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Research Article

Global Impact of COVID-19 on Seeking Emergency Department Services; A Systematic Review

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Abstract

Background: COVID-19 pandemic had affected the health systems worldwide, including decreasing the number of emergency department visits and the characteristics of these visits.

Purpose: This review aimed to investigate the impact of the COVID-19 pandemic on seeking emergency department services.

Methods: A systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines was conducted to search for eligible publications in two databases. The search was conducted between December 20, 2020, and the last search on January 7, 2020.

Results: A total of 12 research studies were reviewed, appraised, and summarized. The studies reported a significant decrease in the number of patients presenting to emergency departments, hospitalization rate, and non-respiratory related complaints. Besides, home quarantine decreased the number of motor vehicle crashes, trauma, and musculoskeletal injuries.

Conclusion: Some patients might delay seeking help because of their fear of cross-contamination with the virus; health institutions must act to meet patients' needs during the pandemics through public awareness and utilizing outpatient management systems.

Keywords: *COVID-19; Emergency Services; Emergency Department Access; Emergency Department Visits; SARS-CoV-2*

Abbreviations

ACS: Acute Coronary Syndrome; ED: Emergency Department; GI: Gastrointestinal Symptoms; ICU: Intensive Care Units; JBI: Joanna Briggs Institute; MVC: Motor Vehicle Crashes; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta Analyses; WHO: World Health Organization

Introduction

The World Health Organization (WHO) declared the COVID-19 as a pandemic on March, 2020 [1]. A substantial drop in the emergency department (ED) visits during the pandemic has been reported. Patients probably stopped going to hospitals because they were afraid of

getting the infection [2]. Further, this decline in ED visits may reflect the overuse of ED before the pandemic era, as indicated by Durand., *et al*. [3], who reported the proportion median of the non-urgent ED visits of 32%. For some chronically ill patients, avoiding ED resulted in a deterioration of their condition; some needed intensive care units (ICU) admissions, while few died [4]. The extent to which COVID-19 affected patients' utilization of ED worldwide is a vital indicator for planning ED reorganization to accommodate patients' needs during times of health and pandemics.

Objective and Research Question

The aim of this review was to investigate the impact of the COVID-19 pandemic on seeking ED services. The current systematic review was guided by a PICO question (population, intervention, comparison, and outcomes) to assure a systematic and comprehensive search. However, as the review was conducted for observational studies, only the population (patients who seek ED care) and the outcomes (ED visits) were applicable. Therefore, this study answered the following question: what is the impact of COVID-19 on seeking ED services?

Materials and Methods

Review protocol

The review authors followed the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) to guide the review process [5]. Further, this review is registered in the PROSPERO database, ID (CRD42021230942).

Studies identification and selection

Searching for eligible publications was conducted using the Medline (through PubMed) and CINAHL to identify eligible studies. The literature search was started on December 20, 2020, and the last search on January 7, 2020. The search was conducted through entering search terms generally then expanded. Besides, possible combinations of the terms were then searched to locate target publications. A manual search of the reference lists of eligible articles was also conducted. The keywords used included: "COVID", "COVID-19", "emergency service, hospital", "emergency department access", "emergency department visits", and "SARS-CoV-2".

The review authors followed pre-determined eligibility criteria to include the retrieved articles: (1) a report of a quantitative research study, (2) investigated the seeking of ED services during COVID-19, (3) addressed surgical or medical reasons for seeking ED care, (4) included adult patients, and (5) written in English. Studies were excluded if they reported seeking specific clinics/disciplines, such as neurology and urology.

All screened literature was imported into Mendeley to facilitate organization and removal of duplicates. Studies selection was conducted over several stages. Initially, the review authors screened the studies' titles to assess if they address the problem under study, which is "seeking ED during COVID-19". After that, they read the abstracts to verify if they meet the eligibility criteria. They resolved any disagreement through discussions and consensus.

