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The effectiveness of tele-triage during the COVID-19 pandemic: A systematic review and narrative synthesis

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Abstract

Background: Telehealth services were used by healthcare centers during the COVID-19 pandemic in order to identify and manage patients at the forefront of the healthcare system. As one of these technologies, tele-triage refers to the assessment of a patient's health status through telephone or another means of communication and recommending treatment or providing appropriate referrals in emergency rooms and primary care offices. This study aimed to perform a systematic review of the evidence on the effectiveness of tele-triage, as one of these technologies, during the COVID-19 pandemic.

Methods: Medline (via PubMed), Scopus, and Web of Science databases were searched for relevant English articles published since the pandemic's onset until December 30, 2021. Studies investigating the tele-triage's effect on patient safety, clinical outcomes, and patient satisfaction were included. Data on study characteristics, intervention characteristics, and their effects on study outcomes were extracted separately by two authors. A narrative synthesis of the included studies was ultimately performed.

Results: Out of the 6312 retrieved studies, 14 met the inclusion criteria. The tele-triage intervention was offered by an algorithm-based system in eight studies (57.14%) and by healthcare providers in six other studies (42.86%) to determine the patient's level of care. According to the results, tele-triage interventions during COVID-19 can reduce unnecessary emergency room visits (by 1.2–22.2%), improve clinical outcomes after intervention (such as would closure in diabetic feet), reduce mortality and injuries, and ensure patient satisfaction with tele-triage (53–98%).

Conclusions: This study found that tele-triage interventions reduced unnecessary visits, improved clinical outcomes, reduced mortality, and injuries, increased patient satisfaction, reduced healthcare provider workload, improved access to primary care consultation, and increased patient safety and satisfaction. Therefore, tele-triage systems are not only suitable for providing acute and emergency care remotely but they are also recommended as an alternative tool to monitor and diagnose COVID-19.

Keywords

Telehealth, triage, COVID-19, systematic review

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Introduction

Globally, healthcare systems are currently faced with the coronavirus disease 2019 (COVID-19), which was declared a pandemic by the World Health Organization on March 11, 2020.[1] Fear and trepidation have been widespread in the wake of the COVID-19 pandemic. This has led to overcrowding in emergency departments (EDs), as people have been seeking reassurance through screening exams.[2–4] As a result, healthcare providers not only needed to care for numerous patients suffering from a highly contagious new disease but they also needed to take care of patients suffering from chronic diseases, emergency conditions, or other illnesses, while avoiding exposure to COVID-19.[5,6] So minimizing the unnecessary face-to-face visits through triage was necessary to restrict the spread of COVID-19 virus and protect medical staff and personal protection equipment (PPE).[7–10]

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By definition, triage is the act of sorting and prioritizing based on quality, and triage in health services refers to the process of classifying patients in order of priority for treatment.[11] The use of triage services can reduce healthcare costs by preventing unnecessary and costly visits of patients to the EDs and helping them through self-care and unofficial care at the time of the physician's absence. One way to provide patient access to a suitable level of care would be the use of technological systems including tele-triage which facilitates remote decision-making and can be used synchronously or asynchronously to overcome accessibility obstacles through platforms such as telephone, email, or video conference.[12]

Tele-triage is a type of telehealth service that has been used increasingly as a result of the COVID-19 pandemic.[13] The common feature of telehealth, telemedicine, telenursing, tele-home care, and tele-triage is the use of communication technologies (such as telephones, video conferences, emails, and digital imaging) to transmit clinical information.[9,14] Tele-triage is performed by nurses or physicians in various medical centers.[15] Tele-triage seeks to determine the most appropriate level of care required and discuss treatment options and the necessity of care. Based on the information obtained from evaluations, these options may include self-care or unofficial care, routine or emergency visits by the physician, immediate referral to the ED or emergency clinics, or ambulance dispatch. Tele-triage services may also include offering information and guidance for complex health decisions and management of symptoms to facilitate self-care and unofficial care.[16]

Evidence suggests different results regarding the effectiveness of tele-triage systems. Some studies showed that tele-triage interventions lead to a significant decline in postponing emergency visits and re-hospitalization, especially in older and chronic patients and parents with young children.[17,18] Moreover, patients have reported high levels of acceptance and increased satisfaction with tele-triage services. Meanwhile, one study indicated that a large number of the patients referred to ED through tele-triage could have been managed outside the emergency environment as well.[19] Thus, it would appear that the results reported in various studies need to be integrated into a systematic review to determine the overall effects of this type of intervention.

