

## Original Article

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# Impact of Ramadan on Emergency Department Patients Flow; a Cross-Sectional Study in UAE

Irma Faruqi<sup>1</sup>, Lateifa Al Mazrouei<sup>1</sup>, Rasha Buhumaid<sup>2\*</sup>

1. Department of Emergency Medicine, Sheikh Khalifa Medical City, Abu Dhabi, UAE

2. Mohammed Bin Rashid University of Medicine and Health Science, Dubai, UAE.

\*Corresponding author: Rasha Buhumaid; Email: rasha.buhumaid@mbru.ac.ae

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## Abstract

**Introduction:** Ramadan, the ninth month of the Islamic lunar calendar, is, to Muslims, the holiest month of the year. During this month, young, able-bodied Muslims are commanded to abstain from food and drink from dawn to dusk.

**Objective:** The objective of the study is to analyze emergency department (ED) patients flow during the holy month of Ramadan and compare it to non-Ramadan days. We hypothesized that Ramadan would affect ED attendance by altering peak hours, and expected a dip in attendance around evening time (after sunset).

**Methods:** In Abu Dhabi, United Arab Emirates, a retrospective study was conducted at a tertiary hospital (2014-2016). The data was strategically separated and patient presence was analyzed year-wise, weekday basis and based on the hourly presence of the patients in the ED of the chosen hospital.

**Results:** A total of 45,116 ED's patient visits were analyzed over the mentioned study period. There was a difference in the total volume of Ramadan and non-Ramadan patient between the years 2014-2016. In all of the years, the highest percentage of visits was during the non-Ramadan days and this had a small fluctuation from 53% in 2014 to 52% in 2016 ( $p=0.001$ ). It was observed from the collected data that 53% of the patients were present in the hospital during the fasting hours whereas 47% were present during the non-fasting hours ( $p<0.001$ ).

**Conclusion:** We were successfully able to derive a pattern from the data of 3 years in relation to the patient flow in the ED of the hospital. Moreover, we observed the difference in the patient arrival pattern between the Ramadan and non-Ramadan days in the hospital along with the predominant categorization of patient chief complaints. Our study identified a unique pattern of ED hourly visits during Ramadan.

**Key words:** Emergency Service, Hospital; Fasting; Patient Admission

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## INTRODUCTION

Ramadan is considered one of the most pious and important religious event of the Muslim communities. Strict rituals and mandates are followed during this period every year. Ramadan, the ninth month of the Islamic lunar calendar, is, to Muslims, the holiest month of the year for it is when the Qur'an, the book of Islam, was revealed. Like other months of the lunar calendar, it is either 29 or 30 days long, based on the moon sighting. During this month, young, able-bodied Muslims are commanded to abstain from food and drink from dawn to dusk (Exceptions are made for pregnant, menstruating and breastfeeding females, as well as the sick, the elderly and the children). The period of fasting is preceded by a typically light early morning meal, and is followed by a larger meal at sunset (1). In addition to alterations in meal timings, sleep cycles have also been shown to

change in Ramadan, with shorter periods of sleep during the night aided by naps during the daytime (2-5). Emergency department (ED) staffing is a complex process that is influenced by numerous factors (6, 7). Important factors to consider when deciding on the manpower required to staff an ED are patient volume, acuity, length of stay, the hospital expectations and financial goals (8). Since fasting during Ramadan affects eating and sleeping habits, we hypothesized that ED patients flow and/or patient complaints may vary during this period, when compared to regular days. We expected to see more gastrointestinal-related complaints during the month of Ramadan due to the alteration in eating habits. The objective of the study is to analyze emergency department (ED) patients flow during the holy month of Ramadan and compare it to non-Ramadan days.

## Methods

### Study design and setting

We conducted a retrospective cross-sectional observational study, of all ED visits in a tertiary health care center in Abu Dhabi, UAE between the first of June to the 31st of July during the years 2014, 2015, and 2016 consecutively. Islam is the official religion of the United Arab Emirates (UAE), and more than 76% of the residents in the UAE are Muslim (9). Abu Dhabi is the capital city of the country and is the largest of the seven emirates.

