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VARIA

Overview of telemedicine use aspects in natural and technical disaster and combat situation

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Abstract: Background: Preparation and hospital development estimated an essential part of the policies and strategic purposes of healthcare in each government. Today, applications of management to reduce the burden of natural and technical disasters appear are very necessary.

Objectives: The study aimed to review the major relevant articles in the case of the application of telemedicine for trauma injuries in disaster and military situations.

Methods: Original clinical trials investigating the effects of telemedicine on trauma injuries published before April 2018 were aggregated, and used in this study. We search the scientific sources such as PubMed, MEDLINE, Wiley, EMBASE, ISI, and Scopus. The keywords that applied to identify these articles combined: Telemedicine, Mobile Health, Health, Mobile, mHealth, Telehealth, eHealth, Trauma, War, military, medicine, Wounds and Injuries, injuries.

Results: The text of the articles and abstracts were examined from various aspects, the 21 articles were evaluated for quality, and then 10 papers entered in a systematic review. We found that the use of telemedicine in trauma injury, rural and the military is very helpful for high-quality trauma care; also the telemedicine and telephone consultations can be were demonstrated reducing the risk of physician-related medicine mistakes. The economic evaluation of telemedicine was demonstrated cost-saving and cost-effective of telemedicine consultations. We also realized the importance and practicable of telemedicine for improving rural trauma care.

Conclusions: Ultimately, the telemedicine can help patients and health government organizations economically, the telemedicine consultations due to cost-saving and cost-effective. Further studies to evaluate the running of telemedicine need to abating the practical and high-efficiency method, that can be done everywhere and it's free from mistakes and defects.

Keywords: telemedicine, trauma, disaster

BACKGROUND

Preparation and hospital development estimated an essential part of the policies and strategic purposes of

healthcare in each government. Today, applications of management to reduce the burden of natural and technical

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disasters appear are very necessary. [1, 2]. Telemedical technology is increasingly moving into the medical system. Teleconsultation between crisis positions with a lack of specialists' physician and a trauma center in surgical and trauma patients could save interventions [3-5]. In recent years, Telemedicine is growing more prevalent in intensive care medicine, but its impacts and the excellent organizational pattern is also ambiguous [6-8]. Particularly in situations that there is a shortage of extremely educated healthcare workers on-scene such as rural EMS, disaster, and military conditions, conditions teleconsultation could improve in patient care via consultation of a specialist [3-7].

Telemedicine is a valuable method of implementing remote diagnoses such as ophthalmology, dermatology, and radiology [8]. Telemedicine represents the use of medical knowledge transferred from one position to another by electronic connections to enhance patients' health situation and care [2-5]. Crisis management in natural and technical disasters should decrease the harmful impacts of trauma events, mortality, and morbidity applying a designed program of development and mobilization. Notwithstanding, there are a lot of experiences in crisis management, it has limited application of telemedicine in disaster and military situations [2-6].

Application of the telemedicine in disaster and military situations management is the principal subject to maintain the health of accident patients [7]. Regarding the destruction created in the health services infrastructure, infrastructure has become a significant issue, the existence, and utilization of telemedicine technology and according to continuous development in electronic technology, communication to

deliver health services in remote regions [6-8].

We try to review the major relevant articles in case of application of telemedicine for trauma injuries in disaster and military situations to help clinicians and patients to have a better understanding of these technologies and choosing the better therapeutic option. A highly standardized evidence-based review can be one of the best references for clinicians to decide about their treatment plan.

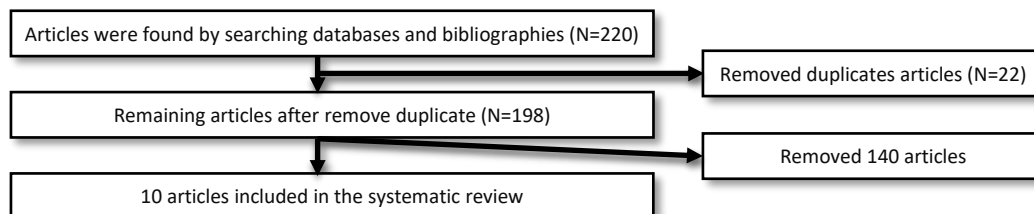
MATERIALS AND METHODS

Original clinical trials investigating the effects of telemedicine on trauma injuries published before April 2018 were aggregated, and used in this study. We search the scientific sources such as PubMed, MEDLINE, Wiley, EMBASE, ISI Web of Knowledge, and Scopus.

