Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Infection and Public Health 15 (2022) 132–137

Contents lists available at ScienceDirect

Journal of Infection and Public Health

journal homepage: http://www.elsevier.com/locate/jiph

Original Article

The effect of COVID-19 on the characteristics of adult emergency department visits: A retrospective cohort tertiary hospital experience in Riyadh

Raied Alotaibi[a,b], Ali Alahmari[c,e], Ibrahim Ababtain[c,e], Abdullah Altamimi[c,e], Abdullah Alkhaldi[c,e,*], Mohammed Alhelail[c,d,e], Majid Alsalamah[c,d,e]

[a] Department of Basic Science, Prince Sultan Bin Abdulaziz College for Emergency Medical Services, King Saud University, Riyadh, Saudi Arabia
[b] Usher Institute, University of Edinburgh, Teviot Place, Edinburgh, EH8 9AG, UK
[c] College of Medicine, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia
[d] Emergency Medicine Department, Ministry of the National Guard - Health Affairs, Riyadh, Saudi Arabia
[e] King Abdullah International Medical Research Center, Riyadh, Saudi Arabia

ARTICLE INFO

Article history:
Received 22 June 2021
Received in revised form
15 September 2021
Accepted 5 October 2021

Keywords:
Emergency department visits
COVID-19
Health care utilization
Access to care
Emergency admission rate
Ramadan
Acuity level
Primary care

ABSTRACT

Background: On March 2, 2020, Saudi Arabia identified the first positive COVID-19 case. Since then, several aspects of the COVID-19 impact on Emergency Departments (EDs) use have been reported. The objective of this study is to describe the pattern and characteristics of Emergency Department visits during the COVID-19 pandemic period, compared with the same period in the previous year, including the patients' demographic information, acuity level, length of stay, and admission rate.
Methods: Data were collected from King Abdulaziz Medical City in Riyadh, Saudi Arabia. The health records of all the patients who presented at the Emergency Department from January 2019 to September 2020 were retrospectively reviewed. The variations in the patient and the visit characteristics were described for the periods before and during COVID-19.
Results: The records of 209,954 patients who presented at the Emergency Department were retrieved. In contrast to 2019, the number of visits during the pandemic period reduced by 23%. A dramatic decrease was observed after the announcement of the first COVID-19 diagnosed case in Saudi Arabia, and subsequently the numbers gradually increased. The patients who presented at the Emergency Department during the pandemic period were slightly older (mean age, 43.1 versus 44.0 years), more likely to be older, more urgent and had a higher admission rate compared to the pre-pandemic period. There was a slight increase in visits during the daytime curfew hours and a decrease during the nighttime.
Conclusion: We report a considerable decrease in the number of Emergency Department visits. The reduction was higher in non-urgent and less urgent cases. Patients presenting at the Emergency Department during the curfew times were more likely to stay longer in the Emergency Department and more likely to be admitted, compared with the pre-pandemic period.

Introduction

Background

In December 2019, an outbreak of cases with unexplained low respiratory tract infections caused by a new coronavirus were first detected in Wuhan, China. The World Health Organization (WHO) recognized this outbreak as coronavirus disease 2019 (COVID-19) and officially declared a pandemic on March 11, 2020 [1]. On March 2, 2020, Saudi Arabia identified the first positive COVID-19 case [2]. The Saudi government promptly took several preventive actions in an attempt to contain the virus, including the suspension of prayers in mosques and travel restrictions [3]. In addition, a strict social distancing policy, including a partial curfew and complete lockdown, were implemented to prevent the spread of the disease [4].

In recent literature, several aspects of the COVID-19 impact on Emergency Departments (EDs) use have been reported. For

* Corresponding author at: College of Medicine, King Saud Bin Abdulaziz University for Health Sciences, P.O. Box 3660, Riyadh, 11481, Saudi Arabia.
E-mail address: aabdulochik@gmail.com (A. Alkhaldi).

https://doi.org/10.1016/j.jiph.2021.10.009

instance, the volume of EDs visits showed a significant reduction in the United States, Italy, France, Switzerland, Finland, Norway, Israel, and Taiwan [5–14]. There was also a variation in the admission rates and acuity levels in different countries. The number of non-urgent and less urgent cases levels decreased, and the admission rates increased in most countries [12,13,17,18]. However, these changes were only investigated in the early phase of the pandemic and during lockdown, without assessing the change in trends during the different types of lockdown, as well as the late periods of 2020. Though it is apparent that younger age groups are affected less frequently and with a more benign disease spectrum than older people [15,16], limited studies assessed the variations in the age in patients presenting at EDs during COVID-19 pandemic [8,9]. In a systematic review of COVID-19 related research in Saudi Arabia, it was reported that no study has yet explored the impact of COVID-19 on the use of Emergency Departments [19].