Recent studies have reported the advantages of tele-triage during the COVID-19 pandemic, indicating that this system eliminates person-to-person interaction, reduces the risk of healthcare workers and other patients' exposure, and saves limited resources by maintaining PPE.[7,8] According to the studies, further research is required to determine the effect of tele-triage on clinical outcomes, costs, and the use of follow-up care. Moreover, to the best of the authors' knowledge, no systematic review has yet been conducted to investigate the effect of tele-triage on patient outcomes during the COVID-19 pandemic, so this study examined whether tele-triage was effective during this period.

Methods

Data sources and search strategies

The electronic databases searched in this study were Medline (via PubMed), Scopus, and Web of Science. The search strategy combined Medical Subject Headings terms and keywords in title and abstract to define three groups: triage, telehealth, and COVID-19. The search period was from the onset of the pandemic inception until December 30, 2021. The reference list of included studies and relevant reviews were also examined to identify additional studies. Appendix 1 demonstrates the details of search strategy.

Inclusion and exclusion criteria

It was decided to include English-language cohort studies because they provide the strongest observational study design to evaluate causal inferences[20] on the effectiveness of tele-triage-based interventions on patient safety, clinical outcomes, and patient satisfaction during the COVID-19 pandemic. Review articles, letters to the editor, protocols, conferences, theses, the design and development of tele-triage interventions, and the studies conducted before the onset of the COVID-19 pandemic were excluded from the study.

Screening and data extraction

The title, abstract, and full text of the articles were screened by two researchers independently (M.F. and R.Sh.). The data were extracted from the included studies using a structured form. Disagreements were resolved by discussion with a third researcher (E.N.), if necessary. The data extracted from each study included study characteristics (including author, year, country, study design, and setting), participants characteristics (including the number of visited patients, health condition, and age range), intervention characteristics (including the study beginning, study period, the platform used for the intervention, and the type of triage intervention), targeted outcomes, and effects of the intervention.

Data synthesis and analysis

Given the heterogeneity of the included studies in this systematic review, a narrative synthesis of the evidence was performed rather than a meta-analysis. To perform the narrative synthesis, the studies were classified based on various characteristics including their design, intervention features, outcome categories, and effects of interventions on

outcomes. The study design complied with the classification used by Bashar et al. including the three categories of the prospective cohort, retrospective cohort, and retrospective analysis of prospective cohort.[21]

Quality assessment of studies

The quality of the included studies was assessed using the tool designed by Qumesaya.[21] This novel scale is among the appropriate tools to evaluate cohort medical studies and has favorable performance characteristics, easy interpretation, and suitability for researchers and physicians conducting systematic reviews. The tool consisted of nine questions and rates studies based on four domains: study design, outcomes and their measurements including patients and their characteristics, and Identifying outlier scoring points. The maximum score for each study was 10. Studies scoring less than 6 were considered low quality, 6–7 moderate quality, and 8–10 high quality.

Results

Literature search results

Figure 1 demonstrates the search results and study selection process using the PRISMA flow diagram. Among the 6312 articles identified (1905 from PubMed, 2983 from Scopus, and 1424 from ISI Web of Science), 2041 were duplicates and were therefore excluded from the study. First, two researchers examined the titles and abstracts of the articles independently to exclude those that did not meet the inclusion criteria, which resulted in the exclusion of 4216 articles. Following the first screening, both researchers independently reviewed and screened the full text of 55

