

Administration of Emergency Medicine

THE IMPACT OF RAMADAN ON PATIENT ATTENDANCE PATTERNS IN AN EMERGENCY DEPARTMENT AT A TERTIARY CARE CENTER IN BEIRUT, LEBANON

Rana Saleh, MBA,* Maha Makki, MSC,† Hani Tamim, PHD,†† and Eveline Hitti, MD, MBA*

*Department of Emergency Medicine, American University of Beirut Medical Center, Beirut, Lebanon, †Clinical Research Institute, Faculty of Medicine, American University of Beirut Medical Center, Beirut, Lebanon, and ‡Department of Internal Medicine, American University of Beirut Medical Center, Beirut, Lebanon

Reprint Address: Eveline A. Hitti, MD, MBA, Department of Emergency Medicine, American University of Beirut Medical Center, P.O. Box 11-0236, Riad El-Solh, Beirut 1107 2020, Lebanon

Abstract—Background: Emergency departments (EDs) worldwide experience substantial variability in hourly patient arrivals. The month of Ramadan represents a repetitive annual occurrence, which could be associated with distinct patient arrival patterns compared with other months of the year. **Objective:** This study examined hourly patient arrival patterns and patient characteristics in an ED in a tertiary care center in Beirut, Lebanon to determine whether there are significant changes in patient attendance patterns during the month of Ramadan. **Methods:** Data on patients presenting to the ED during the month of Ramadan with those presenting 1 month prior to and 1 month after, between 2012 and 2018, were accounted for in the study. Pearson chi-squared test was used in the bivariate analysis, whereas Student's *t*-test was used to compare continuous variables. **Results:** Patient attendance patterns significantly varied between Ramadan and non-Ramadan periods ($p < 0.0001$). Patient flow dropped starting at 8:00 AM, with the greatest drop between 6:00 PM and 9:00 PM, and increased in the early morning hours between 2:00 AM and 4:00 AM ($p < 0.0001$). The total number of visits per day significantly decreased in Ramadan compared with non-Ramadan periods (135.6 ± 14.74 vs. 145.5 ± 18.90 , p -value < 0.0001), whereas length of stay decreased slightly. **Conclusion:** We found a drop in daily ED visits during Ramadan, in addition to a distinct pattern of patient arrivals. ED administrators should consider different scheduling arrangements for nurses and physicians during this period in EDs that

serve communities where Ramadan is commonly observed. © 2020 Elsevier Inc. All rights reserved.

Keywords—Ramadan; ED overcrowding; patient flow; ED visits per hour per day; staffing

INTRODUCTION

With the rise in demand for emergency department (ED) services, EDs worldwide are experiencing increased patient visits on an annual basis. However, given the innate variability that characterizes ED patient flow, matching patient demand to provider resources in the ED proves to be a challenging task (1). Although patient arrival patterns can sometimes be unpredictable, such as in the case of a disaster or mass casualty events, most of the variability occurring in patient flow is often times foreseen.

The month of Ramadan represents an example of a recurring and predictable annual period during which patient arrival patterns can be distinct compared with non-Ramadan periods. Ramadan is the month during which Muslims abstain from eating, drinking, and taking oral medications or intravenous fluids, from sunrise till sunset. The time of observance of Ramadan differs every year because it depends on the lunar month (2). There are few studies that have analyzed variability in patient

demographics and patient arrival patterns in Ramadan. One prior study found lower patient volume and higher length of stay of ED patients in Ramadan compared with non-Ramadan periods (3). Two other studies of EDs at tertiary care institutions in Saudi Arabia and the United Arab Emirates, countries which predominately serve Muslim populations, found a shift in patient census toward the evening and early morning hours, which correlates with the nocturnal pattern often observed during this month (1,4).