Importance

Previous studies attributed the decline in EDs use to different factors, such as lockdown and the public's fear of contracting the virus [20]. However, investigating the effect of the different curfew times as well as the extensive period of 2020 will provide a better understanding of the decline, to support improved resource allocation in future [22]. Investigating the demographic information, acuity level and admission rates in different circumstances will enable decision makers and clinicians to update policies and the risk stratification processes during a pandemic, and to increase public health awareness for optimal use of EDs.

Aims of the investigation

The aim of the current study was to identify the change in EDs visits during the COVID-19 pandemic period, compared to the same period in the previous year. Data will include an assessment of the variation in the type, acuity level, patient characteristics, as well as the effect of the different governmental curfew hours. We also aimed to assess the pattern of EDs visits during specific periods related to the community of Saudi Arabia, such as during the holy month of Ramadan with Muslims fasting from sunrise to sunset, as well as during Eid al-Fitr and Eid al-Adha, two holidays in the Islamic calendar.

Methods

This observational retrospective study collected data of all the ED patients visits at King Abdulaziz Medical City in Riyadh, Saudi Arabia. The ED of King Abdulaziz Medical City is a level 1 trauma centre and one of the largest emergency care centres in the Middle East, with an average annual visit volume of 200,000 visits. The data were retrieved from the hospital's electronic health records for all the patients older than 14 years, from January 1, 2019, to September 19, 2020. The records contained information about the patient demographic information and the visit characteristics, including the time and date of visit, length of stay, acuity level, the reason for ED visit and admission status.

The first diagnosed case of COVID-19 in Saudi Arabia occurred on March 2, 2020. Subsequently, the cases increased, and the government declared new measures to control virus transmission, including school closure and a nationwide curfew. The first curfew imposed was a 12-h partial curfew from 18:00 to 6:00, starting on March 23, 2020, to April 06, 2020. Subsequently, a 24-h curfew was imposed from April 07 to April 25. During this period individuals were allowed to go to an EDs only if they received permission from officials after completing and submitting an electronic form. Later, the government announced a 15-h curfew starting from 17:00 to 9:00 from April 26 to May 22, followed by a nighttime curfew (20:00 to 6:00) from May 23 to June 21. On June 21, the government lifted the curfew in Riyadh.

Table 1
Characteristics of Emergency Department visitors during the COVID-19 pandemic period (1 January 2020–17 September 2020) versus the same period in 2019.

Year	2019 N[a] = 118,405	2020 N = 91,548	P-value
Daily visit average, N	448	345	–
Female, N (%)	64,464 (54.4)	46,879 (51.2)	<0.001
Male, N (%)	53,941 (45.6)	44,666 (48.8)	
Mean age, years (±standard deviation)	43.1 (19.7)	44.0 (19.6)	<0.001
Severity level[b], N (%)			
Resuscitation	366 (0.3)	329 (0.4)	
Emergent	4829 (4.1)	4823 (5.3)	
Urgent	55,802 (47.3)	47,490 (52.0)	<0.001
Less urgent	50,407 (42.7)	34,942 (38.3)	
Non-urgent	6664 (5.6)	3731(4.1)	
Nationality, N (%)			
Saudi	112,434 (95.0)	85,470 (93.4)	<0.001
Non-Saudi	5971 (5.0)	6076 (6.6)	
Ramadan, N	12,515	7900	–

[a] N number of participants.
[b] Acuity level was determined using the Canadian Triage and Acuity Scale (CTAS).

In this study, we reviewed the number of ED visits during the different curfew times and compared the findings with the same period in the previous year (2019). To control for the seasonal variation in ED visit volumes, we selected January 1, 2019, to September 17, 2019, as the "baseline" period to compare the patient demographic information and the visit characteristics. In addition, we analyzed the time and number of visits during the period of the holy month of Ramadan in 2019 (May 1 to June 3) in comparison to 2020 (April 23 to May 23).

The frequency and percentage of the visits were calculated and compared in terms of the different study periods. The acuity level was determined using the Canadian Triage and Acuity Scale (CTAS), a validated tool used to prioritize patients in the ED according to their urgency level from 1 (resuscitation) to 5 (non-urgent) [[23]]. The admission rate was calculated for each period by dividing the number of patients admitted through the ED by the total number of ED visits. In terms of age, the mean and standard deviation are reported and compared with the Independent Samples *t*-test. For all the other variables, descriptive statistics were used and are reported with a cross-tabulation and a chi-square test. All used data are anonymous and statistical significance was determined at $P < 0.05$. All the data were analyzed with Stata (version 15; StataCorp, College Station, TX). This study was reviewed and approved on August 18, 2020, by the Institutional Review Board at King Abdullah International Medical Research Center (Approval number RC20/447/R).