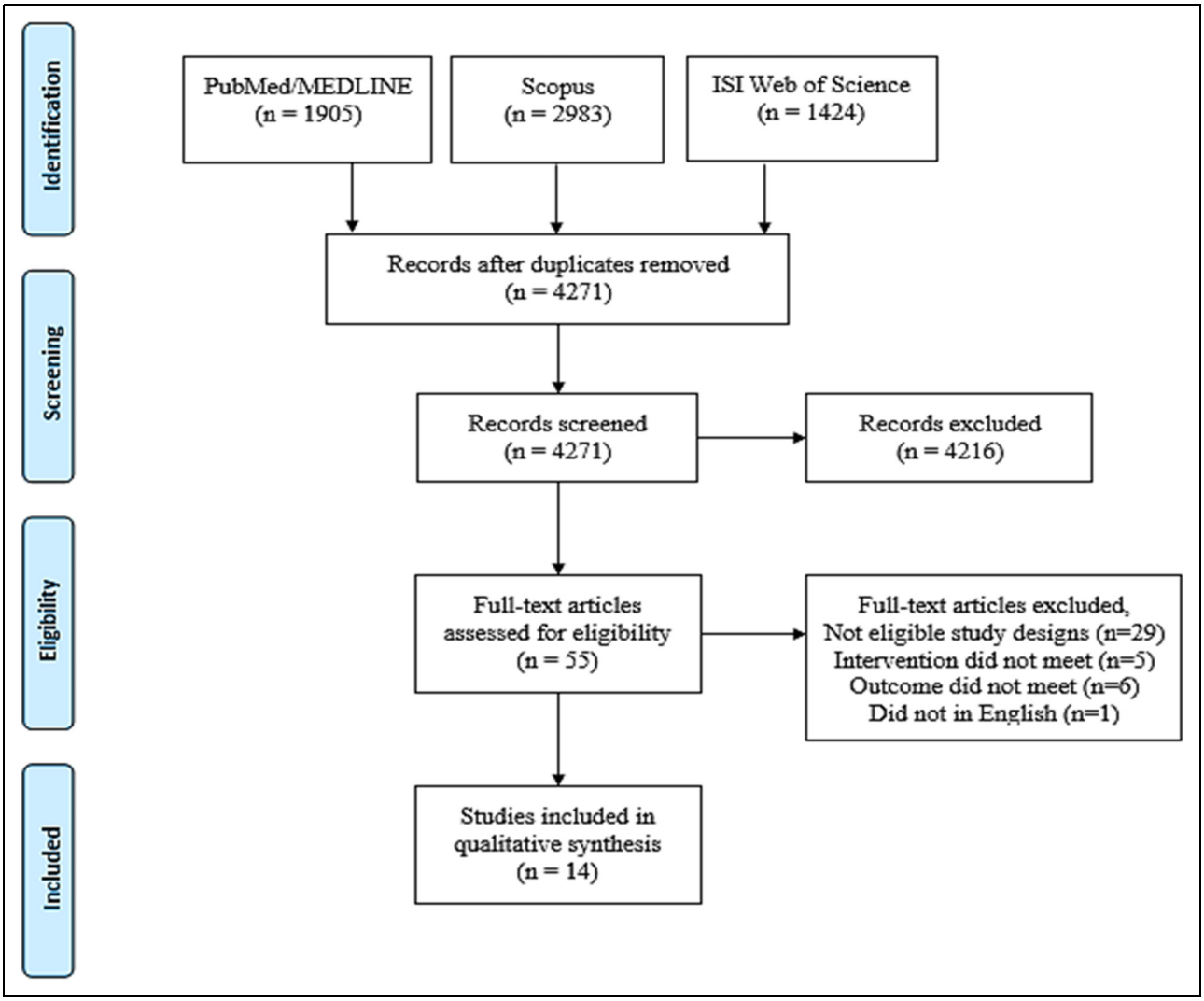

Figure 1. Flow diagram of the literature search and study selection.

articles for compliance with the inclusion and exclusion criteria. A total of 41 articles did not meet the criteria, and 14 articles were eventually included. Two researchers resolved any disagreements through discussion with a third researcher.