Unlike Saudi Arabia and other Gulf Cooperation Council countries where the predominant religion is Islam, Lebanon is a country characterized by religious pluralism. The observed shift in patient census during the month of Ramadan might not thus apply to Lebanese EDs. This study aimed to examine patient characteristics, the number of visits per day, and the patient arrivals per hour of the day, comparing Ramadan with non-Ramadan periods in an ED at a tertiary care center serving a religiously diverse community in Beirut, Lebanon.

MATERIALS AND METHODS

Study Setting and Design

We carried out a retrospective study of ED visits at a tertiary care center comparing Ramadan months with non-Ramadan months between 2012 and 2018. The center is a 384-bed teaching hospital and a referral center in Beirut, Lebanon. It serves a diverse socioeconomic patient profile from Ras Beirut and the neighboring areas and is considered a hub for delivering specialized services in Lebanon and the region. The ED is one of the largest in the country, seeing approximately 57,000 patients annually, of which 27% are pediatric. The ED is staffed by a mix of American board-certified Emergency Medicine (EM) physicians as well as locally trained non-EM physicians with extensive experience in emergency practice. Whereas ED staffing is based on historical ED visit hourly load, ancillary and consultant service staffing drops to off-hour level between 5:00 PM and 8:00 AM. The ED is divided into three areas: high acuity, low acuity, and pediatrics. The majority of patients (80%) are triaged to an Emergency Severity Index (ESI) score of 3 (intermediate acuity), 15% have an ESI of 4–5 (low acuity), and 5% have an ESI of 1–2 (high acuity). Around 20% of ED patients get admitted for inpatient care. Around 80% are insured, and 20% pay out of pocket.

All ED visits were collected based on the following criteria: we identified the Ramadan period for the past 7 years, from 2012 until 2018, and we took 1 month prior to and 1 month after to account for seasonal variability. The data corresponding to the Ramadan period were

grouped under a category called “Ramadan Period,” whereas the data corresponding to the month prior to and the month after were grouped under a category called “non-Ramadan period.”

The study conforms to the Declaration of Helsinki provisions and is deemed exempt from human subject research by the Institutional Review Board of our institution.

Outcome Measure

The main outcome measured is trends in patient visits per hour of the day in Ramadan compared with non-Ramadan periods. Secondary outcomes considered were daily volume and length of stay.

Data Collection

Data were extracted from the administrative electronic database that includes daily patient visit as well as corresponding arrival and discharge date and time, ED bed assignment, disposition, gender, age, ESI, nationality, and guarantor.

Data Analysis

The Statistical Package for Social Sciences (SPSS Inc., Chicago, IL), version 22 was used to enter and manage data. Descriptive analyses were carried out by reporting the mean and standard deviation (\pm SD) for continuous variables, whereas number and percent were used for categorical ones. In the bivariate analysis, the association between the Ramadan period and different categorical variables was done using the Pearson chi-squared test. On the other hand, Student’s *t*-test was used to compare continuous variables. A *p*-value < 0.05 was used to denote statistical significance.

RESULTS

A total of 88,150 patients were included in the study, 28,203 (32.0%) of whom were included in Ramadan periods, whereas 59,947 (68.0%) were included in non-Ramadan periods. The characteristics of the patient population are presented in [Table 1](#), stratified by Ramadan period. The mean age of patients was 34.84 (\pm 24.22) years; 50.8% were males, and 87.3% were Lebanese. The majority of patients were insured (77.1%). When the two groups are compared, it is evident that more females presented to the ED in Ramadan compared with non-Ramadan periods (49.8% vs. 48.9% respectively, *p*-value = 0.01), and patients in the Ramadan period were more likely to be insured (77.5% vs. 76.8%, *p*-value 0.03). Moreover, more patients presented with

Table 1. Comparison of Patients' Characteristics Between Ramadan and Non-Ramadan Periods

