Review Article

Use of telemedicine in disaster and remote places

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ABSTRACT

One of the methods, especially those living in remote areas or have crashed and does not have access to specialists is telemedicine. Telemedicine describes the use of medical information exchanged from one site to another via electronic communications to improve patients' health status and care. Travel and wait times between the initial consultations with the patient's own general practitioner and referral to specialist can be reduced and specialists have successfully provided remote triage and treatment consults of victims via the robot. The robot proved to be a useful means to extend resources and provide expert consulting if specialists were unable to physically be at the site. In fact, the telemedicine system is providing health care services for individuals who are not available because of geographical and environmental conditions. The aim of this study was to identify telemedicine applications in disaster, and proposed use of this technology in areas where the shortage of specialists in remote areas in disasters. This study was un-systematic (narrative) review. The literature was searched for using of telemedicine in disaster and remote places with the help of libraries, conference proceedings, data bank, and also search engines available at Google, Google scholar. In our searches, we employed the following keywords and their combinations: telemedicine, remote place, earthquake, disaster, war, and telecommunication in the searching areas of title, keyword, abstract, and full text. In this study, more than 85 articles and reports were collected and 26 of them were selected based on their relevancy. This literature review helps define the concept of "components and usages of the Telemedicine in disaster" as the new technology in the present age.

Key words: Earthquake, remote place, telecommunication, telemedicine

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INTRODUCTION

In recent years, with the increase in disasters, planning and hospital preparation considered an important part of policies and strategic objectives of health care in each country. Today, efforts to improve disaster management appear necessary. The study of natural disaster in the past and compliance them with possible events in the future is very difficult and time consuming, yet related to one another. However, it also provides opportunities with sufficient information to understand and prepare to deal with the next event.[1]

It is estimated that in the past two decades Billion people around the world were affected by crisis and disaster and were killed and many others injured and also some are homeless. However, alone number 666,000 deaths have occurred in

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accidents and natural disasters. The incident of accident and unexpected crisis in the world is growing, so it is said that every week occurs a crisis or unexpected event in the world that require the active and thoughtful reflex. Furthermore, the direct losses associated with an unexpected accident per year more than 100 Million Dollar is estimated.[2]

Disasters continue to contribute to increased morbidity and mortality with significant economic impacts worldwide. Psychological, physical, and social sequelae persist years after the events. Many pre-existing socioeconomic conditions are aggravated following disasters.[3]

Iran, because of extensive, geographical situation, and climatic variety, is one of the disaster-prone countries of the world.[4-7]

In Iran, during the past 8 years, 924 earthquakes have occurred, which were 3-3.7 magnitude quake and on these 17,676 were killed, 53,300 injured, and 27,500 homes destroyed.[8]

During a disaster, hospitals may be overwhelmed and have an insufficient number of paediatric specialists available to care for injured children.[9]

Natural, technological, and human-generated disasters have always been a fact of life as major causes of premature death, impaired quality of life, and altered health status. Of all the problems experienced during disaster events, one of the most serious centers on communication, specifically, the lack of appropriate means to efficiently collect, process, and transmit important information in the midst of a disaster. If accurate and timely information can be made available, needless morbidity and mortality might be prevented. Thus, establishing rapid and reliable telecommunications systems specifically directed toward the disaster medical field is one of the most important challenges. During a disaster communication may be congested or misused. In addition, the local administration may be too heavily damaged or ill-equipped to make contact with neighbouring areas to ask for help. Therefore, emergency communications systems (including contingency systems) should have the ability of being quickly prepared and installed in areas where terrestrial communications lines or systems are unreliable, damaged, or nonexistent. In a disaster, communications are essential prerequisites to establish contact with the outside world. This contact could be as simple as a voice lifeline, or it could be as advanced as an Internet link or broadcast-quality video/audio transmission. Scenarios may include any location, whether it is a desolate desert, on board an ocean vessel, or a zone of national emergency where terrestrial communications have been cut. Ideally, systems should be compact, reliably powered, easy to use, easy to repair, lightweight, rugged, and highly mobile or transportable.[10]