Data collection

The review authors developed a data extraction form to summarize the retrieved studies. Data were extracted by the first author, then checked by the second author. Any discrepancies were resolved by referring to an expert researcher. The review authors conducted an in-depth review of the eligible studies; information was extracted about (1) the characteristics of the study and (2) outcome measures (ED visits rate, triage levels, chief complaint/diagnosis, hospitalization rate, and other ED visits characteristics).

Risk of bias

Two reviewers independently assessed the risk of bias in all studies. The retrieved studies were assessed using the Joanna Briggs Institute (JBI) critical appraisal tool (Appendix A) [6]. If the scores differed, an agreement was achieved by reaching a consensus.

Results and Discussion

Studies selection and characteristics

A total of (36) articles was retrieved. After duplicates removal, the titles of (28) were screened. There were (16) relevant articles that underwent full-text screening, of which 12 were found eligible to be included in the review. The search and selection of the studies are shown in figure 1.

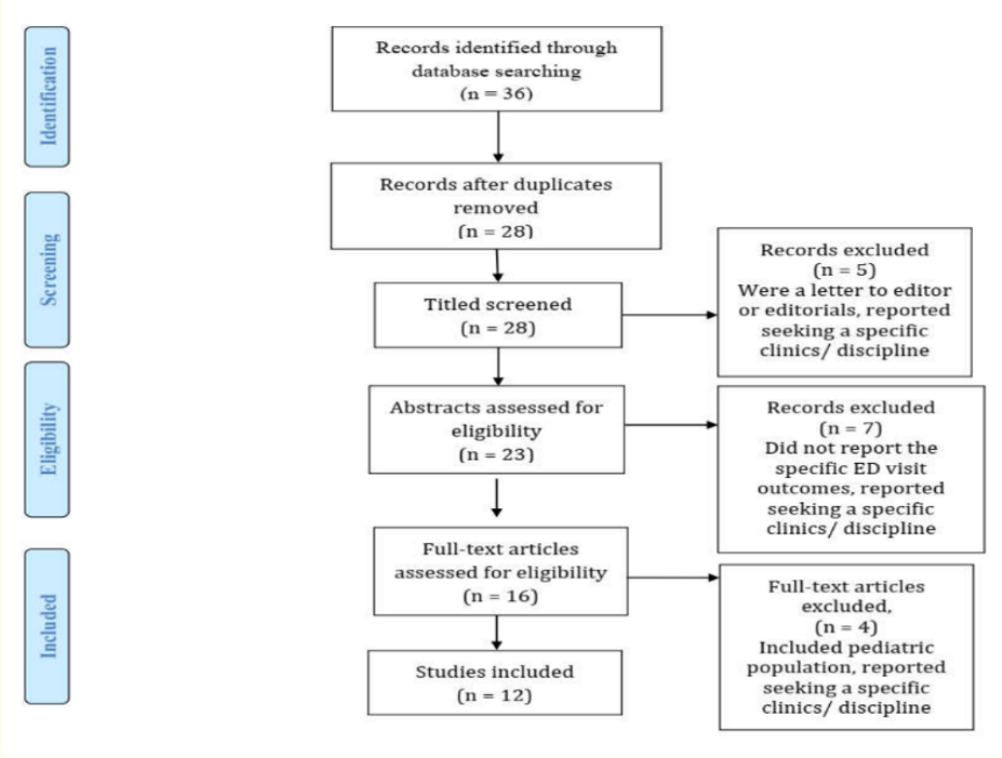


Figure 1: *PRISMA, the literature review flow diagram*

Generally, four studies were conducted in the United States of America (USA), six in Europe, and two in Asia (one of these in the Middle East). Due to the nature of the research questions, the studies were conducted as observational, either prospectively or retrospectively. A summary of studies characteristics is shown in table 1.

