


The role of telemedicine services in changing users' intentions for presenting to the emergency departments in Saudi Arabia

Digital Health
Volume 8: 1–8
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/20552076221091358
journals.sagepub.com/home/dhj


Amjad Alfaleh^{1,2}, Abdullah Alkattan¹ , Alaa Alageel¹, Mohammed Salah³,
Mona Almutairi¹, Khlood Sagor¹ and Khaled Alabdulkareem⁴

Abstract

Background: Emergency department (ED) overcrowding is described as one of the main issues in any hospital. In Saudi Arabia, the ministry of health applied new telemedicine technology to serve patients by using the mobile application, including the Sehha application and 937 medical call center. The main aim of this study is to determine the role of different telemedicine services in changing the intention users' intentions for visiting the emergency departments in Saudi Arabia.

Methods: A cross-sectional study was conducted during August 2020 to May 2021 among 319 patients using two telemedicine services in Saudi Arabia, including the medical call center and Sehha smartphone application. The primary endpoint of this study was to determine the number of patients intended to visit ER before and after contacting one of the two telemedicine services and the frequency of people who changed their opinion to visit an ED.

Results: This study analyzed the data from 319 patients who completed the survey provided by the Saudi Ministry of Health concerning information related to their health status and ED visits. Among patients that had the intention to visit the ED ($N=159$), 53 of them did not go to EDs after using telemedicine services ($p<0.01$). Regarding the medical call center and Sehha application, 9.6% and 24.4%, respectively, of the patients who used these telemedicine services changed their minds concerning visiting ED after taking the medical advice ($p<0.01$).

Conclusions: The implemented telemedicine services in Saudi Arabia, namely the Sehha application and medical call center, could reduce those intended to visit ED and consequently reduce the overload of EDs by providing medical advice to patients concerning their minor medical issues.

Keywords

telemedicine, call centers, mobile application, triage, medical emergency service, Saudi Arabia

Submission date: 9 July 2021; Acceptance date: 15 March 2022

¹Department of Research and Development, General Directorate of Medical Consultations, Ministry of Health, Riyadh, Saudi Arabia

²General Director Office, General Directorate of School Health, Ministry of Health, Riyadh, Saudi Arabia

³Department of Health Statistics, General Directorate of Primary Health Centers, Ministry of Health, Riyadh, Saudi Arabia

⁴Research Department, Assistant Deputy Minister for Primary Healthcare, Ministry of Health, Riyadh, Saudi Arabia

Corresponding authors:

Amjad Alfaleh, Department of Research and Development, General Directorate of Medical Consultations, Ministry of Health, Riyadh, Saudi Arabia.
Email: amfalfaleh@moh.gov.sa

Abdullah Alkattan, Department of Research and Development, General Directorate of Medical Consultations, Ministry of Health, Riyadh, Saudi Arabia.
Email: abdullahalkattan@gmail.com



Introduction

ED overcrowding is described as one of the main issues in emergency departments (EDs) of any hospital.¹ ED overcrowding is defined as a condition occurring when health-care providers' lose the capability to provide medical care service within a short time.²

In general, there are many reasons leading to ED overcrowding, and these reasons could be related to manpower and non-manpower deficiency. The deficiency of manpower resources, including nursing staff, specialist physicians, administrative staff, or other staff related to different departments in hospitals could cause ED overload. The non-manpower deficiency includes beds, medications, diagnostic tools, or machines that may also lead to ED overload.³

However, another important reason for ED overload is related to increased non- and less-urgent patients presenting

at ED. This issue is usually due to a lack of patients' education or telemedicine services.⁴ Patients categorized as less- or non-urgent ill are highly distributed in every district of any city. Therefore, presenting these patients in ED will lead to ED overcrowding and may delay or reduce health-care efficacy in treating patients with very serious illnesses, which usually need resuscitation, emergent, or/and urgent medical intervention. In addition, ED overcrowding may reduce patients' satisfaction and increase their risk.⁵