Telemedicine describes the use of medical information exchanged from one site to another via electronic communications to improve patients' health status and care.[11]

Using new technologies to manage and organize events and disaster can be very useful by using the telemedicine management rules. Crisis management in disaster should reduce the harmful effects of accidents, deaths and damaged by using a planned program of preparation and mobilization. Despite of a lot of experience in crisis management, it has limited use of the telemedicine in disaster. Use of the telemedicine in disaster management is the main issue to save lives of accident victims. According to the devastation created in the health services infrastructure has become an important point, the existence and utilization of the telemedicine technology and according to continuously improvement in electronic technology, communication to deliver health services in remote areas.[12]

The telemedicine is one of the latest developments in information technology and communications. Change is an efficient tool in providing quality health care to individuals, especially in critical situations. British Association of Telemedicine: The telemedicine is, delivering health services, where distance and time is an important factor by professional using information and communication technology for accurate information regarding diagnosis, treatment and prevention of diseases and research, using the latest achievements in the field of health services in order to provide more health.[13]

Types of the telemedicine services: Telemedicine services are divided into two groups, audio and video:

Voice information and services: These services are based on the information provided through telephone lines. This service is divided into two species. The first group (off line): For example, the doctor sends the patients' heart beat and records by the device, analyses, and sometimes draw-out curve and thus the patient announce. The second group (on line), for example, the patient's voice would be sent to the doctor through the phone line directly and doctor makes a decision and announces the result.

The telemedicine applications are divided into four groups, include:

1. Tele-consultation that can happen through various means such as telephone, E-mail, or video conferencing.
2. Tele-education today in the world, it has been proved that every scientific development requires specialized training groups.
3. Medical emergency and assistance to victims: In critical situations and disasters access to medical emergencies is difficult; the telemedicine can be a short way and take place more quickly.
4. Tele-surgery in the telemedicine has great social and economic benefits that highlight the need of this technology. The main advantages of this system include: Reduce costs, reduce waiting time, reduce travelling, improve consulting, etc.

An unexpected incident management needs various technologies to carry out appropriate responses. Generally there are three steps in response to the disaster:

1. Before the incident: The most important activity is the emphasis on prevention and preparation phases of disaster;
2. After the incident: Hour to weeks after the accident;
3. Rehabilitation: After the incident may remain accident-induced effects for months and years. They can include, physical and mental effects in society.[8]

In 1996, the US Department of Defence established a medical network serving troops in Bosnia and other countries. The telemedicine segment was designed to help military physicians communicate with each other using real-time voice and video for consultation and diagnosis. The communications network in Bosnia, supported by a communications satellite orbiting over the area, provided direct broadcast capability. Frontline physicians transmitted radiographs and other medical images to field hospitals for diagnostic support. These same links connected Army field physicians by physicians at five regional military medical centers in the United States. This provided medical units with capabilities to access computerized medical records, track patient evacuations, use full-motion remote video tele-consultation, far-forward delivery of laboratory and radiology results, prescription support, digital diagnostic devices, ultrasound, computer tomography (CT) scanning, filmless tele-radiology, digitized medical logistics support, tele-dentistry, on-line clinical information/E-mail, and medical command and control/situational awareness.[10]