Characteristics of the included studies

The key characteristics of the included studies are summarized in Table 1. Among the 14 studies, four were conducted in the United States (28.57%), three in the United Kingdom (21.43%), and one in each of the following countries: China, India, Taiwan, Canada, Belgium, Mexico, and Israel. Most studies (78.57%) were conducted in developed countries. The health condition evaluated in the studies included patients with COVID-19 (four studies), patients with suspected head and neck cancer (two studies), patients with diabetic foot complications, and chronic kidney disease (each in one study). Moreover, six studies evaluated all patients (regardless of their health complications). In total, four studies (28.57%) were multi-center and 10 (71.43%) were single-center. There were six studies conducted in hospitals (hospitalization wards), five in inpatient clinics, and four in EDs. The number of visited patients in the studies ranged from 40 to 17,730. Of the 14 included studies, six studies were retrospective, five were prospective, and three were retro-prospective.

Interventions description

According to Table 1, the beginning of the interventions varied between June 2019 and May 2020. The longest intervention period was eight months and the shortest was one month. Out of the 14 studies, the type of tele-triage intervention in six studies (42.86%) was an app, in five studies (35.71%) telephone consultation, and in three studies (21.43%) video calls. The tele-triage intervention was offered by an algorithm-based system in eight studies (57.14%) and by healthcare providers in six other studies (42.86%) to determine the patient's level of care.

Quality assessment of the included studies

The results of the quality assessment of the studies are shown in Table 1, which suggests that 28.57% of the studies had a high quality, 64.29% moderate, and 7.14% low quality.

Effects of interventions on outcomes

The categories of outcomes and effects of interventions on them are shown in Table 2. The outcomes were generally classified into five categories: improving access to care, triage rates, patient safety, clinical outcomes after triage, and patient satisfaction. Results indicated that out of the 14 studies, three studies (from the improving access to care category) had reported the triage-based emergency management strategy as an approach to limit patient admissions and ensure the effective relief of the symptoms and pain control. Four studies had reported the outcome of referral to the ED (from triage rates category), the results of which indicated that tele-triage intervention during the COVID-19 pandemic can treat a large number of patients in this way and reduce unnecessary ED visits (by 1.2–22.2%). The outcome of hospitalization was investigated in five studies, the results of which demonstrated a decline in unnecessary referrals to the hospital (by 1.1–14%). Outcomes related to death (in four studies) and side effects studied in tele-triage-based interventions (in three studies) showed that the mortality rate ranged from 0.1% to 28.5% and injury rates ranged from 0% to 2% across studies. Four studies reported that the clinical outcomes after tele-triage intervention including wounds closed or reduced in diabetic feet, head and neck cancer, and overall cancer rate improved. Four studies investigated the outcome of patient satisfaction with tele-triage intervention during the COVID-19 pandemic, all of which indicated the satisfaction of the patients with these interventions (around 53–98%).

Discussion

This systematic review summarized 14 cohort studies on the effect of interventions based on tele-triage during the COVID-19 pandemic. Overall, the outcomes were classified into five categories of enhanced access to care, triage rates, patient safety, post-triage clinical outcomes, and patient satisfaction. Most studies used apps and telephone consultations as tele-triage interventions. Determining the level of care (triage) of the patients was based on algorithms in eight studies and the based on physician's decisions in six studies. Results showed that tele-triage interventions can reduce unnecessary ED visits and hospitalizations and improve clinical outcomes and patient satisfaction following tele-triage.

Results of the present study indicated that tele-triage interventions could help treat many patients through a 1.2–22.2% reduction in unnecessary referrals to ED. Other studies showed different results regarding the effect of tele-triage systems on the emergency units so some studies suggested that tele-triage interventions led to a moderate to significant decline in non-emergency visits and re-hospitalization, specifically for older and chronic patients and parents with young children.[17,18] Still, Turbitt et al. stated that patients referred to ED through tele-triage could be potentially managed outside the emergency environment as well.[19] Therefore, tele-triage systems in pandemic situations can be effective in preventing unnecessary visits of patients to ED. However, in order to fully understand the effect of tele-triage on emergency

Table 1. Tele-triage interventions characteristics.