Study (Country)	Design	Settings	Follow-up period	Sample
Boserup., *et al*. 2020 (USA)	Retrospective analysis	• Facilities reporting to the CDC	• 29/9/2019 to 5/4/2020	3,415 facilities
Butt., *et al*. 2020 (Qatar)	Retrospective analysis	• A tertiary care general hospital • A cardiac hospital • A national center for cancer care and research • Women's wellness and research center	• March to April 2019 (pre-COVID era) • January 2020 • March to April 2020 (COVID era)	192,157 ED visits
Casalino., *et al*. 2020 (France)	Prospective observational non-interventional study	Four academic hospitals	• 25/11/2018 to 25/11/2019 (pre-epidemic period) • 26/11/2019 to 26/3/2020 (COVID-19 and lockdown periods)	368,262 ED visits
Garrafa., *et al*. 2020 (Italy)	Retrospective analysis	University Hospital	• 1/2/2020 to 22/2/2020 (pre- COVID) • 23/2/2020 to 1/3/2020 (fear week) • 2/3/2020 to 3/5/2020 (COVID time) • 4/5/2020 to 30/6/2020 (release of lockdown) • And similar periods in 2019	Not reported
Giannouchos., *et al*. 2021 (USA)	Retrospective, cross-sectional study using	Urban, academic hospital	• January to March 2020; • April 2020 • May to August 2020 • And similar periods in 2019	80,000 outpatient visits
Hautz., *et al*. 2020 (Switzerland)	Retrospective study	University hospital	• 1/3/2020 to 16/3/2020 (awareness phase) • 16/3/2020 to 30/3/2020 (mitigation phase) • March 2019	7143 patients
Kastritis., *et al*. 2019 (Greece)	Retrospective study	A tertiary hospital	• March 2019 • March 2020	1786 patients • 1133 in 2019 • 653 in 2020
Nourazari., *et al*. 2020 (USA)	Retrospective study	12 EDs	• 1/1/ 2019–9/9/2019 • 1/1/2020–9/8/2020	501,369 ED visits
Ojetti., *et al*. 2020 (Italy)	Retrospective, cross-sectional observational study	Urban tertiary teaching hospital	• February to March 2020 • February to March 2019 • February to March 2018	16,281 patients: • 3951 in 2020 • 12330 in 2018-2019
Sekine., *et al*. 2020 (Japan)	Retrospective study	A tertiary care hospital	• 1–15/1/2020: no COVID-19 • 16/1–1/3/2020: initial COVID-19 outbreak • 2/3–15/4/2020: nationwide closures • 16/4–25/5/2020: state of emergency • And similar periods in 2015, 2016, 2017, 2018, 2019	16,651 patients in 2020 19,292 in 2019 18,366 in 2018 17,864 in 2017 18,375 in 2016 and 18,881 in 2015
Tuominen., *et al*. 2020 (Finland)	Retrospective cohort	A secondary care hospital	• 16/3 to 11/6/2018 • 16/3 to 11/6/2019 • 16/3 to 11/6/2020	27,526 ED visits
Westgard., *et al*. 2020 (USA)	Observational study	Urban level 1 trauma center	• 16/2/2019 to 15/3/2019 • 16/3/2019 to 12/4/2019 • 15/2/2020 to 13/3/2020 • 14/3/2020 to 10/4/2020 (social-distancing measures)	Total: 24,950 patients 6,547 6,744 6,993 4,666

Table 1: *Characteristics of the reviewed studies.*

CDC: Centers for Disease Control and Prevention; ED: Emergency Department.

Risk of bias within studies

The quality of included studies was appraised and reported using the JBI critical appraisal tool. Most studies failed to report clear criteria for participants' inclusion; however, they aimed to collect data about all patients or ED visits that occurred during a pre-determined period. Besides, as the exposure was (COVID-19), and there was no comparison between different exposures, item number three on the checklist (exposure measured in a valid and reliable way) was reported as inapplicable for all studies.

On the other hand, most studies adequately reported the study subjects and the setting, used standard measurement criteria, measured the outcomes adequately, and used appropriate statistical analysis. Further, two studies acknowledged the presence of confounding variables; nevertheless, none of the studies identified strategies to deal with these confounding variables. A summary of the studies' appraisal is provided in table 2. In general, despite the inadequacies in some articles, the review authors decided to include all the studies in the review.