Figure 1 describes the overall system architecture. In each different application the telemedicine unit is located at the patient's site, whereas the base unit (or doctor's unit) is located at the place where the signals and images of the patient are sent and monitored. The telemedicine device is responsible to collect data (bio-signals and images) from the patient and automatically transmit them to the base unit. The base unit is comprised of a set of user-friendly software modules, which can receive data from the Telemedicine device, transmit information back to it and store important data in a local database. The system has several different applications (with small changes each time), according to the current healthcare provision nature and needs. Before the system's technical implementation, an overview of the current trends and the needs of the aforementioned Telemedicine applications was made, so that the different requirements are taken into account during design and development, thus ensuring maximum applicability and usability of the final system in distinct environments and situations. As mentioned above, the system consists of two separate modules [Figure 1]: (a) the unit located at the patient's site called "telemedicine unit" and (b) the unit located at doctor's site called "Base unit". The Doctor might be using the system either in an emergency case or when monitoring a patient from a remote place. The design and implementation of the system were

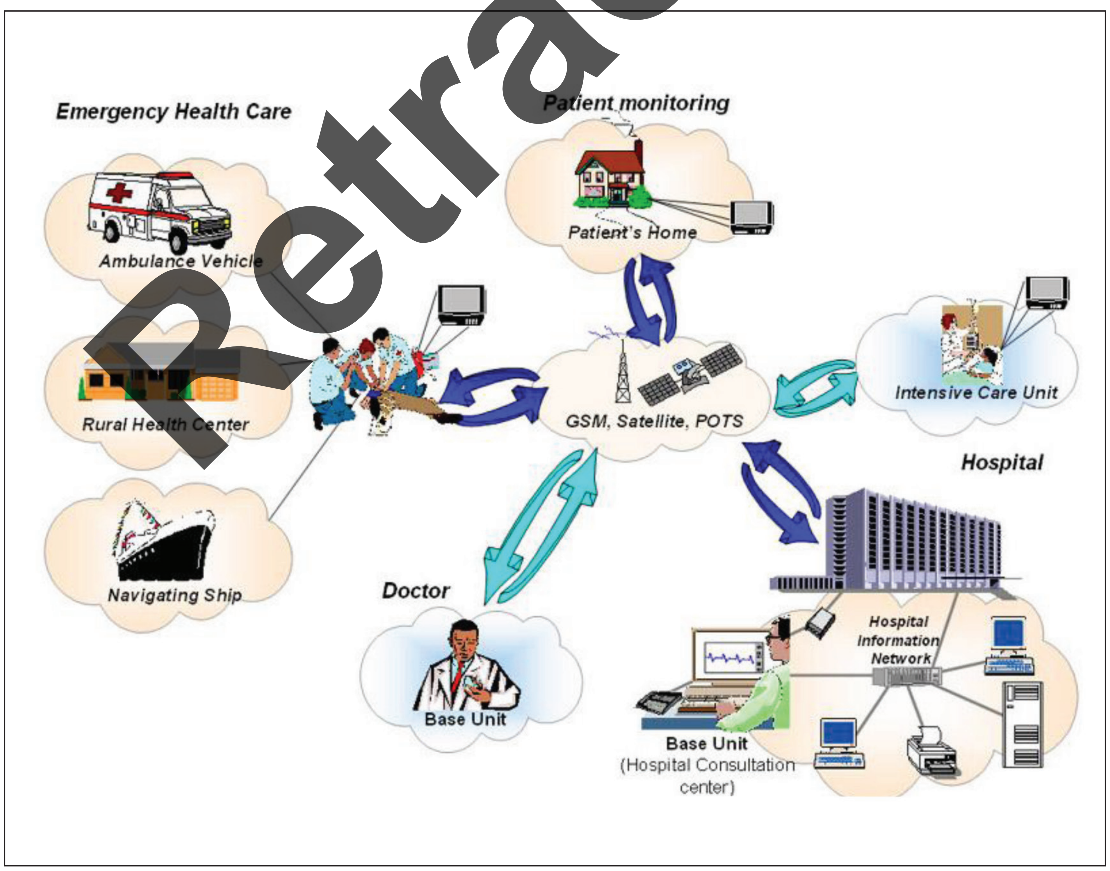

Figure 1: Telemedicine system architecture [13]

based on a detailed user requirements analysis, as well as the corresponding system functional specifications.[13]

Telemedicine unit

According to Kyriacou *et al*. the Telemedicine unit mainly consists of four modules, the bio-signal acquisition module, which is responsible for bio-signals acquisition, a digital camera responsible for image capturing, a processing unit, which is basically a Personal Computer, and a communication module (Global System for Mobile: GSM, Satellite or Plain Old Telephone System: POTS modem)

The bio-signal acquisition module was designed to operate with some of the most common portable bio-signal monitors used in emergency cases or in Intensive care Units.