The keywords that applied to identify these articles combined: Telemedicine, Mobile Health, Health, Mobile, mHealth, Telehealth, eHealth, Trauma, War, military, medicine, Wounds and Injuries, injuries. Two authors have independently assessed the titles and abstracts of all papers obtained by the searching method outlined above.

The studies with the following criteria were excluded: did not evaluate the performance of Telemedicine; were not English-language study, and were review studies and letters to editors or conference abstracts. The two reviewers who carried out the literature search also individually made decisions and selected studies considering inclusion criteria. The following details were extracted from included studies independently by two reviewers, study location, year of publication, the first author's surname, study design, and outcomes.

Figure 1: Flow chart the inclusion studies



RESULTS

Ten studies matched the criteria for analysis and discussion.

Daniel et al. (2013) in a randomized trial study examined emergency care between two groups. Doctor-staffed EMS teams compare to paramedic teams that were established telemedical by an EMS doctor. Overall 16 teams that each team contained one EMS physician and two paramedics

randomly divided into the control and telemedicine group. Telemedical functionalities included 2 methods of audio communication, transportation of vital information, and video streaming from the situation place to the remotely placed EMS doctor. There were no significant differences in the case-specific items and, no potentially hazardous mistreatments were reported. They showed telemedical supported paramedic care as possible and at least not poor

respect to conventional EMS teams with a doctor on-scene in these situations [9].

Table 1: Author's name, type of study and summaries of outcomes in the studies

Author's name	Type of study	Outcomes
Daniel et al. (2013) [9]	Randomized trial study	They showed telemedical supported paramedic care as possible and at least not poor respect to conventional EMS teams with a doctor on-scene in these situations
Brennan et al. (1998) [10]	Randomized trial study	They concluded that telemedicine was observed to be a satisfying system for pre-chosen emergency department patients and was observed by the doctors as an admissible way of complementary application.
Bowman et al. 2003 [11]	Cross-Sectional	Their results showed Telemedicine was a precise, reliable, and effective way of diagnosing and controlling these patients, particularly if slit-lamp images were applied.
Yang et al. 2015 [12]	Cross-Sectional	They concluded that a healthcare payer aspect, telemedicine to health care workers of severely sick and pediatric patients performing to rural EDs are cost-saving or cost-effective regarding the telephone.
Mohr et al. 2016 [13]	Observational cohort study	The telemedicine consultation was requested for severely injured rural traumatic patients (burns, penetrating trauma, and those with abnormal vital signs) in the Emergency Department, but Telemedicine consultation was not decreased interhospital transfer.
Oeveren et al. 2017 [14]	Cross-Sectional	They demonstrated a success rate of 96% of telemedicine during emergency intubation. Telemedicine-assisted intubation can be performed in rural hospitals practically.
Gilmore et al. 2014 [15]	Cross-Sectional	HBT can provide mental health services in a preferable procedure of location in military sexual trauma with PTSD patients and help to them for reducing mental pains and increasing readiness.
Dayal et al. 2016 [16]	Retrospective cohort study	The performance of a telemedicine program is designed to assist in the seriously ill children at admission to the PICU. They provided evidence for improving clinical outcomes in pediatric critical care with telemedicine programs.
Shah et al. 2016 [17]	Prospective cohort study	High-intensity telemedicine can be alternative to traditional severe disease care and it must be included in population health programs.
Dharmar et al. 2018 [18]	Retrospective chart reviews	They were demonstrated reducing the risk of physician-related medicine mistakes among critically sick and traumatic children of 8 rural EDs from academic children's hospital.