The (Canadian Triage and Acuity Scale) CTAS system is used to classify patients at ED depending on severity into five categories: level I called resuscitation; which patients in this category need immediate correction of a specific physiological disorder. Level II is called emergent; patients classified as emergent need medical intervention within 15 min. Patients who are considered as level II needs medical treatment within 30 min. Level IV and level V are called non- and less-urgent, respectively, in which patients under these two categories have minor injuries or illnesses that should be seen by a healthcare provider within 60–120 min.⁶

In Saudi Arabia, the ministry of health applied new telemedicine technology to serve patients by using the Sehha application and 937 medical call center. Sehha application is a mobile application organized by the Saudi Ministry of Health and can be uploaded from either iOS or Android platforms without any costs. Besides, this application provides telemedical consultations via video, audio, and text messages. Compared to other health mobile applications in other countries (e.g. India and United Kingdom), the Sehha application can serve Arabic and English-speaking patients.^{5,7} The 937 medical call center is described as a medical calling service that answers peoples' medical inquiries. However, it only provides acoustic medical consultations. These telemedicine applications serve the patients living in the cities and support patients who are living in remote areas or unable to visit the clinics. Besides, these applications could help to reduce costs consumed without any significant needs and decrease overload at secondary and tertiary care facilities. These telemedicine services' substantial purposes are to manage minor medical cases that do not require immediate interventions and guide those patients with serious medical conditions (e.g. acute coronary disease) to seek ED care.^{5,7,8}

The main aim of this study is to determine the role of different telemedicine services in changing the intention of users' intentions to visit the emergency departments in Saudi Arabia.

Table 1. The scope of questions related to the survey used in this study.

Question scope
Age
Nationality
Gender
Living region
Type of medical consultation
chief complaint
Time to reach the nearest ED
The intention to visit an ED before contacting any telemedicine service
Did the patient visit any ED after contacting the telemedicine services?
For those who visited an ED: the reason(s) why the patient went to an ED after using the telemedicine services? (not a mandatory open-ended question)
For those who visited an ED: which type of hospital did the patient visit? (governmental/private hospital)
For those who did not visit an ED: the reason(s) why the patient did not visit any ED after using the telemedicine services? (not a mandatory open-ended question)
The insurance status of the patient
The patient's willingness to pay the medical costs at the ED

Research design and methods

Study design and patients' recruitment

A descriptive cross-sectional study was conducted during August 2020 to May 2021 among 319 patients using two telemedicine services in Saudi Arabia, including the medical call center and Sehha smartphone application.

The calculated sample size was 318, which considers a margin of error of 5% and type 1 error of 5% (critical $p =$

Table 2. Characteristics of patients used medical call center and Sehha application.

Variable	All patients (N=319)	Patients used medical call center (n= 167)	Patients used Sehha application (n= 152)	<i>p</i> value
Age (mean \pm SD)	35.94 \pm 11.4	35.87 \pm 11.5	36.03 \pm 11.3	0.900
Female gender (%)	174 (54.5)	83 (49.7)	91 (59.8)	0.323
Saudi nationality (%)	290 (90.9)	148 (88.6)	142 (93.4)	0.745
Patients have an intension to go to ED before contacting any telemedicine service (%)	159 (49.8)	75 (44.9)	84 (55.3)	0.285
Time to reach ED (%)				
<30 min	232 (72.7)	127 (76)	105 (69.1)	0.578
30–60 min	68 (21.3)	33 (19.7)	35 (23)	0.566
60–120 min	10 (3.1)	2 (1.2)	8 (5.2)	0.044
>120 min	9 (2.8)	5 (3)	4 (2.6)	0.849
CTAS system classification (%)				
Level-1	0	0	0	-
Level-2	0	0	0	-
Level-3	23 (7.2)	12 (7.2)	11 (7.2)	0.986
Level-4	43 (13.5)	21 (12.6)	22 (14.5)	0.665
Level-5	253 (79.3)	134 (80.2)	119 (78.3)	0.884

0.05). The sample size was calculated using OpenEpi software (Emory University, Atlanta GA https://www.openepi.com/Menu/OE_Menu.htm). The sampling frame was $N = 4786$, representing the average medical consultations per shift in 2020. Based on a previously unpublished pilot, the expected value for the outcome was set to 33%, as one-third of the calls intend to visit the emergency department.