The bio-signals collected by the patient (and then transmitted to the Base Unit) are:

1. Electrocardiogram up to 12 lead, depending on the monitor used in each case;
2. Oxygen Saturation (SpO_2);
3. Heart Rate (HR);
4. Noninvasive Blood Pressure (NIBP);
5. Invasive blood Pressure (IP);
6. Temperature (Temp);
7. Respiration (Resp).

The Personal Computer (PC) used depends on the type of the Telemedicine application (role of the Telemedicine unit).

As mentioned before, data interchange is done using the transmission control protocol/internet protocol network protocol, which allows operation over several communication means. The PC is equipped with the proper modem for each case, i.e., GSM, Satellite or POTS. The design was done in standard Hayes modems. The system supports ETSI– AT (European Telecommunications Standards Institute- AT) command set for GSM modem, for Satellite modems and for Standard POTS modems. Several modems types were used for testing: (a) a NOKIA card phone 2.0 GSM 900/1800 modem pcmcia card and an Option FirstFone GSM 900 modem pcmcia card were used for GSM communication; (b) a Micronet pcmcia POTS modem 56 K and a US-Robotics 33.6 K external modem were wiser for POTS communication; (c) a mini m terminal for ships "Thrane and Thrane TT-3064A Inmarsat Maritime Phone" was used for satellite communication.

The Telemedicine unit is also responsible for the collection and transmission of images of the patient to the base unit. In order to implement a hardware independent system, this module was designed to operate using Microsoft video for WINDOWS. Several cameras were used while testing the system: (a) ZOOM digital camera connected to the PC's parallel port model 1585; (b) ZOOM digital camera connected to the PC's USB port model 1595; (c) Logitech quick cam express digital USB port camera; (d) Connectix quick cam VC (visual C++) parallel port; (e) Creative camera connected to USB port.

The control of the Telemedicine unit is fully automatic. The only thing the telemedicine unit user has to do is connect the bio-signal monitor to the patient and turn on the PC. The PC then performs the connection to the base unit automatically. Although, the base unit basically controls the overall system operation, the Telemedicine unit user can also execute a number of commands. This option is useful when the system is used in a distance health center or in a ship and a conversation between the two sites takes place.[13]

Base unit (or Doctor's unit)

Kyriacou *et al*. mentioned that the base unit mainly consists of a dedicated PC equipped with a modem, which is responsible for data interchange. In addition, the base unit PC is responsible for displaying incoming signals from the Telemedicine unit. When an expert doctor uses the base unit located outside the hospital area like in the intensive care room application — Figure 1, a portable PC equipped with a GSM modem or a desktop PC equipped with a POTS modem is used. When the base unit is located in the hospital, a desktop PC connected to the Hospital Information Network equipped with a POTS modem can additionally be used; the expert doctor uses it as a processing terminal.[13]

The telemedicine can be used for decision making and collaborative arrangements for the real-time management of patients at a distance. The use of telecommunications and information technologies in providing health services is determined.[14,15]

The purpose of this study was to identify telemedicine applications in disaster, and propose the use of this technology in areas where the shortage of specialists in remote areas during disasters.