Results

A total of 118,406 patients presented at the ED from January 1, 2019, to September 17, 2019, compared with 91,548 in the same period in 2020, a decrease of 23%. The mean age of the patients increased marginally from 43.1 years in 2019 to 44.0 years in 2020. Compared with 2019, the patients presenting in 2020 were more likely to be male, non-Saudi and more urgent with CTAS levels of 1 (resuscitation), 2 (emergent) or 3 (urgent). In 2019, the average daily number of visits was 448 patients per day, compared with 345 per day in 2020 (Table 1). The number of daily ED visits decreased dramatically after the announcement of the first COVID-19 diagnosis in Saudi Arabia on March 2, 2020. During the 12-h curfew period (March 23, 2020, to April 06, 2020), the number of visits dropped below 300 per day, compared with the same period in 2019, ranging from 530 to 360 visits per day. This variability between the

Table 2
Change in Emergency Department visit characteristics before and during the various curfew times.

	Baseline	12-h	Full-time	15-h	10-h
Male, %	46.2	59.6	52.2	53.7	53.2
Saudi, %	94.6	95.5	92.5	92.5	89.9
Mean age, years (±standard deviation)	43.4 (19.7)	42.1 (18.5)	44.4 (19.3)	44.5(19.6)	45.3 (19.1)
Mean length of stay, hours (±standard deviation)	4.8 (4.5)	3.5 (3.3)	4.1 (4.6)	4.4 (4.5)	5.00 (4.9)
Admission rate, %	12.0	12.9	14.9	13.5	17.2
Severity Level[a], %					
Resuscitation	0.3	0.7	0.3	0.5	0.4
Emergent	4.4	5.1	6.2	6.1	6.6
Urgent	48.9	48.9	53.4	51.5	54.5
Less Urgent	41.3	38.8	35.9	36.9	34.2
Non-urgent	5.0	6.5	4.1	4.9	4.3

[a] Acuity level was determined using the Canadian Triage and Acuity Scale (CTAS).

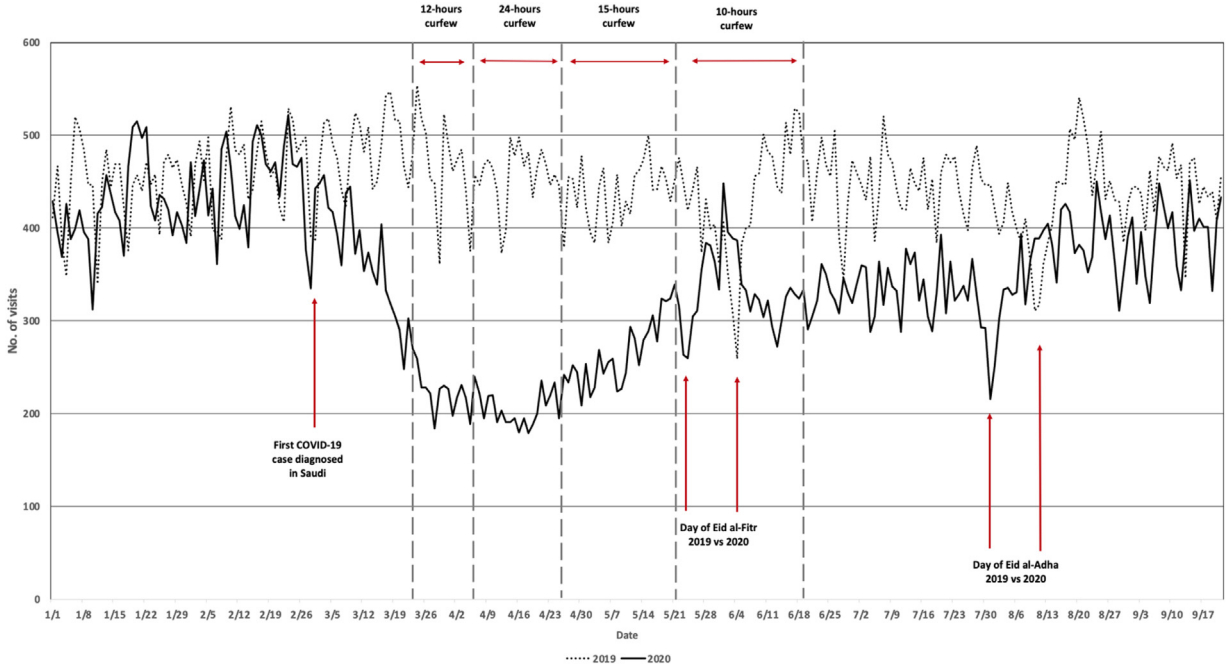

Fig. 1. Trend of Emergency Department visits in the same period (January 1–September 17) in 2019 and 2020.