We chose this period as it was unique in that 29 or 30 (based upon the lunar calendar) of these 61 days, each year, were consistently Ramadan days, while the rest were, by default, non-Ramadan. Based on the lunar calendar, the aggregated number of Ramadan days in the study period was 89 compared to the non-Ramadan days' number of 94. The comparative representation suggests that 2014 and 2016 were having a similar number of Ramadan days (30 days) whereas the year 2015 was a deficit by one day (29 days) (10).

### Study population and data gathering

After obtaining approval from our Institutional Review Board (IRB), we conducted a retrospective data review using the electronic medical records (EMR) census information of all patients who presented to the ED during the study period. The studied population included patients of both adult and pediatric age groups. We compared Ramadan and non-Ramadan days' hourly, daily and total period patient volumes, and chief complaints, looking for a change in the diurnal variation. We also noted demographic information, such as age, religion and nationality among others.

The primary outcome measured was the difference in the number of patients seen per hour during Ramadan and non-Ramadan days, and the secondary outcome was the difference in chief complaints of patients in Ramadan and non-Ramadan days.

### Statistical analysis

We reported continuous variables as mean and categorical variables as frequencies. We compared categorical variables using chi-square test. The level of statistical significant was defined as p-value < 0.05. We used IBM SPSS software Version 20 for statistical analysis. The following result section provides details about the obtained data segregation and their relevant analysis outcome.

## RESULTS

### Total patient volume

A total of 45,116 ED's patient visits were analyzed over the mentioned study period. There was a

difference in the total volume of Ramadan and non-Ramadan patient between the years 2014-2016 (Figure 1). In all of the years, the highest percentage of visits was during the non-Ramadan days and this had a small fluctuation from 53% in 2014 to 52% in 2016 (p=0.001).

There was no statistically significant change observed in patient gender and nationality in Ramadan and non-Ramadan days. However, significant differences (p=0.001) were observed when it comes to age group where the pediatric group had a slightly smaller percentage of Ramadan compared to the adults (Table 1).

### Comparative patient volume per hour assessment

The average number of ED visits per hour was assessed for both Ramadan days and Non-Ramadan days. Figure 2 represents the obtained data related to the hourly patient volume observed in the hospital. It is evident from the analysis that the maximum number of patient flow was observed between 12 a.m. and 1 a.m., followed by 11 a.m. to 12 a.m. On the contrary, a decline in patient volume was found at 5 a.m. to 6 a.m. Specifically, for Ramadan days such declination was observed from 7 p.m. to 8 p.m. These findings were not statistically significant (p=0.99).

Further, we attempted to understand the patient flow during the Ramadan days and non-Ramadan days for each year included in the study period separately. Figure 3 provides a detail view of the hourly patient volume during the Ramadan days with a year-wise comparison. Interestingly, a similar trend was observed for every year as projected in Figure 3 with a slight deviation in the year 2016.

The decline in patient volume was witnessed for each year at around 6 a.m. to 7 a.m. and 7 p.m. to 8 p.m. whereas the increase in patient volume was observed from 12 a.m. to 1 a.m. and 11 a.m. to 12 a.m.

Further, we have done a parallel analysis of the hourly patient volumes for the non-Ramadan days. Surprisingly, changes in the trend of patient volume in the hospital were noted when we strictly assess patients' incoming each hour in the hospital. Figure 4 shows the observed trend witnessed each hour for the non-Ramadan days on an hourly basis. No decline in the patient volume was noticed

**Table 1:** Patient volume by age group during Ramadan and non-Ramadan days

Age group	Ramadan	Non Ramadan	P-value
Pediatric	7244	8444	0.001
Adult	14076	15352	