METHODS

This study was nonsystematical (narrative) review, in which the literature was on the use of telemedicine in disaster and remote areas. We used a sub-systematic method, which was divided into three phases: Literature collection, assessing, and selection. Researchers identified studies which denoted using of telemedicine in disaster and remote areas. The literature search was conducted with the help of library search engines available at Google. Since the use of telemedicine is quite recently, we did not limit our search to any publish date. The search was performed in early May and repeated during August 2012 to ensure that our literature review is most up-to-date and comprehensive. In our searches, we employed the following keyword and their combinations: Telemedicine, remote place, earthquake, war, and telecommunications, in the searching areas of title, keyword or abstract. Technical reports were excluded since we focus on research papers. More than 55 articles were collected and assessed 26 of them were selected based on their relevancy. Telemedicine included variety of healthcare data. We investigated a total of 16 research papers. By analysing the research prototypes, pilot studies, and case studies in our collected literature, we identified using telemedicine to help the injured victims in areas where there is a shortage of specialists. These implications can be used to guide future research in this field.

RESULTS

Telemedicine means the use of information and communication technology for remote medical services; most initially used in clinical care, including diagnosis, treatment, and training; but gradually the armies of the world, space agencies, and governments have started using telemedicine in military operations and disaster and have been tested in real or simulated experiments. The telemedicine can encourage appropriate measures to respond to three major events, including before the incident, incident, and rehabilitation. The first application of wireless telemedicine in disaster was, by the National Air and Space (NASA) in the 1985 Mexico City earthquake that it had destroyed all terrestrial telecommunications infrastructure. Using Advanced Communications Satellite (ATS-3) was possible audio transfer for international rescue organizations. During the earthquake in Armenia, the international satellite communications between different countries, including Russia and the United States was established and was called the space bridge. Several regional hospitals and four medical centers in the United States were established to exchange information and provide clinical consultations. Of course, throughout history we have had other important uses of the telemedicine; for example, the telemedicine in military medicine. In the mid-1980s and early 1990s, advances in military technology were able to establish an integrated healthcare network. In the recent decade, with advancement in computers and information technology industry, the use of technology has helped develop too many wireless telemedicine applications. In March 1990, when Hurricane Hugo devastated the Virgin Island, the Alabama Army National Guard applied military mobile hospital for surgery. The first instances of computer scanners and digital radiography products were used in the hospital in Battle and then through the INMARSAT International Marine Satellite images taken by Walter Read Army Medical Center in Washington and sent to the military medical centre in JVria. This was the first tele-radiology System experience. The telemedicine in space: the second flight of the space by the Soviet Union, established the telemedicine to control the dogs' health.[8]

Various telemedicine experiments have been explored and the telemedicine applications of the Advanced Communications Technology Satellite (ACTS) were launched in 1994. In 1996, the ACTS Montana Telemedicine Demonstration involved a staged disaster at an Exxon refinery remote from hospital facilities. This simulation used a modified version of the ACTS Ultra Small Aperture Terminal (USAT) with a portable Telemedicine Instrumentation Pack (TIP). The TIP is a briefcase-sized medical diagnostic system used in space shuttle missions. With USAT and ACTS, it proved capable of providing a basic medical capability to any location making possible on-site tele-medical examinations in the field capturing, displaying, and sending audio, video, and data for the telemedicine consultations.[10]

Tele-manipulation systems that can be remotely operated from a distant-site, have been used extensively by the National Aeronautics and Space Administration (NASA) for a number of years. These systems, often called tele-robots, have successfully been applied to surgical interventions. A further extension is to operate these robotic systems over data communication networks where a robotic slave and master are separated by a great distance. NASA utilizes the National Oceanographic and Atmospheric Administration, Aquarius underwater habitat as an analog environment for research and technology evaluation missions, known as NASA Extreme Environment Mission Operations (NEEMO). Three NEEMO missions have provided an opportunity to evaluate tele-operated surgical robotics by astronauts and surgeons. Three robotic systems were deployed to the habitat for evaluation during NEEMO 7, 9, and 12. These systems were linked via a telecommunications link to various sites for remote manipulation. Researchers in the habitat conducted a variety of tests to evaluate performance and applicability in extreme environments. Over three different NEEMO missions, components of the Automated Endoscopic System for Optimal Positioning, the M7 Surgical System were deployed and evaluated. A number of factors were evaluated, including communication latency and semi-autonomous functions. The M7 was modified to permit a remote surgeon the ability to insert a needle into the simulated tissue with ultrasound guidance, resulting in the world's first semi-autonomous supervisory-controlled medical task. The deployment and operation of tele-operated surgical systems and semi-autonomous, supervisory-controlled tasks were successfully conducted.[16]