According to the calculated sample size, a systematic random sampling method with a sampling interval of 1:15 was used to recruit callers from each of the two telemedicine services platforms to determine the role of telemedicine services in changing the intention of users intentions for visiting the EDs in Saudi Arabia. The study excluded patients who had already visited an ED before consulting the telemedicine services and patients diagnosed with schizophrenia, bipolar, dementia, or any cognitive skills defects that may interfere with their participation in this study.

Data collection

The data were obtained from a previous survey designed by the Saudi Ministry of Health. The survey's data reflects the patients' sociodemographic characteristics, chief complaint, type of consultation, time to reach the nearest ED, intention to visit ED, and ED visits within 24 h of telemedicine services (see Table 1).

Endpoints

The primary endpoint of this study was to determine the number of patients intended to visit ER before and after contacting one of the two telemedicine services and the frequency of people who changed their opinion to visit an ED. The secondary endpoint compares the medical call center and Sehha application concerning these variables.

Statistical analysis

For the analysis of the results, Student *t*-test, Fisher exact, and chi-square tests were performed by using SPSS version 22 to determine the differences between 937 call center and Sehha application users regarding several variables, including the mean age, frequency of female gender, Saudi nationality, patients intended to visit ER before and after contacting one of the two telemedicine services, the most reasons why patients intend to visit or not to visit ED, and patients who changed their opinion to visit an ED, time to reach ED. Besides, the CTAS system classification of patients, time to reach the ED, type of the visited hospital, type of medical insurance, and patient's willingness to pay in case of lacking medical insurance variables were also determined.

The differences between these variables were determined to compare the effect and factors related to each

telemedicine service in changing users' intentions for presenting to the EDs in Saudi Arabia.

The data were saved, organized, and graphed using the Microsoft excel 2010 program. The level of significance was considered when the p value was less than 0.05.

Ethical consideration

The study proposal was reviewed and approved by an ethics review committee (the Central Institutional review board) in the Saudi Ministry of Health. The approval letter for this study was given in June 2020 with the central IRB log number: 20–96 M. Answering and submitting the survey form by the patients was regarded as approval for participation, and the data available were completely anonymized.

Results

This study analyzed the data from 319 patients who completed the survey provided by the Saudi Ministry of Health concerning information related to their health status and ED visits. The mean age of the enrolled patients was 35.94 years, and the majority of them were Saudi females living in Riyadh and Makkah regions (see Table 2 and Figure 1).

Almost 50% of the included patients had the intention to visit an ED before contacting the telemedicine services, and most of them needed less than 30 min to reach the nearest ED. Besides, physicians working in the telemedicine services had categorized the severity of patients' medical status based on the CTAS system, which revealed that 7.2%, 13.5%, and 79.3% of total patients were classified as CTAS level III, level IV, and level V, respectively ($p < 0.01$). Besides, more than 70% of the enrolled patients need 30 min or less to reach the nearest ED (see Table 2).

Table 3 shows the variables related to patients who had an intention to visit EDs before and after contacting telemedicine services ($N = 159$). The analysis of these variables showed that 53 (17%) of them did not visit EDs after using telemedicine services (medical call center and Sehha application). This reduction in the number of patients intended to visit EDs was significant ($p < 0.01$) (see Figure 2). Regarding the analysis of each telemedicine service, 10% and 24% of the patients who used the medical call center and Sehha application, respectively, had changed their opinion concerning visiting an ED after taking the medical advice. There was a significant reduction in the number of patients who intended to visit EDs after contacting the Sehha application ($p < 0.01$); however, the medical call center showed no significant decrease in the intention to visit EDs ($p > 0.05$) (see Figure 2). The difference in rates of lowering EDs visiting intentions between the two telemedicine services was significant ($ps < 0.01$) (see Table 3 and Figure 2). Several patients who changed their intentions to visit the ED stated that they were convinced by the

physicians' medical advice to stay at home and use specific medications. Also, some patients did not visit the EDs due to coronavirus disease 2019 (COVID-19) and fear of SARS-CoV-2 infection.