Study	Clear criteria for inclusion	Study subjects and the setting described	Exposure measured in a valid and reliable way	Standard measurement criteria	Confounding factors identified	Strategies to deal with confounding factors	Outcomes measured in a valid and reliable way	Appropriate statistical analysis
(9)	N	N	NA	Y	N	N	Y	Y
(10)	N	Y	NA	Y	N	N	Y	Y
(11)	N	Y	NA	Y	N	N	Y	Y
(12)	N	N	NA	Y	N	N	Y	Y
(13)	N	Y	NA	Y	N	N	Y	Y
(14)	N	Y	NA	Y	N	N	Y	Y
(15)	N	Y	NA	Y	N	N	Y	Y
(16)	N	Y	NA	Y	N	N	Y	Y
(17)	Y	Y	NA	Y	Y	N	Y	Y
(18)	N	Y	NA	Y	N	N	Y	Y
(19)	N	N	NA	Y	N	N	Y	Y
(20)	N	Y	NA	Y	Y	N	Y	Y

Table 2: *Critical appraisal for risk of bias.*

Y: Yes; N: No; U: Unclear; NA: Not Applicable.

Results of individual studies

The in-depth review of the articles gave insight about the (1) change in ED visits in response to COVID-19, (2) the impact of COVID-19 on through-ED admissions, and (3) ED visits characteristics during COVID-19. A detailed summary of the studies is shown in table 3.

Study	Main study variables	Seeking ED during COVID-19 (significant findings)				
		ED visits rate	Triaging	Chief complain/diagnosis	Hospitalization rate	Other ED visits characteristics
(9)	• Number of ED visits • Percentage of visits for CLI • Percentage of visits for ILI	Reduction (during the pandemic) per week by 31-45%.	Not reported	ILI and CLI around February 23, 2020 (due to awareness of COVID-19)	Not reported	Decrease in MVCs 55-66%
(10)	• Number of ED visits • Triage acuity level	Reduction by 20-43%.	• Resuscitation and emergency decrease by 26-69% • Urgent decrease by 21-45% • Less urgent decrease by:11-50% • Non-urgent decrease by 15-47% • Increase in not triaged: 26-59%	Not reported	Not reported	A decrease in the reported live birth, (due to movement restriction)
(11)	• Number of ED visits • Number of admissions through ED • Triage acuity level	Reduction by (36.9%) during the pandemic and (49.6%) during the lockdown.	• Resuscitation, emergency, and urgent levels: increased during the pandemic by 74.4%, and decreased during the lockdown by 21.6% • Less urgent and non-urgent levels: increased during the pandemic by 5.2%, and decreased during the lockdown by 63.1%	• During the pandemic, PE/ DVT increased by 42.4%, and by 33.5% during the lock-down. • ILI increased by 225% during pandemic, and decreased by 42% during lockdown. • During lockdown, decrease in ACS by 51.2%, CVA by 57.1%, seizures by 48%, and DKA by 47.2%.	• During the pandemic, increased admissions to floors (33.9%) and ICU (277%) • During the lockdown, decreased admissions for floors (16.8%) and ICU (15.5%)	Not reported
(12)	• Number of ED visits • Number of admissions through ED • Triage acuity level	Reduction by 31.8% (in fear week), 44% (during the COVID), and 34% (after the lockdown release)	• Urgent and less urgent patients: decreased by 24.7% (in fear week), 27% (during the COVID), and 19% (after the lockdown release) • Non-urgent and inappropriate ED patients: decreased by 35% (in fear week), 54% (during the COVID), and 42% (after the lockdown release).	• Chest pain complaints reduced by 32% (in fear week), 60% (during the COVID), and 28% (after the lockdown release) • Abdominal pain complaints reduced by 32% (in fear week), 70% (during the COVID), and 36% (after the lockdown release)	Reduction by 12.7% (in fear week), and 5.6% (during the COVID), and 19% (after the lockdown release)	Decreased waiting time in ED during the pandemic.
(13)	• ED visits • Medical urgency • Clinical • diagnoses	Overall reduction in 2020 by 8.1%	• In April, decreased the emergent not preventable/avoidable by 40%, preventable or avoidable by 48.2%, primary care treatable by 35%, and non-emergent by 23%.	• Reduced chest pain complaints by 10% • Increased Lower respiratory disease by 67%, and palpitations/ tachycardia by 30%	Not reported	Almost all types of outpatient ED visits bounced back after May 2020.
(14)	• ED visits • Urgency • Chief complaints • Admission rate	Reduction by 24.9% (during the awareness phase), and by 42.5% (during the mitigation phase)	• During the awareness phase, decrease in the semi-urgent cases by (1.3%) • During the mitigation phase, decrease in the life-threatening by (12.6%), high urgent by (26%), urgent by (40%), and non-urgent by (57%).	• During the awareness phase, the GI complaints decreased by 31.8%, Ear/ nose/ throat/ eye by 26%. And respiratory complaints increased by 25%. • During the mitigation phase, decreased in trauma complaints by 49%, musculoskeletal by 64%. While respiratory complaints increased by 70%.	During the awareness phase, decreased by 21%	The ED death increased by 233% during the awareness phase, and by 367% during the mitigation phase.
(15)	• ED visits • Diagnosis • Admission rate	Reduction by 42.3%	Not reported	• URTI increased by 20.7%, and LRTI by 32%. • GI complaints reduced by 58.8%, fatigue, back or musculoskeletal pains reduced by 70%, angina, MI, CVA reduced by 39.7%, cancer patients and terminal care reduced by 40%.	Reduction by 34.8%	Among patients above the age of 65, 61.8% required hospitalization in the 2020 period compared to 48.9% in the 2019.
(16)	• ED visits • Diagnosis • Admission rate	Reduction by 55% in non-COVID visits	Not reported	• Reduced in asthma by 64%, COPD by 61%, HF by 47%, • Increased in TBI/concussion by 18%, respiratory symptoms by 5%, and respiratory failure by 3%	Reduction by 49% for non-COVID admissions	Reduction in admission differed according to the insurance; Medicare patients by 37%, Medicaid by 30%, private patients by 28%, self-pay patients by 15%.

