the MMDIS's homepage, there is the menus' section that is ranked according to user authorization and there is the section including general information and overall queries of the system.

In the future in case of an integration with the page of victims' identity information page including credentials and triage code information of victims and central population data supplied by the system of Interior Ministry, General Directorate of Population and Citizenship Affairs, necessary integration field has been created in the database.

MMDIS's page of health care professionals' credentials is an interface design that allows entering and updating personal information and also creating business charts of health care professionals working in the disaster area. With health care professionals' identification interface and with timeline, it's intended to record the information about professionals' that will serve in the disaster area. Also before disasters, assuming that a system of health care professionals' credentials that all units can use has been available, system is designed in an appropriate structure to be integrated. The reason for this is to service for personnel planning as using the credentials of voluntary health care professionals and also health care professionals that work close to the disaster area and provide their access to the area. Also it's intended to provide storing information about the personnel that takes part in all interventions on the victims.

Physical medical examination interface including registration and reporting issues, pages of general interventions, medication order and drug treatment information are given as examples for data entry interfaces of medical practices related with the disaster victims. In designing processes of all interfaces, supports of process steps of paper-based recording practices, literature and expert opinions are taken. Also it's possible to use the system with mobile devices and tablet computers.

iv. Discussion

With MMDIS, it's intended to improve the speed and service quality in maintaining health care services in unusual cases. Developed web-based system will be a leading practice to collect all health care data under one roof in cases of disaster in our country (13).

With this study, used information and communication technology is envisaged to contribute to the coordination of disaster hospital emergency department and pre-hospital emergency medical service team in terms of speed and service quality by transferring "right knowledge" to "right people" at the "right time" (14). An information system that has whatever scale or purpose, it should be capable of collecting, editing and analyzing data and also communication and evaluation capacity. MMDIS records that all units will collect and manage were developed among the literature and expert opinions (11).

In order to ensure the universal standards, system was designed in an integrated manner assuming that data likely

needed was stored before the disaster cases and was developed in standard forms ensuring the unity of language. In disaster-based medicine, according to the studies about the usage and efficacy of mobile technology in last ten years, studies can be gathered under five groups of remote monitoring of disaster victims, incident area management, medical image transmission, decision-support applications and field hospital information technology systems. MMDIS is developed to be run on stationary computers and mobile devices as smart phones as well; it was tested and observed that it can be run on all these devices (15-17).

Real test of the system in a disaster case couldn't be done. Thus, it's not known what kind of implementation problems may be faced in a real disaster case. The main reason of this condition is that human behaviors cannot be predicted in an unusual situation in advance (17). However, it's the superiority of the proposed system that can be run on mobile devices as minimizing data loss in pre-hospital operations compared to the paper-based processes (15). The user tests started at the first week of February and are aimed to be finished at the end of April so the results of user tests are not discussed here.

In the literature, information system recommendations in unusual situations like disasters are available. With this study, a suggestion has been put forward how to use the disaster information systems in medical fields. An awareness has been developed that disaster information system should not be perceived only as an early warning system. The contents and difference of MMDIS application have been proved. The web application which can provide the user can meet the functions such as data entry to the data base with designed interfaces and data query has been developed. Also, by analyzing user test results, reengineering which will be held on and the improvement of developed system will be taken to a step further. In the next study, it is aimed that data related to the improvement of system will be shared with the scientific circles.

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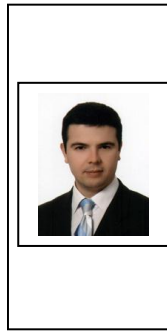
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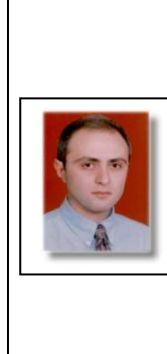
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