And according to policy makers, the telemedicine offers "huge opportunities to improve the quality and accessibility of health services." It is defined as diagnosis, treatment, and monitoring, with doctors and patients separated by space (and usually time) but mediated through information and communication technologies. This mediation is explored through an ethnography of a U.K. tele-dermatology clinic. Diagnostic imaging transfer enables medicine at a distance, as patients are removed from knowledge generation by concentrating their identities into images. Yet, that form of identity allows images and the expert gaze to be brought into potentially life-saving proximity. Following Latour's thread, images must be captured and then mobilized to the knowledge base, where they must be stabilized into standard diagnoses, then combined with different images, waiting lists, skin lesions, dermatologists, paper records, and beds, so that ultimately, outcomes are produced.[17]

Furthermore, on December 7, 1988, an earthquake destroyed a significant portion of the Spitak Region of Soviet Armenia. The destruction resulted in significant death toll, building, and infrastructure destroyed, and the displacement of hundreds of thousands of people. The entire local medical infrastructure was significantly damaged. Before the disaster, the space medical leadership of the United States and the Union of Soviet Socialist Republics were collaborating on joint activities in medicine and biology. The leaders of this collaborative effort devised an approach to support a disaster recovery utilizing telecommunications assets. This effort was focused on healthcare in a post-disaster event and became known as the Space Bridge to Armenia. This space bridge was put in place 5 months after the calamity and operated for several months in the spring-summer of 1989. The space bridge was extended to Ufa, Russia, in response to a second disaster. The influence of the Space Bridge to Armenia in the 20 years since has been significant.[18]

In late 1992, US forces were deployed to Somalia as part of a United Nations humanitarian relief effort. The country's communications, transportation, and public works infrastructures were severely damaged after a prolonged civil war. Medical care was in short supply and limited. Although, medical units depended on a deployable field hospital for medical care, not all medical specialties and essential technologies were represented. Therefore, in early 1993, the Remote Clinical Communications System was deployed to transmit still, digitized images and voice messages from a portable INMARSAT terminal. Using low bandwidth, CT images were sent back to the US for neurological and Neuro-radiologist consultation. Colour high-resolution images in the areas of dermatology, infectious disease, and preventive medicine were also transmitted. During the 13-month period of operation, 74 cases consisting of 248 images were transmitted from Somalia. In several cases, air evacuation or on-site surgical intervention was avoided because of the telemedicine. This experience emphasized the value and potential of international telemedicine.[10]

In addition, none of the 200 local and statewide telemedicine programs in the United States have ever responded to a large-scale disaster, let alone, experienced one directly. Based on its experience with hurricanes Rita and most recently, Ike, the University of Texas Medical Branch (UTMB) experienced its most challenging trials. Although, there were significant disruptions to a majority of UTMB's physical and operational infrastructures, it's the telemedicine services were able to resume near normal activities within the first week of the post-Ike recovery period, an unimaginable feat in the face of such remarkable devastation. This was primarily due to part of the flexibility of its data network, the rapid response, and plasticity of its' telemedicine program. UTMB's experiences in providing rapid and effective medical services in the face of such a disaster offer valuable lessons for local, state, and national disaster preparations, policy, and remote medical delivery models and programs.[19]