(17)	• Number of total ED visits • Diagnoses • Hospitalization rates	Reduction in 2020 by 34.2% compared to 2018, and 37.6% compared to 2019	• Emergent decreased by 21% • Urgent decrease by 27% • Non-urgent decreased by 48%	Fever	Increased in 2020 to 42.9%, compared to 27.7% in 2018 and 26.4% in 2019.	• Increase of triage urgency level at ED admission • Reduction ($p < 0.05$) of night admissions.
(18)	• Number of total ED visits • Triage levels • Admission rate	Reduction by 10.2% (16651 patients in 2020 compared to an average of 18556 patients in previous years)	• Level 4 (less urgent) decreased by 22%, and level 5 (non-urgent) by 29% during the pandemic. • Levels 1 (Resuscitation), 2 (Emergent) and 3 (Urgent) increased during the pandemic (non-significantly).	Not reported	Increased during the pandemic, but statistically not-significant.	The number of ambulance ED visits during the pandemic significantly increased by 8.3% during the initial COVID-19 outbreak.
(19)	• Number of total ED visits • Diagnoses • Triage levels	Reduction in total daily visits by 23% (compared to 2018 & 2019).	• Non- Emergent visits declined by 42%, • Emergent - ED Care Needed - Not Preventable/Avoidable and Emergent/ Primary Care Treatable declined by 19% • Emergent/Primary Care Treatable declined by 19% • Emergent - ED Care Needed-Preventable/ Avoidable reduced by 28%	• Drug-related visits were reduced by 29% • Injuries were reduced by 25%	Not reported	Not reported
(20)	• Number of ED visits • Triaging • Diagnoses • Hospitalization rates	Reduction by 7.7% in weekly ED visits, by 49.3% overall, and by 35.2% with respect to 2019.	• Resuscitation decrease by 29.4% • Emergent decrease by 37.5% • Urgent decrease by 35.3% • Less urgent decrease by 34.8% • Non-urgent decrease by 18.8%	• Significant decreases in patients presenting with syncope by 70.5%, CVA by 58.3%, urolithiasis by 70.0%, abdominal pain by 43.3%, and back pain by 50.7%. • Significant increases in and URTI by10.0%, SOB by 25.1%, and chest pain by 13.1%.	Reduction by 37% compared to 2019.	Declined in AMA discharged by 75.6%