Respecting the patients who already visited an ED after contacting telemedicine services ($N = 106$), the majority of them (76%) visited governmental hospitals, and only 24% of them went to private hospitals ($p < 0.01$) (see Table 4). Besides, some of those patients declared that they went to the ED because their medical issues were not treated well at home (e.g. bleeding, shortness of breath, fever, and severe pain).

A highly significant number of the included patients in this study (264 out of 319) declared that they do not have medical insurance to cover the medical services costs in private hospitals ($p < 0.05$). Besides, more than 70% of the patients are not willing to pay for medical charges at the EDs in private hospitals ($p < 0.01$) (Table 5).

Discussion

Patients categorized as less- or non-urgent are commonly presented in the ED of any hospital globally. These patients could lead to ED overcrowding and may delay the medical interventions or reduce the healthcare efficacy in treating patients with very serious illnesses, which usually need resuscitation, emergent, and urgent medical intervention. Moreover, ED overcrowding may lead to lower patient satisfaction rates and could increase the risk of delaying critical interventions.⁹

The existing evidence revealed that patients living in Saudi Arabia showed high satisfaction rates after using the implemented telemedicine services.⁸ In this study, the researchers were trying to find the role of applying telemedicine services in Saudi Arabia (medical call center and Sehha application) to reduce the number of patients intended to visit EDs classified as CTAS level IV and level V. Also, to reveal the differences between telemedicine services regarding this issue.

Most of the included patients were young adults living in the central and western regions. The study results showed that the applied telemedicine services in Saudi Arabia had a role in decreasing the users' intention to visit EDs. Moreover, the researchers figured out that the Sehha application had a more significant reduction in those who intended to visit EDs than the medical call center. This statistical difference could be related to the video call feature found in the Sehha application only, as the physicians are able to diagnose medical issues more efficiently by determining the need for visiting an ED based on visual assessment of the illness source.

On the other hand, this research suggests that lacking medical insurance for private hospitals and the unwillingness of people to pay for medical charges could be the main factors for the ED overload in the governmental hospitals in Saudi Arabia.