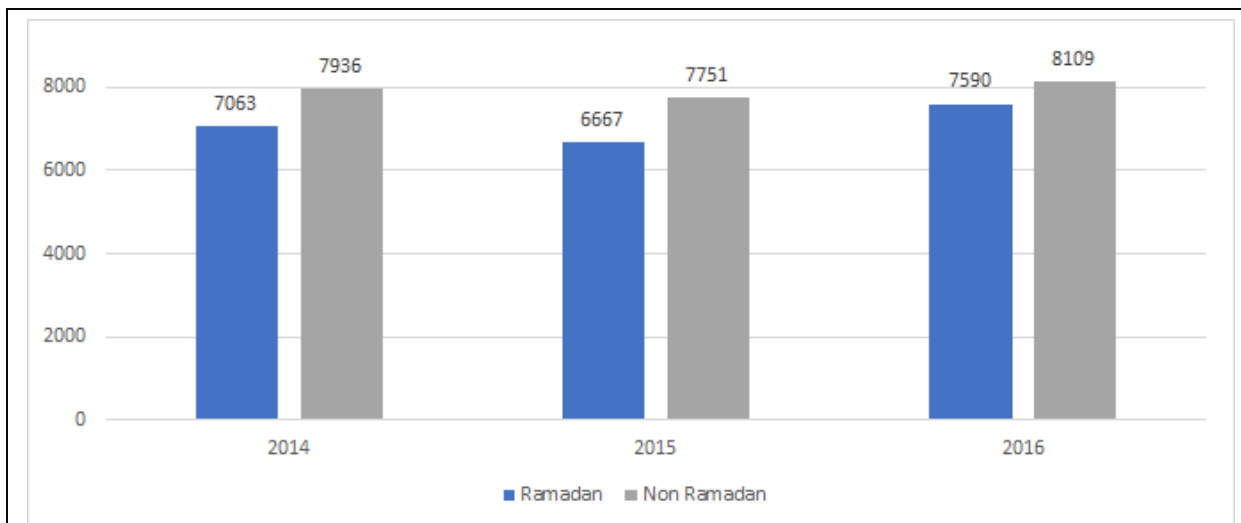


Figure 1: Depiction of patient volumes for Ramadan and Non-Ramadan days for all the years considered for this study