	Total n = 88,150	Non-Ramadan n = 59,947	Ramadan n = 28,203	p-Value
Gender				0.01
Male	44,810 (50.8)	30,660 (51.1)	14,150 (50.2)	
Female	43,340 (49.2)	29,287 (48.9)	14,053 (49.8)	
Age, Mean (\pm SD)	34.84 \pm 24.22	34.70 \pm 24.14	35.12 \pm 24.39	0.02
\leq 18	23,507 (26.7)	16,030 (26.7)	7477 (26.5)	0.09
19–44	35,490 (40.3)	24,261 (40.5)	11,229 (39.8)	
45–64	15,979 (18.1)	10,814 (18.0)	5165 (18.3)	
65–84	11,255 (12.8)	7551 (12.6)	3704 (13.1)	
\geq 85	1919 (2.2)	1291 (2.2)	628 (2.2)	
Nationality, Lebanese	76,951 (87.3)	52,110 (86.9)	24,841 (88.1)	< 0.0001
Guarantor				0.03
Insurance company	67,920 (77.1)	46,066 (76.8)	21854 (77.5)	
Self-paying	20,230 (22.9)	13,881 (23.2)	6349 (22.5)	
Disposition				0.04
Admitted	16,041 (18.2)	10,813 (18.1)	5228 (18.6)	
AMA	3191 (3.6)	2140 (3.6)	1051 (3.7)	
Dead in ED & dead on arrival	149 (0.2)	91 (0.2)	58 (0.2)	
Home	68687 (78.0)	46852 (78.2)	21835 (77.5)	
ESI, Mean (\pm SD)	3.11 \pm 0.49	3.12 \pm 0.49	3.10 \pm 0.48	< 0.0001
High acuity	4406 (5.0)	2923 (4.9)	1483 (5.3)	< 0.0001
Intermediate acuity	70,086 (79.5)	47,429 (79.1)	22637 (80.3)	
Low acuity	13,658 (15.5)	9595 (16.0)	4063 (14.4)	
LOS, days, Mean (\pm SD)	0.10 \pm 0.23	0.10 \pm 0.24	0.09 \pm 0.21	0.003
LOS, hours, Mean (\pm SD)	2.44 \pm 5.56	2.47 \pm 5.83	2.36 \pm 4.94	
Number of visits per day	142.18 \pm 18.21	145.5 \pm 18.90	135.6 \pm 14.74	< 0.0001

AMA = left against medical advice; ED = emergency department; ESI = Emergency Severity Index; LOS = length of stay.

intermediate complexity (ESI 3) in Ramadan compared with non-Ramadan periods (3.10 average ESI vs. 3.12, respectively, p -value < 0.0001), with patients having a shorter length of stay in Ramadan (2.36 h vs. 2.47 h, respectively, p -value = 0.003). As for the average daily visits, the ED was less busy in Ramadan, seeing an average of 135.6 \pm 14.74 visits per day, compared with an average of 145.5 \pm 18.90 visits per day in the non-Ramadan periods (p -value < 0.0001).

Figure 1 shows the graphical presentation of the patient flow per hour of the day in Ramadan compared with non-Ramadan periods. The upper and lower limits of the graph represent the 95% confidence interval. Results showed significant differences in patient attendance patterns between Ramadan and non-Ramadan periods (p < 0.0001). A significant difference was also observed in patient attendance patterns over time between the two groups (p < 0.0001).

DISCUSSION

This study examined hourly patient flow and ED visit volume comparing Ramadan with non-Ramadan periods in an ED in a tertiary care center in Beirut, Lebanon. The medical center is located in one of the most religiously diverse areas in Lebanon. Patient flow significantly dropped during the day and evening during Ramadan periods, starting at 8:00 AM, with the greatest drop between 6:00 PM and 9:00 PM, around Eftar times when Muslims break their fast. On average, Eftar time was around 7:46 PM for the time periods considered in this study. Alternatively,

patient flow increased in the early morning between 2:00 AM and 4:00 AM. This could be related to the more nocturnal culture during Ramadan, or patients deferring medical care that may interfere with their fast (5).