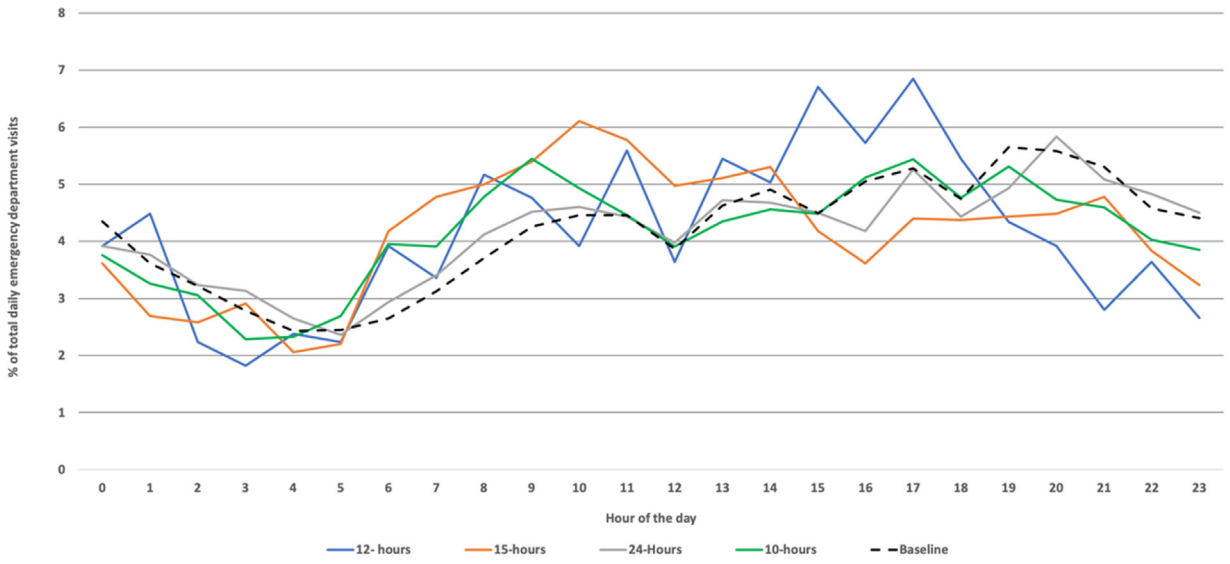

Fig. 2. Daily Emergency Department by visiting hour and different curfew times.