Brennan et al. (1998) conducted a randomized clinical study in the emergency department. Overall 104 patients were included. Fifty-four participated in the telemedicine group and 50 to the control group. There are no differences between the groups for an incident of 72 hours emergency department return visits; the requirement for further care; doctor communication; nurse communication; satisfaction. The mean patient throughput period for the telemedicine group was 106 minutes; the mean for the control group was 117 minutes. They concluded that telemedicine was observed to be a satisfying system for pre-chosen emergency department patients and was observed by the doctors as an admissible way of complementary application [10].

Bowman et al. (2003) assessed the precision and effectiveness of telemedicine in diagnosing and treating eye injuries. The methods were a clinical trial with a face-to-face

group (40 patients) and a telemedicine group (40 patients). In the face-to-face group, consultations were in person; in the telemedicine group, researcher one handled video conferencing technology at 384 kbit/s, and observer two observed the patient face to face. In this study, 80 patients were included in the department. Principal result measures were agreement levels between the two observers for every phase, time of consultation, and several unnecessary recalls. There were more important conflicts applying telemedicine, in per sample the telemedicine diagnosis and management failed on the side of safety; consequently, no patient would have experienced via the improper administration because of the consultation using telemedicine. Their results showed Telemedicine was a precise, reliable, and effective way of diagnosing and controlling these patients, particularly if slit-lamp images were applied [11].

Yang et al. (2015) carried a financial assessment to

determine the price, effect, and return on investment of telemedicine consultations presented to health care workers of severely sick and pediatric patients in rural EDs confronted with phone consultations from a healthcare payer prospect. The cost-effectiveness investigation was according to program effectiveness, obtained from change choices after telemedicine and telephone consultations. They concluded that a healthcare payer aspect, telemedicine to health care workers of severely sick and pediatric patients performing to rural EDs are cost-saving or cost-effective regarding telephone [12].

Nicholas M. Mohr et al. evaluated factors associated with telemedicine and interhospital transfer as a cohort study of all adult treated traumatic patients between 2008 and 2014 in North Dakota critical-access hospital (CAH). They demonstrated telemedicine consultation was requested for severely injured rural traumatic patients (burns, penetrating trauma, and those with abnormal vital signs) in the Emergency Department, but Telemedicine consultation was not decreased interhospital transfer [13].

Lucas Van Oeveren et al. evaluated intubations which done by telemedicine in rural EDs with ED telemedicine network. They were collected probable data of all patients with video telemedicine-assisted intubation from May 1, 2014, to April 30, 2015, and telemedicine involvement/intervention was evaluated using statistical analysis. Lucas Van Oeveren et al have involved 206 intubations with respiratory failure as most common. They demonstrated a success rate of 96% of telemedicine during emergency intubation. Telemedicine-assisted intubation can be performed in rural hospitals practically. This telemedicine-assisted intubation was done at first in emergency tracheal intubations via a live telemedicine link [14].

Amanda K. Gilmore et al. was described a randomized controlled trial comparing Prolonged Exposure (PE) delivered face-to-face and delivered via Home-based telemedicine (HBT) in female veterans, they focused on female veterans with military sexual trauma with PTSD. Their hypothesize was more be effective in improving the quality of life in PE delivered via HBT than SD at the post, 3-, and 6-month follow-up. Ultimately, Amanda K. Gilmore et al concluded HBT can provide mental health services in a preferable procedure of location in military sexual trauma with PTSD patients and help to them for reducing mental pains and increasing readiness. Generally, Home-based telemedicine can reduce systemic barriers for treatment [15].

Parul Dayal et al have compared the effects of access to a telemedicine program (pediatric critical care) on the

intensity of disease and results for referral children to children's hospital PICU in the cohort study. The 582 patients with telemedicine that were younger and less sick than 524 patients from without telemedicine were compared during the study period. Parul Dayal et al was indicated the performance of a telemedicine plan for the care of seriously ill children. The performance of a telemedicine program is designed to assist in the seriously ill children at admission to the PICU. They provided evidence for improving clinical outcomes in pediatric critical care with telemedicine programs [16].

Manish N. Shah et al have evaluated the effect High-intensity telemedicine programs on emergency department use for the care of Six senior living community (SLC) residents in a cohort study over 3.5 years. They were indicated reducing emergency department use in High-intensity telemedicine care of SLC residents. Manish N. Shah et al was presented High-intensity telemedicine can be alternative to traditional severe disease care and it must be included in population health programs [17].