Table 3: *Summary of the studies' findings.*

ACS: Acute Coronary Syndrome; AMA: Against Medical Advice; CLI: COVID-19-Like Illness; COPD: Chronic Obstructive Pulmonary Disease; CVA: Cerebrovascular Accident; DKA: Diabetes Ketoacidosis; DVT: Deep Vein Thrombosis; ED: Emergency Department; GI: Gastrointestinal; HF: Heart Failure; ICU: Intensive Care Unit; ILI: Influenza-Like Illness; LRTI: Lower Respiratory Tract Infections; MI: Myocardial Infarction; MVCs: Motor Vehicle Crash; PE: Pulmonary Embolism; SOB: Shortness of Breath; TBI: Traumatic Brain Injury; URTI: Upper Respiratory Tract Infections.

Change in ED visits in response to COVID-19

The retrieved studies compared the number of ED visits during the COVID-19 pandemic with similar periods in previous years. Generally, all the studies reported a decline in ED visits during the pandemic and the lockdown periods. The overall reduction in ED visits ranged from 8.1% to 55%. Eight studies reported a decline of more than 30% in ED visits. However, it was noted that in some EDs that visits bounced back after passing the pandemic.

The impact of COVID-19 on through-ED admissions

Eight studies (out of 12) reported the change in hospitalization rate during the hit of COVID-19. The studies presented a substantial variation in the admission rate; five studies reported a decrease in the admission rate (5.6% - 49%), while three studies reported an increase in hospitalization (33.9% - 42.9%). One of these studies reported a tremendously elevated admission rate of 277% to the ICUs; this increase may reflect the severity of patients' illness during the COVID-19 pandemic who needed ICU admissions. Further, higher admission rates were reported for patients above the age of 65 years. Besides, the reduction in admission differed according to the insurance; higher reduction rates were among insured patients.

ED visits characteristics during COVID-19

The EDs during the pandemic witnessed fewer night admissions, AMA discharged, and less waiting time. On the other hand, more patients used an ambulance to arrive at the ED and had higher urgency levels and death rates. Most of the studies reported a decrease in patients numbers presented at the various triaging levels compared with the pre-pandemic era. However, one study reported an increased number of patients who were triaged at resuscitation or urgent levels during the pandemic hit.

The chief complaints or diagnoses were also significantly affected by the pandemic. Generally, complaints related to the respiratory system were significantly increased compared to the pre-COVID era. On the other hand, motor vehicle crashes (MVC), trauma, gastrointestinal symptoms (GI), acute coronary syndrome (ACS), and strokes were significantly fewer.

Summary of evidence

This review found a significant decrease in the number of patients presenting to EDs. This can be related to the WHO declarations describing the COVID-19 outbreak, their desire to maintain social distancing to avoid contact with infected individuals, and the travel restrictions. This avoidance of ED visits may negatively affect patients outcomes, especially those with acute conditions that require urgent hospital care, such as stroke and myocardial infarction [7]. Further, the lower numbers of ED visits and fewer risk patients (measured by triage level) presented to ED may be contributed to the decline in ED-through admission rates.

Another interesting finding was that home quarantine, which most countries imposed, decreased the number of cars on the streets, subsequently significantly decreasing MVCs. This decrease in MVCs has likely also contributed to a further reduction in ED visits. Similar findings were reported about trauma and musculoskeletal injuries, which decreased due to limited outdoor activities [7].