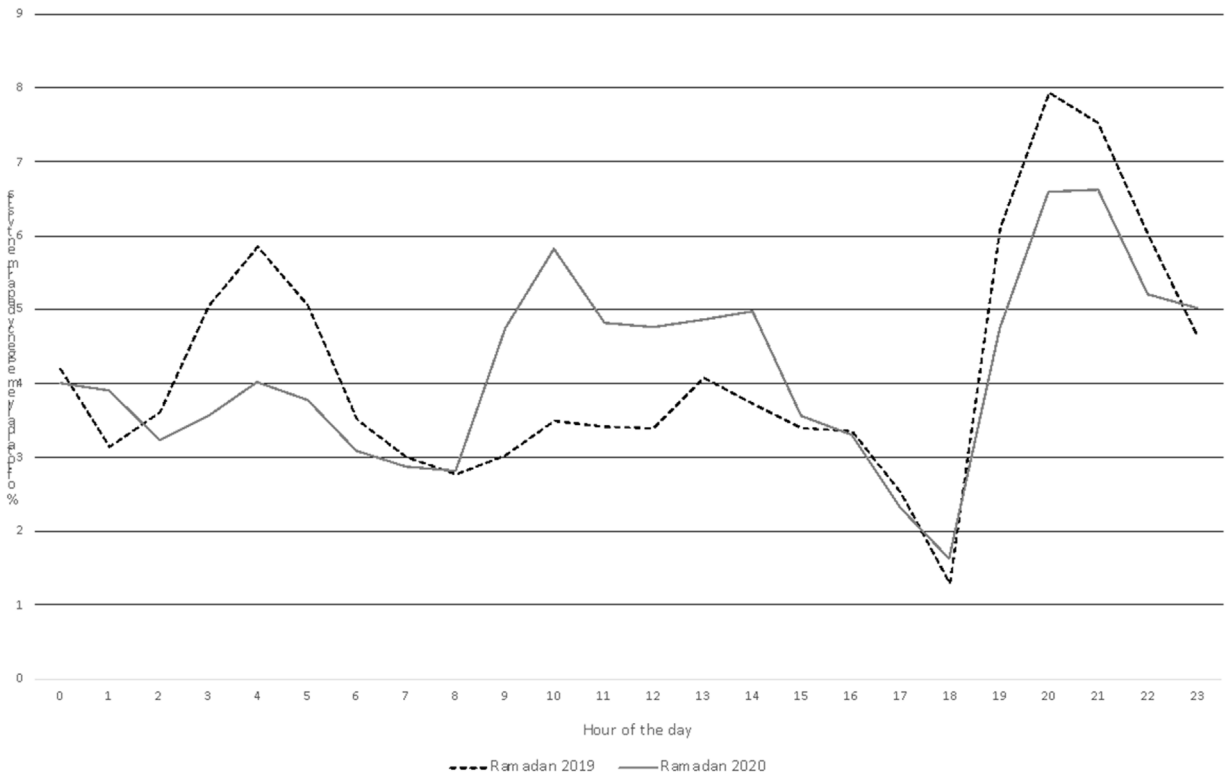

Fig. 3. Daily Emergency Department visits during Ramadan 2019/2020, by visiting hour.

same periods in 2019 and 2020 remained consistent during the 24-h and 15-h curfew periods (Table 2). The ED visits started to increase modestly during the 10-h curfew period and after the curfew was suspended. On the day of Eid-Al-Fitr, the ED visits in 2019 and 2020 were almost identical, 259 vs 260, respectively (Fig. 1). The baseline admission rate was 12.0%, this rate increased in all the curfew periods, with the highest admission rate of 17.2% observed during the 10-h curfew period. The length of stay (LoS) in the ED decreased in all the curfew periods, except the 10-h, as there was a slight increase from the baseline LoS average, from 4.7 h to 5 h. The time of the ED visits differed slightly between the different curfew periods when compared to the baseline (Fig. 2). In addition, there was a slight increase in the daytime visits during the curfew hours, with a decrease in the nighttime. The same trend was also observed during Ramadan with an increase in the daytime visits in 2020, compared to nighttime (Fig. 3). However, when comparing Ramadan to the baseline period, we observed a different pattern for the time of the visits in both years, characterized by a major decrease in the visits from 15:00 and 18:00, followed by an increase, peaking at 20:00 (Fig. 3).

Discussion

This study with 209,953 ED visits before and during the COVID-19 pandemic period indicated a decrease in the ED visits during the pandemic period and some variations in the visit characteristics such as age, nationality, gender, severity level, the time of visit, length of stay and admission rate. We compared the daily visit rate and visit characteristics during the holy month of Ramadan and the two religious holidays in Saudi Arabia. We observed a dramatic reduction in the number of visits in both 2019 and 2020, compared with the baseline period. Findings of this report may support policy makers and clinicians to reallocate and manage ED resources in different circumstances, for example, rescheduling shifts, diverge resources between hospitals to avoid the risks of ED overcrowding and to optimize healthcare utilization [22].

Similar to previous studies, the current study reports a reduction in ED visits during the pandemic, compared with the same period in 2019 (Fig. 1) [17,24–26]. The reduction began in the early days of the pandemic period when COVID-19 was first introduced to the public and before the announcement of the national curfew. A few reasons may explain the reduction in the ED visits during the pandemic. A study reported that 70% of the people who participated in a poll were concerned about overloading the healthcare system during the pandemic, and 30% avoided seeking medical attention to avoid contracting the virus [27,28]. During the non-pandemic period, these concerns do not exist. Another possible explanation is that the ED visits decreased due to a reduction in the burden of specific cases during the pandemic, for example injury-related cases [24]. In the United States (US), a study analyzing 26 million ED visits in 141 EDs, reported that the greatest reduction in the ED visits was injury-related (-56.1%), suggesting more cautious behavior during the pandemic. Another recent study from the US found that trauma admissions reduced with 57% during the pandemic, and a Spanish study concluded that working from home has contributed to a reduction of work-related injuries [24,29,30].

During the curfew imposed in 12-, 15-, and 10-h periods, the proportion of the total daily ED visits in each hour was lower than the baseline period. Interestingly, the proportion of the total daily ED visits in each hour during the 24-h curfew days followed almost the identical pattern of the baseline. A possible explanation of the pattern seen in the non-24-h curfew days is the government's implementation of a new pathway to access medical care during the curfew hours. Medical attention during curfew hours required official permission, obtained through various electronic media, to drive to the nearest medical facility [31]. This additional step required for accessing medical care, could cause a delay in seeking medical attention until after the curfew hours, adding pressure on the ED during the non-curfew hours (Fig. 2).