Madan Dharmar et al was evaluated the rate of physician-related medicine mistake on seriously 234 patients receiving 85 telephone consultations, 73 telemedicine consultation, and 76 no consultations in rural emergency departments, then outcomes of the study were compared. They were performed retrospective reviews critically sick and traumatic children of 8 rural EDs from academic children's hospital. Ultimately, Madan Dharmar et al was demonstrated reducing the risk of physician-related medicine mistakes among critically sick and traumatic children of 8 rural EDs from academic children's hospitals [18].

DISCUSSION

Traumatic injury is a common cause of death for those under the age of 44 years. On the other hand, accessing sufficient and adequate high-quality trauma care is a secondary problem after the trauma, and one of the main mechanisms associated with bad results in trauma patients. Generally, the improvement of trauma results is under the influence of triage of seriously traumatic patients. Telemedicine is a strategy to improve trauma care, with the aim of given tertiary level services locally. Using telemedicine is particularly increasing and improving the care of trauma patients, it can be valuable when the time-sensitivity is palpable in trauma interventions [19-30].

This study reviews several strengths aspects of telemedicine such as generally, treatment in a high-risk (population, condition, and location) and removal of barriers to care of traumatic patients.

In this systematic review, the literature searched in important databases for telemedicine in various fields such as trauma injury, war, rural, and military. The text of the articles and abstracts were examined from various aspects, the 21 articles were evaluated for quality, and then 10 papers entered in a systematic review. This manuscript is in the first study in various fields of telemedicine.

We found that the use of telemedicine in trauma injury, rural and the military is very helpful for high-quality trauma care; also the telemedicine and telephone consultations can be demonstrated reducing the risk of physician-related medicine mistakes. Also, telemedicine can be useful, practical, and preferable procedure of location for care military sexual trauma patients with PTSD and help to them for reducing mental pains and increasing readiness. The economic evaluation of telemedicine was demonstrated cost-saving and cost-effective of telemedicine consultations. We also realized the importance and practicability of telemedicine for improving rural trauma care.

Duchesne et al. [31] were reported that the performance of a telemedicine plan decreases trauma transfers to 89%. Many rural EDs have not board-certified physicians in emergency medicine [32] despite the increasing of traumatic injury and trauma-related mortality in rural populations.

In a study that uses tele-emergency services, they were indicated to improve 95% quality of care by using tele-emergency services [33]. The clinical care is improved by using of telemedicine because access to specialized physicians [33]. In the other study, they found the utilization of expert physicians via telemedicine helped stabilize trauma patients during early care [34]. This study demonstrated a limit of 8% of patients have received care that may survive through using telemedicine consultation [34]. On the other

hand, the levels of task-based communication of care services can be increased through telemedicine care [35]. Lucas Van Oeveren et al results were illustrated telemedicine improves care and enhances accessibility to treatment.

MST-related PTSD as one of the subjects for telemedicine was investigated by Gilmore et al. in particular; HBT increases treatment access women and even men with their MST histories which suffering from other physical or mental difficulties.

Although quality of care is fairly suitable in most EDs to children, it may behave rates of poor events, such as medication errors in non-children's hospitals for seriously ill children [36–38], nevertheless, the telemedicine can provide access to pediatric expertise for a decrease of physician mistakes [39].

The telemedicine programs significantly increase the quality of care and reduce mortality in traumatic injuries, also the telemedicine is the importance and practicability for improving rural trauma care. This producer can be a suitable alternative to traditional care, in other words, this method causes access to skilled and experienced physicians in far-off areas, subsequently; telemedicine can decrease the risk of physician-related ED medication errors particularly in a pediatric case. Besides, telemedicine can be useful and practical producer for PTSD patients; and home-based telemedicine access for these patients in their home.

CONCLUSIONS

Ultimately, the telemedicine can help patients and health government organizations economically, the telemedicine consultations due to cost-saving and cost-effective. Further studies to evaluate the running of telemedicine need to abating the practical and high-efficiency method, that can be done everywhere and it's free from mistakes and defects.

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