Several studies reported setting up a location outside the hospital to triage and manage patients with Covid-19. Unfortunately, a recent study reported an increase in pre-hospital cardiac arrest and mortality during the COVID-19 pandemic, either because of the virus itself or to confinement consequences, including fear of getting the infection [8]. Establishing separate locations and staff to manage COVID-19 may reassure patients on ED safety and make them overcome their fear of accessing the ED to receive appropriate care as needed.

Conclusion

COVID-19 decreased patients' access to ED, hospitalization rate, and non-respiratory related complaints. However, numbers of low ED visits must be interpreted carefully, especially considering that some patients might delay seeking help because of their fear of cross-contamination with the virus, contributing to the increased pre-hospital mortality. On the other hand, the home confinement associated with the restriction of outdoor activities, better self-care, and lifestyle changes might influence patients' health, consequently, seeking EDs services.

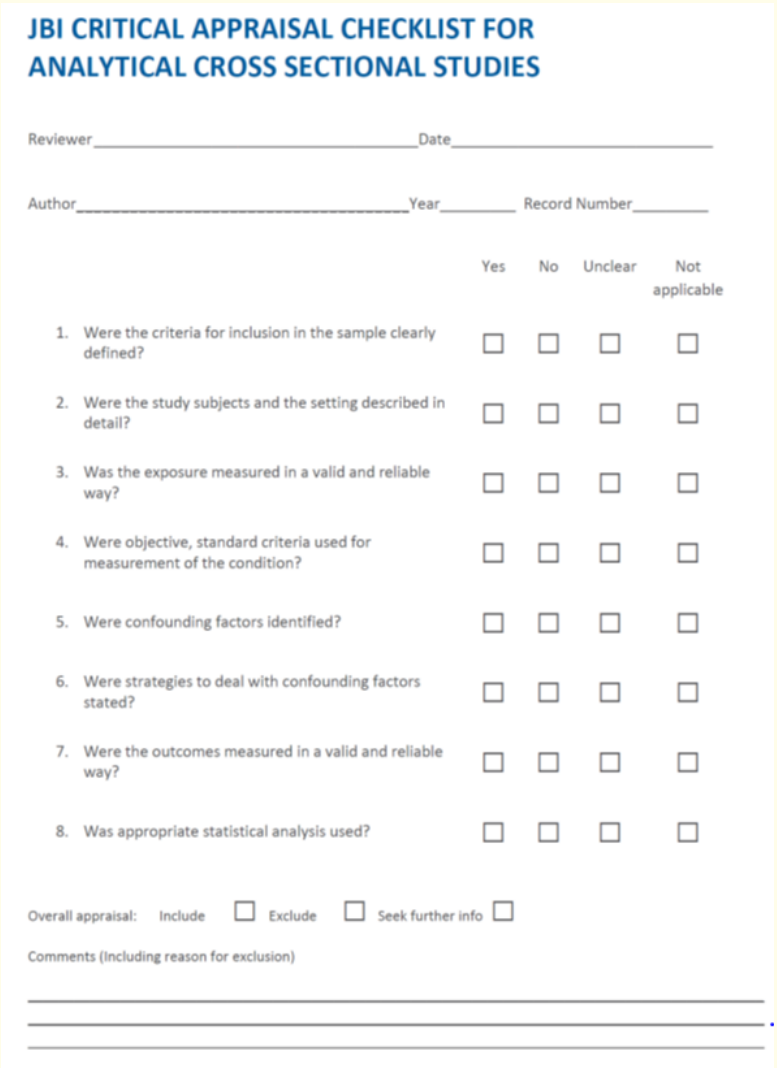
Health institutions must find appropriate approaches to meet patients' needs during the pandemics. One of the most critical strategies is increasing public awareness about accessing ED services and the consequences of delaying timely management. Other strategies such as outpatient management systems, utilizing the nursing homes, rehabilitation and long-term acute care facilities may decrease the burden on ED resources and provide appropriate care to patients. Further studies are needed to measure the impact of the decreased ED visits on the patients' health status and the trends in utilizing ED services after the pandemic.

Conflict of Interest Statement

None.

Appendix A

Critical appraisal checklist



JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Figure

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