Previous studies in Islamic countries indicated that the pattern of ED visits changes during the holy month of Ramadan with more visits during the nighttime. There was a notable sharp reduction at the time of breaking the fast, approximate 18:00 in Saudi Arabia, followed by a sharp rise peaking around 20:30 [32–34]. In the current study, the Ramadan of 2019 ED visits had a similar pattern, however, the 2020 Ramadan had a higher proportion of visits during the day, compared with the previous year. This trend is possibly due to the effect of the curfew period in Ramadan 2020, which was the whole night.

An interesting pattern of visits was noticed during the two Islamic holidays, Eid al-Fitr and Eid al-Adha. In both 2019 and 2020, and regardless of the presence or absence of a pandemic, the number of ED visits dropped significantly on the first day of both holidays, compared to the average daily visits before and after that day. The number of visits during 2019 and 2020 Eid al-Fitr was almost identical in both years. Compared with the Eid al-Adha day, there was a slight variation in the number of visits between 2019 and 2020, with a lower number during the pandemic. Given that Islam is the prominent religion in Saudi Arabia, this reduction in religious holidays might be explained by sociocultural factors and society traditions, such as family gatherings and elderly visits in the days of Eid al-Fitr and Eid al-Adha.

A few studies reported that the mean of age of patients visiting the ED was higher during the pandemic period, which could be associated with the higher ED acuity presentation [35,36]. This is consistent with the current finding that the proportion of patients with a higher acuity, CTAS levels 1, 2, and 3, increased during the pandemic period. The increased acuity level also occurred during all the curfew hours, compared to the pre-pandemic period. The increase in age and severity level can explain the increase in the admission rate in the current study as older patients are known to have a higher risk of morbidity and mortality.

A last observation is that the proportion of ED visits by non-Saudis and male patients increased during the pandemic. Shortly following the first COVID-19 positive case in Saudi Arabia, the government issued an order to treat all COVID-19 positive patients free of charge, regardless of their nationality, including people who violated the immigration rules [37]. This strategy encouraged non-Saudis or illegal residents to seek medical attention without fearing legal consequences. Another plausible explanation is that people working in construction sites, such as road constructions were allowed to work during the curfew hours, and most of those workers are male and non-Saudis.

Conclusion

The number of Emergency Department visits decreased during the pandemic. The visit characteristics differed substantially during the COVID-19 pandemic period, the admission rates and length of stay were higher than the pre-pandemic period. Compared with the baseline ED visits pattern, patients presenting at the ED were more likely to be older and urgent. Proportion of males and non-citizens of Saudi Arabia increased during the pandemic period. During the month of Ramadan when Muslims fast during the day, the number of visits decreased during the day and increased at night after the time of breaking the fast.

Limitations

The current study has several limitations that should be noted. Firstly, the data used were retrieved from a single ED and the findings may not be generalizable to the entire population. Secondly, data pooled from an adult ED are not representative of younger age groups (under 14 years old).

Funding

Primary funder: King Abdullah International Medical Research Center (KAIMRC).

Competing interests

None declared.

Ethical approval

Not required.

Research data

Data are available upon request.