The number of visits per day dropped during the month of Ramadan; our results are in line with other studies looking into patient attendance patterns in EDs during the month of Ramadan (3). A plausible explanation for this observation could be that patients who fast might prefer to defer medical care during Ramadan. Length of stay slightly decreased for the whole patient population during the month of Ramadan, which could be related to lower hospital occupancy and improved throughput. Although the difference in ESI and gender of patients presenting in Ramadan vs. non-Ramadan months was statistically significant, this was not clinically meaningful.

Our study findings revealed significant implications related to staffing and resources optimization for EDs during the month of Ramadan. In our setting, and in line with best practice on provider staffing and scheduling in EDs, nursing and physician scheduling is based on the number of expected patients per hour as well as expected complexity of the section staffed, with higher nurse/physician-to-patient ratios in the high-acuity area (6,7). This is based on average trends in non-Ramadan hours and usually leads to a significant drop in providers around midnight. In addition, ancillary resources and consultant availability usually drop during off hours, which are usually after 5:00 PM. Thus, the increased patient flow during the early morning hours with fewer emergency

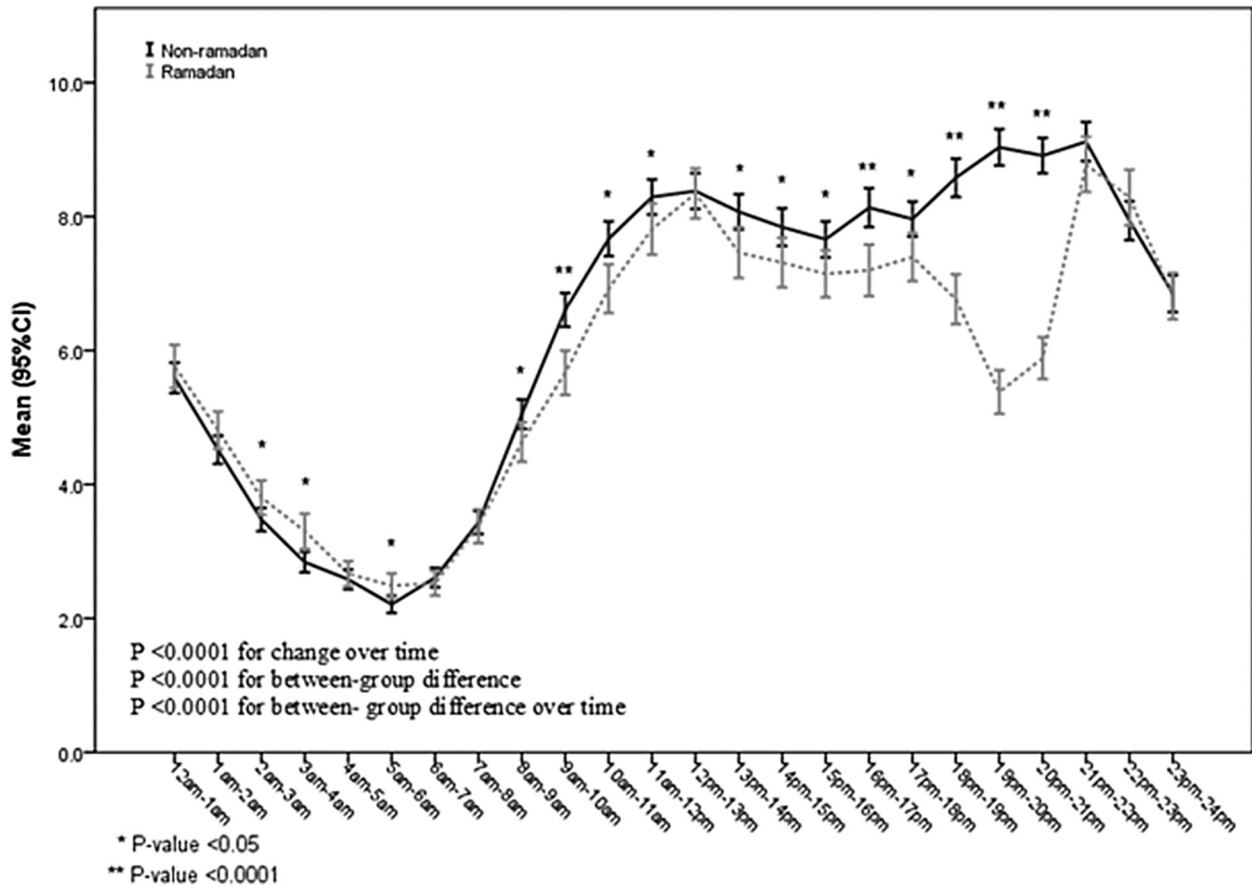


Figure 1. Comparison of average number of emergency department visits per hour per day comparing Ramadan with non-Ramadan.

physicians and nurses as well as ancillary staff can create an unsafe environment for patient care during Ramadan times. On the other hand, the reduced flow of patients during the day and evening in Ramadan may lead to over-staffing during those hours if no adjustments are made to the baseline schedule. Based on our finding, Ramadan months need to be looked at separately for scheduling arrangements, with an anticipated higher load in the early morning and lower staffing in the daytime and evening when visit trends suggest lower rates of ED visits.

With the growth in health information technology and the availability of electronic health care systems, integrating forecasting models into ED processes and resource management has become more feasible, with increased application to improve real-time patient flow, bed management, and discharge processes (8,9). It is also imperative that models incorporate comprehensive approaches that incorporate variations in patient flow based on predictable recurring factors in the communities and cultures the ED serves, including the impact of Ramadan in regions where there is common observance irrespective of the diversity of the population (8).