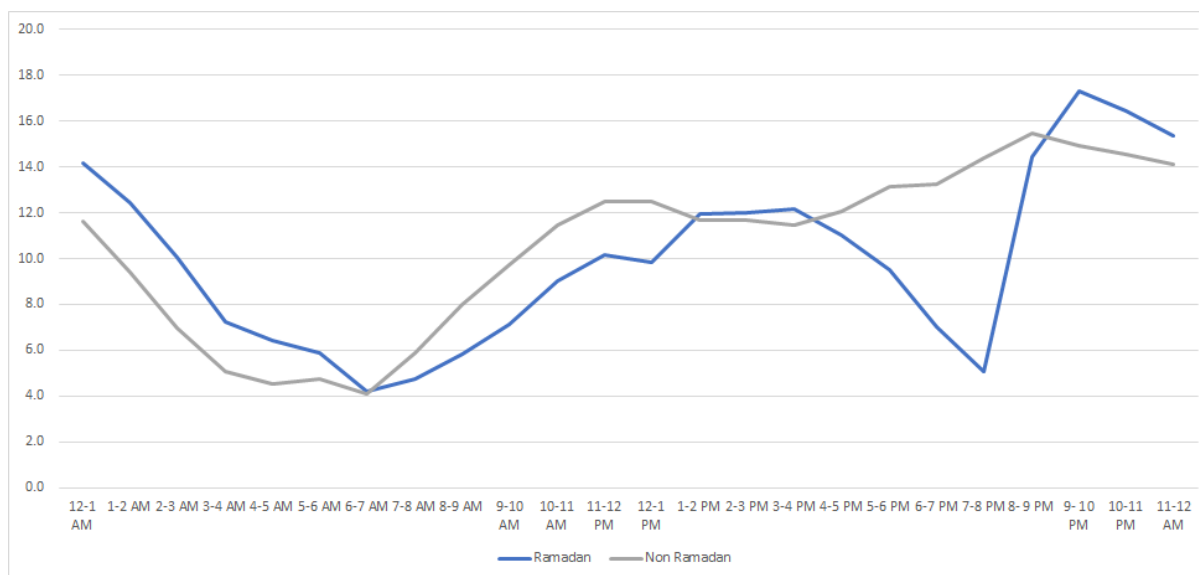


Figure 2: Presentation of average emergency department patient visits for Ramadan and Non-Ramadan days on an hourly basis

during the evening hours, especially from 7 p.m. to 8 p.m.

**Analysis of patient volumes with relation to fasting**

During the month of Ramadan, Muslims fast from dawn to dusk. During the study period, patients who practiced fasting spent on average 63% of the day fasting (15 hours) and 37% not fasting (9 hours). It was observed from the collected data that 53% of the patients were present in the hospital during the fasting hours whereas 47% were present during the non-fasting hours. This was statistically significant ( $p < 0.001$ ).

**Assessment of complaints of the patients**

Table 2 summarizes the most common chief complaints observed during the study period.

Complaints related to the gastrointestinal system was the most common chief complaint in both Ramadan and non-Ramadan days. This was followed by traumatic musculoskeletal and Head, eyes, ears, nose, and throat (HEENT) and Respiratory complaints. The percentage of non-

Table 2: Breakdown of the most common complaints seen during Ramadan and Non-Ramadan days

Complaint	Ramadan	Non-Ramadan
Gastrointestinal	3446	4019
Musculoskeletal trauma	2054	2407
Head, eyes, ears, nose, throat	1714	2002
Respiratory	1218	1487
Back pain	763	709
Chest pain	643	773

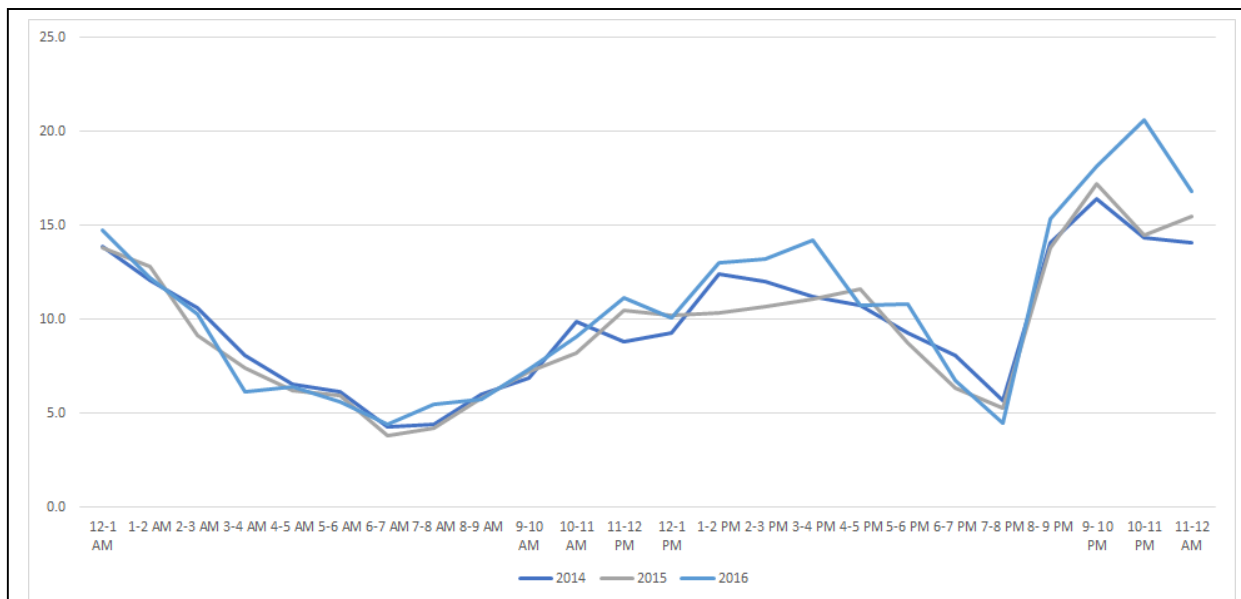


Figure 3: Presentation of patient volumes for Ramadan days on an hourly basis per year