References

[1] Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, evaluation, and treatment of coronavirus (COVID-19). In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021. March 1.
[2] Alsofayan YM, Althunayyan SM, Khan AA, Hakawi AM, Assiri AM. Clinical characteristics of COVID-19 in Saudi Arabia: a national retrospective study. J Infect Public Health 2020;13(7):920–5, http://dx.doi.org/10.1016/j.jiph.2020.05.026.
[3] Siddiqui AA, Alshammary F, Amin J, Rathore HA, Hassan I, Ilyas M, et al. Knowledge and practice regarding prevention of COVID-19 among the Saudi Arabian population. Work 2020;66(4):767–75, http://dx.doi.org/10.3233/WOR-203223.
[4] Yezli S, Khan A. COVID-19 social distancing in the Kingdom of Saudi Arabia: bold measures in the face of political, economic, social and religious challenges. Travel Med Infect Dis 2020;37:101692, http://dx.doi.org/10.1016/j.tmaid.2020.101692.
[5] Bjørnsen LP, Næss-Pleym LE, Dale J, Laugsand LE. Patient visits to an emergency department in anticipation of the COVID-19 pandemic. Pasienttilstrømming i et akuttmottak i påvente av covid-19-pandemien. Tidsskr Nor Laegeforen 2020;140(8), http://dx.doi.org/10.4045/tidsskr.20.0277. Published 24 April 2020.
[6] Basis F, Zeidani H, Hussein K, Hareli S. drastic reduction inpatient visits to the emergency department in a hospital in Israel during the COVID-19 outbreak, compared to the H1N1 2009. Int J Health Policy Manag 2020, http://dx.doi.org/10.34172/ijhpm.2020.151 [Published online ahead of print, 9 August 2020].
[7] Giamello JD, Abram S, Bernardi S, Lauria G. The emergency department in the COVID-19 era. Who are we missing? Eur J Emerg Med 2020;27(4):305–6, http://dx.doi.org/10.1097/MEJ.0000000000000718.
[8] Westgard BC, Morgan MW, Vazquez-Benitez G, Erickson LO, Zwank MD. An analysis of changes in emergency department visits after a state declaration during the time of COVID-19. Ann Emerg Med 2020;76(5):595–601, http://dx.doi.org/10.1016/j.annemergmed.2020.06.019.
[9] Hartnett KP, Kite-Powell A, DeVies J, Coletta MA, Boehmer TK, Adjemian J, et al. Impact of the COVID-19 pandemic on emergency department visits - United States, January 1, 2019-May 30, 2020. MMWR Morb Mortal Wkly Rep 2020;69(23):699–704, http://dx.doi.org/10.15585/mmwr.mm6923e1. Published 2020 June 12.
[10] Mantica G, Riccardi N, Terrone C, Gratarola A. Non-COVID-19 visits to emergency departments during the pandemic: the impact of fear. Public Health 2020;183:40–1, http://dx.doi.org/10.1016/j.puhe.2020.04.046.
[11] Lien WC, Wu JL, Tseng WP, Chow-In Ko P, Chen SY, Tsai MS, et al. Fight COVID-19 beyond the borders: emergency department patient diversion in Taiwan. Ann Emerg Med 2020;75(6):785–7, http://dx.doi.org/10.1016/j.annemergmed.2020.04.003.
[12] Hautz WE, Sauter TC, Exadakytlos AK, Krummrey G, Schauber S, Müller M. Barriers to seeking emergency care during the COVID-19 pandemic may lead to higher morbidity and mortality — a retrospective study from a Swiss university hospital. Swiss Med Wkly 2020;150:w20331, http://dx.doi.org/10.4414/smw.2020.20331. Published 11 August 2020.
[13] Kuitunen I, Ponkilainen VT, Launonen AP, Reito A, Hevonkorpi TP, Paloneva J, et al. The effect of national lockdown due to COVID-19 on emergency department visits. Scand J Trauma Resusc Emerg Med 2020;28(1):114, http://dx.doi.org/10.1186/s13049-020-00810-0. Published 4 December 2020.
[14] Casalino E, Choquet C, Bouzid D, Peyrony O, Curac S, Revue E, et al. Analysis of emergency department visits and hospital activity during influenza season, COVID-19 epidemic, and lockdown periods in view of managing a future disaster risk: a multicenter observational study. Int J Environ Res Public Health 2020;17(22):8302, http://dx.doi.org/10.3390/ijerph17228302. Published 10 November 2020.
[15] Qiu H, Wu J, Hong L, Luo Y, Song Q, Chen D. Clinical and epidemiological features of 36 children with coronavirus disease 2019 (COVID-19) in Zhejiang, China: an observational cohort study. Lancet Infect Dis 2020;20(6):689–96, http://dx.doi.org/10.1016/S1473-3099(20)30198-5.