Limitations

The month of Ramadan arrives around 10 days earlier each year, which affects Eftar time and subsequently, the duration and times of fasting. However, given the location of Lebanon near the equator, this timing over a period of 7 years is within a 32-min range. Similarly, because Ramadan months varied over the 7 years 2012 to 2018, seasonal variations in volume may have impacted the trends observed, though we attempted to account for this by comparing with the month prior to and the month after Ramadan for each year. Finally, this was a single-center study, limiting generalizability of our findings. Our ED, however, is the busiest in the country, with a catchment area that includes the largest governorates.

CONCLUSION

Our study revealed an overall drop in patient volume in Ramadan, with distinct patient arrival patterns. The changes in patient flow warrant separate scheduling

arrangements for nurses and physicians to ensure optimal ED provider-to-patient ratios, with increased needs during high-flow times in the early morning and lower requirements during the day and evening when patient flow drops. Although Lebanon is a religiously diverse country, patient attendance patterns in Ramadan were comparable with countries with predominant Muslim populations.

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ARTICLE SUMMARY

1. Why is this topic important?

This article tackles the implications of a recurrent event, the month of Ramadan, on an emergency department's (ED) patient flow. Predicting patient flow is key to staffing arrangements to ensure optimal ED provider to patient ratios and therefore safe patient care.

2. What does this study attempt to show?

This study aims to show that the month of Ramadan is characterized by a different patient arrival pattern compared with other months of the year, which warrants other scheduling considerations.

3. What are the key findings?

Total patient visits dropped in Ramadan compared with non-Ramadan periods. Patient flow throughout the day also changed, dropping from 8:00 AM and most prominently from 6:00 PM and 9:00 PM, then increasing in the early morning hours between 2:00 and 4:00 AM. Furthermore, length of stay decreased during Ramadan period.

4. How is patient care impacted?

Results of this study showed that patient flow increased during the early morning hours of the Ramadan period when EDs usually drop the number of providers and support staff, and decreased during the day and evening. To ensure safe care, with appropriate provider to patient ratios, scheduling during Ramadan in EDs that serve largely observant communities needs to be adjusted accordingly.