Row	Author (year)	Country	Health condition	Setting	Visited patients	Study design	Intervention characterization				Quality score[a]
							Study beginning	Study period	Triage delivery mode	Triage type	
1	Koziatek et al.[22]	United States (Developed Country)	All child and adult patients	Multi-center/ Outpatient clinics	17,730	Retrospective	March 2020	1 month	- Application on mobile devices and computers with video visit	Physician-based	High (8)
2	Chai et al.[23]	United States (Developed Country)	All adult patients (>18 years old)	Single-center/ Emergency department	40	Prospective	April 2020	4 month	- Mobile Robotic System with video link on the tablet computer	Physician-based	Moderate (6)
3	Tabacof et al.[24]	United States (Developed Country)	Patients with a confirmed or probable diagnosis of acute COVID-19 infection	Single-center/ Hospital	162	Retrospective	March 2020	6 month	- Web-based software platform	Physician-based	Low (5)
4	Rastogi et al.[25]	India (Developing Country)	Patients with diabetic foot complications	Single-center/ Outpatient clinic	1199	Retro-prospective	March 2020	6 month	- Video calls (WhatsApp, WeChat)	Risk algorithm-based	Moderate (6)
5	Zhao et al.[26]	China (Developing Country)	Patients with chronic kidney disease (CKD)	Single-center/ Outpatient clinic	181	Retro-prospective	February 2020	3 month	- Smartphone application	Physician-based	Moderate (7)
6	O'Keefe et al.[27]	United States (Developed Country)	Patients with confirmed COVID-19 (aged ≥ 18 years)	Multi-center/ Emergency departments	496	Retrospective	March 2020	2 month	- Telephone call	Risk algorithm-based	High (8)
7	Lin et al.[28]	Taiwan (Developed Country)	Adult patients (aged ≥20 years)	Single-center/ Emergency department	198	Retro-prospective	March 2020	2 month	- Video interview	Risk algorithm-based	Moderate (7)
8	Li et al.[29]	United Kingdom (Developed Country)	Adult patients (aged ≥ 18 years)	Single-center/ Hospital	854	Retrospective	May 2020	6 weeks	- Video calls	Physician-based	Moderate (7)
9	Kaddour et al.[30]	United Kingdom	Adult patients with suspected	Single-center/ Hospital	412	Prospective	May 2020	4 month	- Telephone consultations	Risk algorithm-based	Moderate (7)

(continued)

Table 1. Continued

Row	Author (year)	Country	Health condition	Setting	Visited patients	Study design	Intervention characterization				Quality score[a]
							Study beginning	Study period	Triage delivery mode	Triage type	
		(Developed Country)	head and neck cancer								
10	Chan et al.[31]	Canada (Developed Country)	Adult patients (≥16 years old)	Multi-center/ Emergency departments	581	Prospective	June 2019	8 month	- Tablet computer programmed with the prototype symptom checker	Risk algorithm-based	High (8)
11	Beauquis et al.[32]	Belgium (Developed Country)	Adult patients (≥12 years old)	Single-center/ Outpatient clinic	521	Prospective	April 2020	1 month	- Telephone consultation	Physician-based	Moderate (7)
12	Hardman et al.[33]	United Kingdom (Developed Country)	Adult patients with suspected head and neck cancer	Multi-center/ Hospitals	4568	Prospective	March 2020	4 month	- Telephone consultation	Risk algorithm-based	High (8)
13	Rocha-Haro et al.[34]	Mexico (Developing Country)	Patients with confirmed COVID-19 (aged ≥ 20 years)	Single-center/ Hospital	580	Retrospective	March 2020	5 month	- Mobile app	Risk algorithm-based	Moderate (6)
14	Shapiro Ben David et al.[35]	Israel (Developed Country)	Patients with confirmed COVID-19 (aged range 0–97 years)	Single-center/ Hospital	5448	Retrospective	Feb 2020	4 month	- Telephone call	Risk algorithm-based	Moderate (7)

[a]Quality score of studies using Qumseya scale.

Table 2. Tele-triage interventions outcomes categorization.