[16] Eastin C, Eastin T. Epidemiological characteristics of 2143 pediatric patients with 2019 coronavirus disease in China: Dong Y, Mo X, Hu Y, et al. Pediatrics. 2020; doi: 10.1542/peds.2020-0702. J Emerg Med 2020;58(4):712–3, http://dx.doi.org/10.1016/j.jemermed.2020.04.006.
[17] Butt AA, Azad AM, Kartha AB, Masoodi NA, Bertollini R, Abou-Samra AB. Volume and acuity of emergency department visits prior to and after COVID-19. J Emerg Med 2020;59(5):730–4, http://dx.doi.org/10.1016/j.jemermed.2020.08.013.
[18] Wongtanasarasin W, Srisawang T, Yothiya W, Phinyo P. Impact of national lockdown towards emergency department visits and admission rates during the COVID-19 pandemic in Thailand: a hospital-based study. Emerg Med Australas 2021;33(2):316–23, http://dx.doi.org/10.1111/1742-6723.13666.
[19] Almaghlouth I, Islam T, Alamro N, Alsultan A, Alfadda A, et al. Mapping COVID-19 related research from Saudi Arabia, a scoping review. Between reality and dreams. Saudi Med J 2020;41(8):791–801, http://dx.doi.org/10.15537/smj.2020.8.25163.
[20] Baldi E, Sechi GM, Mare C, Canevari F, Brancaglione A, Primi R, et al. Out-of-hospital cardiac arrest during the Covid-19 outbreak in Italy. N Engl J Med 2020;383(5):496–8, http://dx.doi.org/10.1056/NEJMc2010418.
[22] Deana C, Rovida S, Orso D, Bove T, Bassi F, De Monte A, et al. Learning from the Italian experience during COVID-19 pandemic waves: be prepared and mind some crucial aspects. Acta Biomed 2021;92(2):e2021097, http://dx.doi.org/10.23750/abm.v92i2.11159. Published 12 May 2021.
[23] Beveridge R, Clarke B, Janes L, Savage N, Thompson J, Dodd G, et al. Canadian emergency department triage and acuity scale: implementation guidelines. Can J Emerg Med 1999;1(3 suppl):S2–28.
[24] Lucero AD, Lee A, Hyun J, Lee C, Kahwaji C, Miller G, Neeki M, et al. Underutilization of the emergency department during the COVID-19 pandemic. West J Emerg Med 2020;21(6):15–23, http://dx.doi.org/10.5811/westjem.2020.8.48632. Published 24 September 2020.
[25] Jeffery MM, D'Onofrio G, Paek H, Platts-Mills TF, Soares 3rd WE, Hoppe JA, et al. Trends in emergency department visits and hospital admissions in health care systems in 5 states in the first months of the COVID-19 pandemic in the US. JAMA Intern Med 2020;180(10):1328–33, http://dx.doi.org/10.1001/jamainternmed.2020.3288.
[26] Dopfer C, Wetzke M, Zychlinsky Scharff A, Mueller F, Dressler F, Baumann U, et al. COVID-19 related reduction in pediatric emergency healthcare utilization - a concerning trend. BMC Pediatr 2020;20(1):427, http://dx.doi.org/10.1186/s12887-020-02303-6. Published 7 September 2020.
[27] New poll: nearly a third are delaying or avoiding medical care due to COVID-19 concerns. Emergencyphysicians.org; 2021,. Published 2021. [Accessed 6 April 2021] https://www.emergencyphysicians.org/press-releases/2020/4-28-20-new-poll-nearly-a-third-are-delaying-or-avoiding-medical-care-due-to-covid-19-concerns.
[28] Morning consult COVID-19 April poll analysis. Emergencyphysicians.org; 2021,. Published 2021. [Accessed 6 April 2021] https://www.emergencyphysicians.org/globalassets/emphysicians/all-pdfs/acep-mc-covid19-april-poll-analysis.pdf.
[29] Nuñez JH, Sallent A, Lakhani K, Guerra-Farfan E, Vidal N, Ekhtiari S, et al. Impact of the COVID-19 pandemic on an emergency traumatology service: experience at a tertiary trauma centre in Spain. Injury 2020;51(7):1414–8, http://dx.doi.org/10.1016/j.injury.2020.05.016.
[30] Kamine TH, Rembisz A, Barron RJ, Baldwin C, Kromer M. Decrease in trauma admissions with COVID-19 pandemic. West J Emerg Med 2020;21(4):819–22, http://dx.doi.org/10.5811/westjem.2020.5.47780. Published 22 May 2020.
[31] Ministry of Health. Emergency medical permit during curfew can be requested via (Tawakkalna) app. Ministry of Health News; 2020. Published 16 June 2020. Updated 18 June 2020. https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-06-16-002.aspx. [Accessed 6 April 2021].
[32] Butt T, Khan HU, Ahmed I, Eldali A. Emergency department attendance patterns during Ramadan. Ann Saudi Med 2016;36(4):258–64, http://dx.doi.org/10.5144/0256-4947.2016.258.
[33] Balhara KS, Levin S, Cole G, Scheulen J, Anton XP, Rahiman HAF, et al. Emergency department resource utilization during Ramadan: distinct and reproducible patterns over a 4-year period in Abu Dhabi. Eur J Emerg Med 2018;25(1):39–45, http://dx.doi.org/10.1097/MEJ.0000000000000405.
[34] Saleh R, Makki M, Tamim H, Hitti E. The impact of Ramadan on patient attendance patterns in an emergency department at a tertiary care center in Beirut, Lebanon. J Emerg Med 2020;59(5):720–5, http://dx.doi.org/10.1016/j.jemermed.2020.06.039.
[35] Latham LP, Ackroyd-Stolarz S. Emergency department utilization by older adults: a descriptive study. Can Geriatr J 2014;17(4):118–25, http://dx.doi.org/10.5770/cgj.17.108. Published 2 December 2014.
[36] Hendin A, Eagles D, Myers V, Stiell IG. Characteristics and outcomes of older emergency department patients assigned a low acuity triage score. CJEM 2018;20(5):762–9, http://dx.doi.org/10.1017/cem.2018.17.
[37] Ministry of Health. Al-Rabiah: by order of the king, all COVID-19 patients will be treated for free. Ministry of Health News; 2020. Published 30 March 2020. https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-03-30-005.aspx. [Accessed 6 April 2021].