Another telemedicine project, called the AirJaldi network, was implemented in Dharamsala in Northern India. The network has eight long-distance directional links ranging from 10 km to 41 km with 10 endpoints. In addition, the network has over 100 low-cost consumer access points that use a variety of outdoor antennas. Three of the nodes are solar-powered relay stations at remote places. All other antennas are installed on low-cost masts < 5 m in height; the masts are typically located on the rooftops of subscribers. The network provides Internet access and VoIP telephony services for tele-consultation to about 10,000 users within a radius of 70 km in rural mountainous terrain.[20]

Another study of Burke *et al*. showed that paediatric specialists successfully provided remote triage and treatment consults of victims via the robot. The robot proved to be a useful means to extend resources and provide expert consulting if paediatric specialists were unable to physically be at the site.[10]

Furthermore, disaster and emergency management system in Turkey is under the name Disaster Emergency Management Information System (AFAYBIS) of E-government system. AFAYBIS is designed as a minor part of their e-Government system. It was based upon the information acquired in surveys of government and private-sector data providers. The system will use geographical analysis to identify the regions with the greatest disaster potential. The project is also intended to quickly and effectively create a tool for management of response and relief during and after disasters. After an analysis of the current state of affairs was completed, the data and the data sources were identified. The system is designed as two parts: a database and a communication system. The communications component is to constantly update data before disasters and to provide a continuous supply of data.[5]

Xiong *et al*. mentioned, a regional telemedicine hub providing linkage of a telemedicine command center with an extended network of clinical experts in the setting of a natural or intentional disaster may facilitate future disaster response and improve patient outcomes. However, the health benefits derived from the use of the telemedicine in disaster response have not been quantitatively analysed. In this paper, we present a general model of the application of the telemedicine to disaster response and evaluate a concept of operations for a regional telemedicine hub, which would create distributed surge capacity using regional telemedicine networks connecting available healthcare and the telemedicine infrastructures to external expertise. Specifically, we investigate: (1) the scope of potential use of the telemedicine in disaster response; (2) the operational characteristics of a regional telemedicine hub using a new discrete-event simulation model of an earthquake scenario; and (3) the benefit that the affected population may gain from a coordinated regional telemedicine network.[21]

In addition, Nicogossian and Doan argued, many pre-existing socioeconomic conditions are aggravated following disasters. The telemedicine is a useful medical and public health technology that continues to be underutilized due to the lack of inclusion in the preparedness, planning, training, availability of networks, and connectivity costs.[3]

The telemedicine can improve the delivery of health care by increasing access to services, i.e., bringing specialist expertise to the patient. For example, tele-radiology can be used to provide radiology services to peripheral hospitals that do not have a local radiologist speeding up referrals, with earlier diagnosis and treatment. Travel and waiting times between the initial consultation with the patient's own general practitioner and referral to a specialist can be reduced. The number of un-kept appointments may also be lessened with savings in cost. This consists largely of potential advantage.[22]

CONCLUSION

Natural and human-made disasters require both near-term and long-term interventions to reduce morbidity and mortality among the surviving victims. Information technology and modern portable communication devices should be incorporated in disaster preparedness and recovery training and operations.[3]

Chan *et al*. expressed that in this chaotic environment, new technologies in communications, the Internet, computer miniaturization, and advanced "smart devices" have the potential to vastly improve the emergency medical response to such mass-casualty incident disasters. In particular, next-generation wireless Internet and Geo-positioning technologies may have the greatest impact on improving communications, information management, and overall disaster response and emergency medical care. These technologies have applications in terms of enhancing mass-casualty field care, provider safety, field incident command, resource management, informatics support, and regional emergency department and hospital care of disaster victims.[23] Using this technology, information is more electronic and accessible information can provide medical alerts. These technologies are expensive initially but in the long-term it saves costs and creates income.[24]