Outcome category	Outcomes	Reference
Enhanced access to care	Wait time for consultation	22
	Visit duration time	22, 28
	Successful management (patients without emergency admission)	26, 31, 32
Triage rates	Referred to emergency department	22, 24, 26, 34
	Referred to outpatient clinics	26
	Hospital admissions	24–27, 35
	Risk stratification (low, moderate, high)	27, 30, 33
	Accuracy of the system	31
	In-person evaluation	29, 31, 33
	Re-attendance rate within 1 month	28, 30
	72-h ED revisit rate	28
	Discharge	33
	follow-up rate	27, 32, 34
Patient safety	Patients died	24, 25, 34, 35
	Overall harm	29, 31, 33
Clinical outcomes after triage	Wound closed or reduced in area (diabetic foot)	25
	Free from head and neck cancer	30
	Overall cancer rate	31, 33
Patient satisfaction	Satisfaction	22, 23, 26, 28
	Likely to use again	22, 23

units and its economic impact on healthcare systems, further research is required.

The results of this study showed that patients were extremely satisfied with the tele-triage intervention during COVID-19. Moreover, studies that surveyed patients regarding their use of tele-triage services reported a high level of patient satisfaction and stated that patients generally found these services useful and valuable.[7,36,37] However, another systematic review found no clear pattern on the effect of tele-triage on the satisfaction of patients. Some evidence indicated that patients satisfaction may decline depending on the compliance of the services they receive with their expectations.[38] Therefore, training would enable tele-triage users to provide accurate diagnoses which will, in turn, influence the compliance and satisfaction of the patient with the tele-triage decision.

Results indicated that the waiting time for consultation (the time between the scheduled appointment and the time the healthcare provider enters the tele-triage intervention) and the patients visit duration time improved significantly. Findings of other studies suggest that tele-triage interventions can reduce the waiting time for the physician, receiving the necessary care and recommendations, and reduce the delay in diagnosis.[7,39,40] Moreover, a systematic review indicated that telephone triage may reduce the workload of healthcare providers over the short term,[41] which is consistent with our results. Thus, tele-triage systems can prevent costly emergency visits and unnecessary care by increasing access to timely consultation and reducing the obstacles associated with distance, costs, and time for patients and healthcare providers.

The results of this systematic review demonstrated that telephone consultation and apps were the most prevalent tele-triage interventions. Similarly, another study reported that tele-triage services offered in Canada and Australia were telephone call services.[42] Some evidence indicates that oral communication cannot reflect some complexities associated with health statements, and telephone interactions may lead to bias.[43] In this method, patients may be in a non-ideal environment or forget to report their important and key symptoms and provide the physician with an inaccurate outlook. Aside from increasing the number of referrals to the ED, this can negatively impact patient safety and lead to adverse outcomes for patients. Nowadays, multimodal communication methods are important in the design of a modern tele-triage system. Hence, the use of triage systems with tools other than phone calls (e.g., apps, video calls, chat, and text messages) is also one of the preferred tools to communicate with many patients, which requires more researches on how to receive and process requests by triage specialists.

The present systematic review had several strengths and weaknesses. The strengths included the use of a broad search strategy through which a large number of studies were identified. Two authors independently extracted data and assessed the quality of the studies. A valid tool was also used to assess the quality of the cohort studies. However, this study had limitations as well. The first limitation was the difference in the objectives, outcomes, and quality of the included studies which made the comparisons more difficult. Another limitation was the exclusion of non-English language articles (due to the smaller number of these studies compared to other languages) and conference articles (due to the inaccessibility of their full text) which may have led to the loss of some valuable studies in this field. Future studies should investigate the effectiveness of tele-triage interventions in non-pandemic situations and compare them with our findings.

Conclusion

The use of tele-triage and virtual triage services to provide primary care has expanded with the onset of the COVID-19 pandemic. So that the present study showed tele-triage systems have the potential to reduce the workload of healthcare providers, improve access to primary care counseling, reduce inappropriate use of urgent and emergency services, and improve patients' safety and satisfaction. In this way, tele-triage systems can not only provide remote emergency and acute care but also can be used as an alternative tool to

help diagnose and monitor COVID-19 and other pandemics in addition.

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