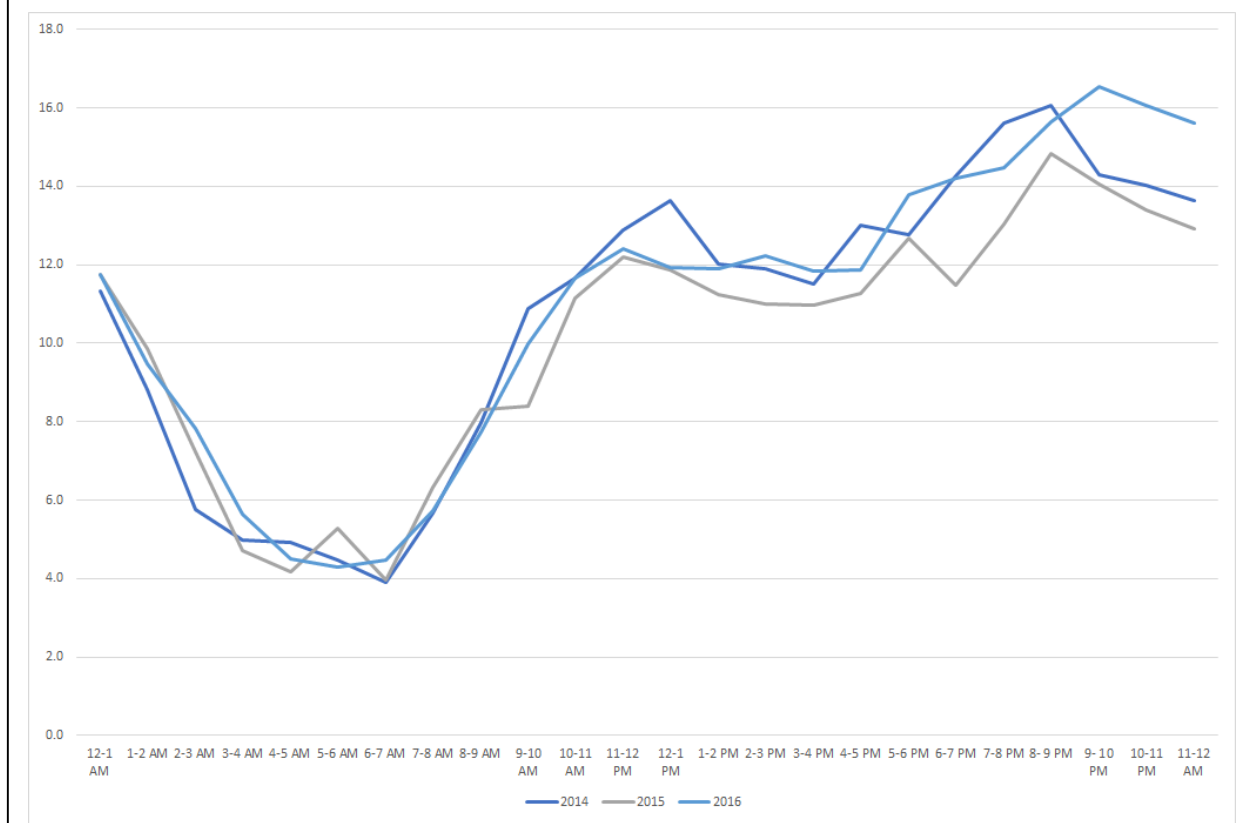


Figure 4: The observed trend witnessed each hour for the non-Ramadan days on an hourly basis

Ramadan patients was the highest in all of the complains apart from back pain where the highest percentage was the one of the Ramadan patients.