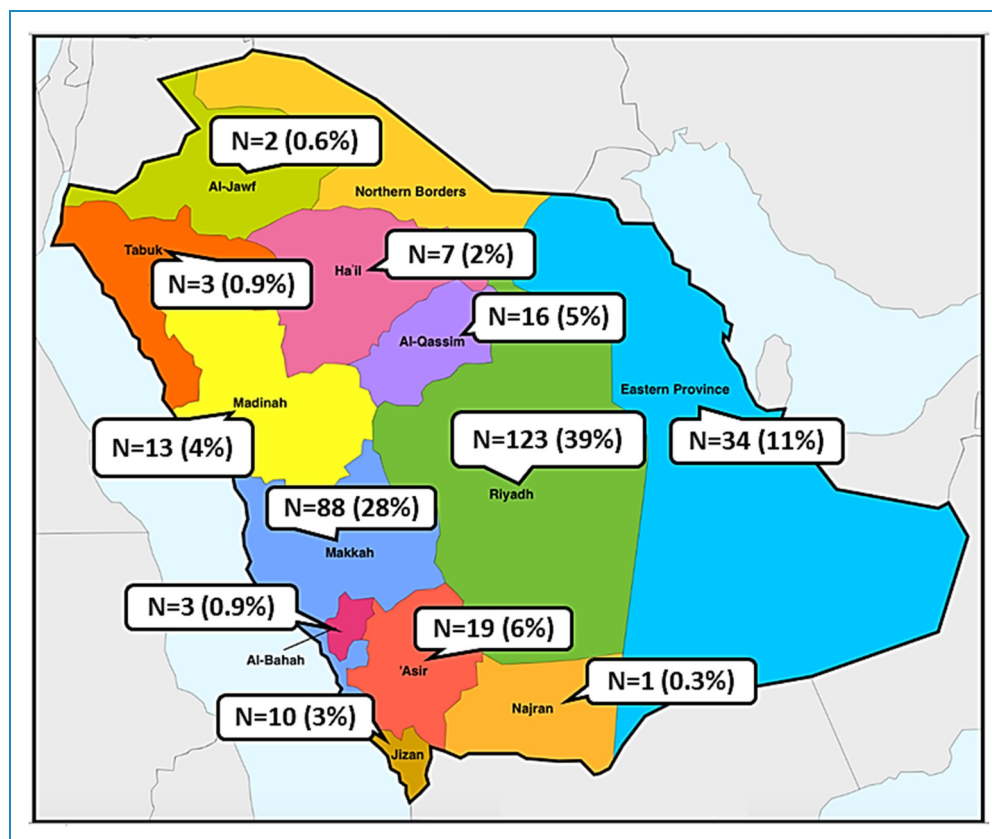


Figure 1. Geographical areas of the participated patients who used medical call center and Sehha application in Saudi Arabia.

Some studies determined the efficacy of telemedicine in reducing ED crowding in the United Kingdom. However, most of these studies did not show a significant difference in decreasing the number of less- or non-urgent patients in ED after applying telemedicine services.^{10–15} Nevertheless, a previous study was revealed that 24 h walk-in clinics in the United Kingdom had the ability to decrease the overload of ED services and showed high satisfaction reflected from the patients.¹⁶

In Iraq, Salman et al. evaluated the role of a Triage and Prioritizing Model (TPM) in reducing ED overcrowding. TPM was aimed to enhance the triage system of medical service. The outcomes of this trial showed that the TPM had reduced the patients' waiting time and differentiated between variable illnesses of patients.¹⁷

Nevertheless, a study conducted in New York, United States, by Sun et al. assessed the role of telemedicine in improving the quality of healthcare services provided in EDs. They revealed that patients were statistically spent less time at EDs after adopting telemedicine applications. Therefore, the authors conclude that telemedicine could significantly expand and enhance the medical care services in EDs.¹⁸

Although the telemedicine services could result in missed diagnoses or false reassurance of actual medical issues, a study done by Jacobs et al. revealed that people consulting

healthcare providers helped them to get away from needless visits to EDs and also minimized the rate of undiagnosed or untreated patients with bone fractures.¹⁹ The result of this study may not be applicable to all telemedicine services in different countries; however, missed diagnoses is a general medical problem, and several serious neurological cases had not been well-diagnosed in the EDs; therefore, missed diagnoses cannot be customized in telemedicine services only.²⁰

Limitations of the study

The cross-sectional design and data based on self-report were the most drawbacks. In addition, the existence of the COVID-19 pandemic could be described as a confounding factor, as some patients claim that they did not visit ED because of their fear of SARS-CoV-2 infection. However, the number of those patients was few compared to patients who had declared that they benefited from telemedicine services. Besides, most of the data were collected in periods with an increasing number of vaccinated people and much less confirmed COVID-19 cases.

Conclusion and recommendation

The implemented telemedicine services in Saudi Arabia, namely the Sehha application and medical call center,

Table 3. Patients' intentions to visit EDs before and after contacting medical call center or Sehha application.

Variable	All patients (N=319)	Patients used medical call center (n=167)	Patients used Sehha application (n=152)	p value
Patients have an intension to visit an ED before contacting any telemedicine service (%)	159 (50)	75 (45)	84 (55)	0.285
Patients have an intension to visit an ED after contacting any telemedicine service (%)	106 (33)	59 (35)	47 (31)	0.554
Patients who changed their opinion to visit an ED	53 (17)	16 (10)	37 (24)	0.002
p value	0.006	0.481	0.006	-

could reduce those intended to visit ED and consequently reduce the overload of EDs by providing medical advice to less- and non-urgent patients dealing with their minor

Table 4. Type of the visited hospital among the included patients who went to ED.