There are myriad tele-health applications for natural or anthropogenic disaster response. The tele-health technologies and methods have been demonstrated in a variety of real and simulated disasters. The tele-health is a force multiplier, providing medical and public health expertise at a distance, minimizing the logistical and safety issues associated with on-site care provision. The tele-health provides a virtual surge capacity, enabling physicians and other health professionals from around the world to assist overwhelmed local health and medical personnel with the increased demand for services post-disaster. There are several categories of the tele-health applications in disaster response, including ambulatory/primary care, Specialty consultation, remote monitoring, and triage, medical logistics, and transportation coordination. External expertise would be connected via existing the tele-health networks in the disaster area or specially deployed the tele-health systems in shelters or on-scene.[25] Research shows that one of the best solution to help victims in disaster and where the shortage of specialist and also remote areas, is the telemedicine and should advertise and promote telemedicine services in crisis management to be a broad and detailed program in levels of various social organizations.

LIMITATIONS

World Health Organization notified that to examine the potential barriers facing countries in their implementation of telemedicine services, survey respondents were asked to select, from a list of ten potential barriers, the four that most particularly applied to their country's situation. While this type of force-choice question could potentially bias results, it was used in this large survey as a method to standardize the responses. Figure 2 shows that on a global level, by far the most prevalent reported barrier was the perceived high costs involved, with 60% of responding countries considering this a barrier to the implementation of telemedicine solutions. No other issue was as widely reported to have a negative impact on telemedicine implementation. The four most prevalent barriers reported within each WHO (World Health Organization) region, alongside the global prevalence rate of that barrier, each region is displayed separately to illustrate the most significant impediments faced within each. The perceived cost of telemedicine was among the four most commonly reported barriers to implementation in all six WHO regions, with over 50% countries in each region reporting this to be a barrier; in four of the six regions it was the most commonly reported barrier. The European and Eastern Mediterranean Regions were the only exceptions, and were the only two regions where the proportion of countries reporting cost to be a barrier was less than the global proportion.

Countries in the Regions of Africa, the Americas, and South-East Asia frequently cited underdeveloped infrastructure as a barrier. The results seem to indicate that these three regions were most affected by cost and infrastructure barriers, with more countries in these regions regarding them as barriers than the level reported globally. While not necessarily indicative of a lack of physical resources, a considerable proportion of countries in the Regions of the Eastern Mediterranean and the Western Pacific reported that other issues within their

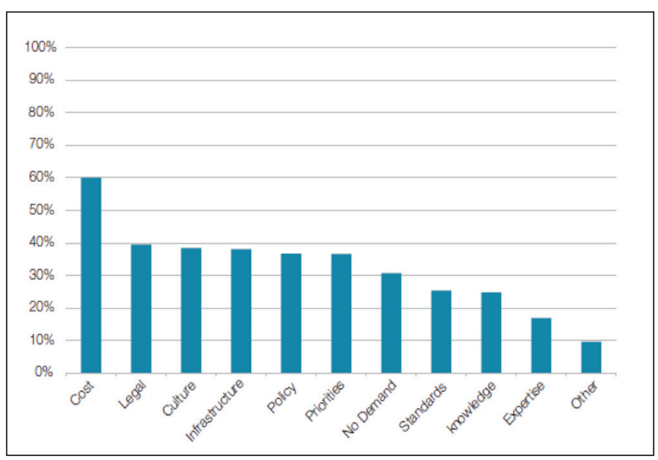

Figure 2: Global barriers of telemedicine

health systems took priority over telemedicine and acted as a barrier to implementation [Figure 2].[26]

RECOMMENDATIONS

1. Researchers recommended that information about injured people and damaged areas collect and transfer to academic centers to recognize required equipment and facilities and screen victims. Then this information through portable equipment can transfer to healthcare centers and other rescue organizations.
2. Public education about these resources and necessary education to the public on how to report critical information to health workers and to the public.
3. Prepare a training package that can be applied for medical assistance in the promotion of knowledge in the whole country.
4. A public body to conduct training and delivery systems in the country.

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