**DISCUSSION**

Patient volumes during Ramadan were lower in all

three years that we studied a finding which was similar to Balhara et al. and Pekdemir et al., who also studied a similar population (11, 12). This could perhaps be due to increased patient reluctance to visit hospitals during this holy period in a predominantly Muslim population, as many

prefer to spend that time in prayer. Had we also studied the level of acuity, we expect that this would show a decrease in visits with lower acuity, whereas volume of higher acuity cases would ideally be the same.

While pre-pubertal children are not religiously obligated to fast, a decreased number of pediatric visits too, were observed during Ramadan, once again, echoing the findings of Balhara et al. (11) If the study were to be conducted prospectively, we could note down whether each patient was fasting that day or not, which would help aid us in deciding if this factor was responsible for the lower number of visits, along with the level of acuity, as previously mentioned. Unlike Butt et al, who reported greater volumes at night, we recorded higher patient volumes during fasting hours versus non-fasting hours (13).

We noted a sharp decline in patient visits at 5 pm, followed by a steep increase at around 8 pm, the likes of which was also observed by Balhara et al. (11), but was the opposite of what was seen in the study conducted by Pekdemir et al. (12), who found highest ED attendance between 4 pm to 8 pm. In their case, however, this was also noted in their control group, which was defined as the 30-day period immediately after Ramadan (11, 12).

We believe our study stands out in that the same time period is studied over three years, effectively eliminating other confounding variables such as vacation period, seasonal variation, etc. This diurnal variation has implications for ED staffing during this unique period, as, in many cases, evenings and nights are more loosely staffed, with shift change and handover occurring a time that may arguably be one of the busiest at this time of year (10).

In our study, the most common chief complaints were related to gastrointestinal system. This is expected and observed in other studies (14-18). Back pain was more common in Ramadan than non-Ramadan days, which was not seen in the other literature that we reviewed. A possible cause may be prolonged hours spent standing in prayer, however, this is only a hypothesis, as there was no discrimination between fasting and non-fasting patients, let alone a discussion about hours spent in prayer.

#### **Limitations**

As mentioned previously, we did not discriminate between fasting and non-fasting patients, which prevented us from being able to analyze the relationship of fasting to certain chief complaints, and its effect on ED visits, as fasting patients would be more reluctant to visit the ED during fasting

hours due to the annulment of their fast from oral medications or intravenous hydration. We also included both adult and pediatric patient populations, while it is only adults and post-pubertal adolescents who are religiously obligated to fast, and it is specifically the fasting population in whom we would expect to observe a change in pattern, such as different chief complaints or different timings of ED visits. Lastly, the three-day period immediately after Ramadan, known as Eid-ul-Fitr, is a time of celebration of the end of the fasting period, and often sees Muslims enjoying massive feasts including with high fat content or a high glycemic index. As one may predict, the pattern of visits during this period would be starkly different compared to Ramadan, with perhaps fewer visits of lower acuity, and higher number of gastrointestinal complaints. To avoid this confounding our results, studying the Eid days independently instead of grouping them with the rest of Non-Ramadan days would be of great value in ensuring that our findings are purely due to the change in diet and lifestyle habits during Ramadan.

#### **CONCLUSIONS**

The results of our study of this unique period reveal a change in the diurnal variation of ED attendance, and prove the need of staffing and resource adjustment, along with a need for change in shift timing during the month of Ramadan. These shifts in expected patterns affect not just the ED, but the entire hospital at large. At present, in our ED, there are no changes made during Ramadan to specifically accommodate the varying need of the population during this time, and with further studies, this may prove to be a necessity.

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#### **AUTHORS' CONTRIBUTION**

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

#### **CONFLICT OF INTEREST**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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