Variable	All patients (N=106)	Patients used medical call center (n=59)	Patients used Sehha application (n=47)	p value
Type of visited hospital (%)				
Governmental hospital	81 (76.4)	45 (76.3)	36 (76.6)	0.988
Private hospital	25 (23.6)	14 (23.7)	11 (23.4)	0.975
p value	0.001	0.001	0.002	-

medical issues. The researchers recommend further studies with control groups and take into account conditions such as the sociocultural differences (e.g. urban vs. rural and high vs. low socio-economic class).

Acknowledgements: The researchers would like to thank Dr Nashwa Radwan and Dr Nagla Mahmoud (Assistant Deputyship for Primary Healthcare, Riyadh, Saudi Arabia) for their assistance in collecting data.

Contributorship: AK and AF contributed in conceptualization. AK, MA, and KS contributed in data collection. AK, AK, and AA contributed in data analysis. AK, AF, and AA contributed in writing – original draft preparation. MA and KA contributed in writing – review and editing. MS, MA, and KS contributed in

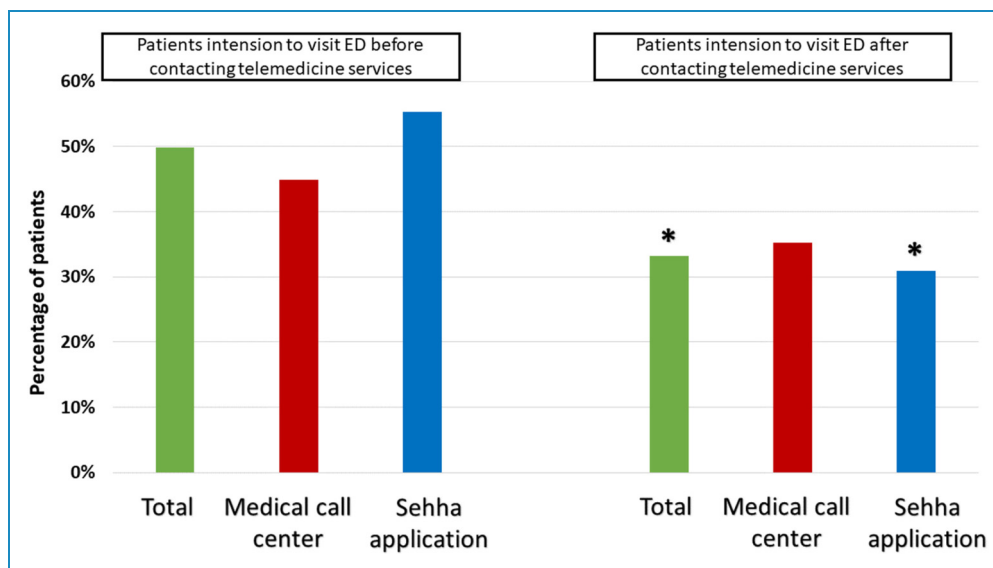
**Figure 2.** Patients' intention to visit ED before and after contacting telemedicine services (medical call center and Sehha application) in Saudi Arabia. * Significant difference between the number of patients intended to visit an ED before and after telemedicine services.

Table 5. Type of medical insurance and status of willing to pay for medical services in the ED in case of not having medical insurance among included patients.

Variable	All patients (N=319)	Patients used medical call center (n= 167)	Patients used Sehha application (n= 152)	p value
Type of medical insurance (%)				
Covering governmental and private hospitals	55 (17.2)	31 (18.5)	24 (15.8)	0.582
Covering governmental hospitals only	213 (66.8)	106 (63.5)	107 (70.4)	0.558
Not covered governmental or private hospitals	51 (16)	30 (18)	21 (13.8)	0.389
p value	0.001	0.001	0.001	-
Willing to pay in case of lacking medical insurance (%)				
Yes	88 (27.6)	42 (25.1)	46 (30.3)	0.442
No	231 (72.4)	125 (74.9)	106 (69.7)	0.682
p value	0.001	0.001	0.001	-

resources. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors have no conflicts of interest to declare.

Funding: The authors received no financial support for the research, authorship, and/or publication of this article.

Ethical approval: The study proposal was reviewed and approved by an ethics review committee (the Central Institutional review board committee) in the Saudi Ministry of Health. The approval letter for this study was given in July 2020 with the central IRB log number: 20–96 M.

Guarantor: AA.

ORCID iD: Abdullah Alkattan  <https://orcid.org/0000-0001-5294-8088>

References

1. Yarmohammadian MH, Rezaei F, Haghshenas A, et al. Overcrowding in emergency departments: a review of strategies to decrease future challenges. *J Res Med Sci* 2017; 22: 23.
2. Sinclair D. Emergency department overcrowding—implications for paediatric emergency medicine. *Paediatr Child Health* 2007; 12: 491–494.
3. Morley C, Unwin M, Peterson GM, et al. Emergency department crowding: a systematic review of causes, consequences and solutions. *PLoS One* 2018; 13: e0203316.
4. Idil H, Kilic TY, Toker İ, et al. Non-urgent adult patients in the emergency department: causes and patient characteristics. *Turk J Emerg Med* 2018; 18: 71–74.
5. Alanzi T. A review of mobile applications available in the app and google play stores used during the COVID-19 outbreak. *J Multidiscip Healthc* 2021; 14: 45.
6. Arafat A, Al-Farhan A and Khalil HA. Implementation of the Canadian emergency department triage and acuity scale (CTAS) in an urgent care center in Saudi Arabia. *Int J Emerg Med* 2016; 9: –5.
7. Hassounah M, Raheel H and Alhefzi M. Digital response during the COVID-19 pandemic in Saudi Arabia. *J Med Internet Res* 2020; 22: e19338.
8. Alfaleh A, Alkattan A, Salah M, et al. Telemedicine and patient satisfaction in Saudi Arabia. *medRxiv* 2021.
9. Tsai JC, Liang YW and Pearson WS. Utilization of emergency department in patients with non-urgent medical problems: patient preference and emergency department convenience. *J Formos Med Assoc* 2010; 109: 533–542.
10. Mason S, Mountain G, Turner J, et al. Innovations to reduce demand and crowding in emergency care; a review study. *Scand J Trauma Resusc Emerg Med* 2014; 22: 1–7.
11. Chalder M, Sharp D, Moore L, et al. Impact of NHS walk-in centres on the workload of other local healthcare providers: time series analysis. *Br Med J* 2003; 326: 32.
12. Penson R, Coleman P, Mason S, et al. Why do patients with minor or moderate conditions that could be managed in other settings attend the emergency department? *Emerg Med J* 2012; 29: 487–491.
13. Maheswaran R, Pearson T, Munro J, et al. Impact of NHS walk-in centres on primary care access times: ecological study. *Br Med J* 2007; 334: 38.
14. Salisbury C, Hollinghurst S, Montgomery A, et al. The impact of co-located NHS walk-in centres on emergency departments. *Emerg Med J* 2007; 24: 265–269.
15. Turner J, O’Cathain A, Knowles E, et al. Impact of the urgent care telephone service NHS 111 pilot sites: a controlled before and after study. *BMJ Open* 2013; 3: e003451.
16. Arain M, Campbell MJ and Nicholl JP. Impact of a GP-led walk-in centre on NHS emergency departments. *Emerg Med J* 2015; 32: 295–300.
17. Salman OH, Aal-Nouman MI and Taha ZK. Reducing waiting time for remote patients in telemedicine with considering treated patients in emergency department based on body sensors technologies and hybrid computational algorithms:

- toward scalable and efficient real time healthcare monitoring system. *J Biomed Inform* 2020; 112: 103592.
18. Sun S, Lu SF and Rui H. Does telemedicine reduce emergency room congestion? Evidence from New York state. *Inf Syst Res* 2020; 31: 972–986.
 19. Jacobs JJ, Jacobs JP, van Sonderen E, et al. Fracture diagnostics, unnecessary travel and treatment: a comparative study before and after the introduction of teleradiology in a remote general practice. *BMC Fam Pract* 2015; 16: –9.
 20. Dubosh NM, Edlow JA, Goto T, et al. Missed serious neurologic conditions in emergency department patients discharged with nonspecific diagnoses of headache or back pain. *Ann Emerg Med* 2019; 74: 549–561.
-