Emergency department attendance patterns during Ramadan

Taimur Butt, Hameed Ullah Khan, Israr Ahmed, Abdelmoneim Eldali

From the Department of Emergency Medicine and Department of Biostatistics, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

Correspondence: Dr. Taimur Butt · Chairman, Department of Emergency Medicine, King Faisal Specialist Hospital and Research Centre, PO Box 3354, Riyadh 11211, Saudi Arabia · T: +966-11-4647272 · tbutt@kfshrc.edu.sa · ORCID: http://orcid.org/0000-0003-4949-2344

Ann Saudi Med 2016; 36(4): 258-264
DOI: 10.5144/0256-4947.2016.258

BACKGROUND: Patient attendance in the emergency department (ED) is inherently variable and unpredictable. Resources might be better allocated if use of the ER could be predicted. During the month of fasting (Ramadan), healthy adult Muslims do not eat or drink from dawn to sunset and in the Middle East, social activities occur mostly during night. There is no published data that has reported changes in local ED attendance pattern during Ramadan.

OBJECTIVES: Determine if there are differences in tertiary care ED attendance during Ramadan compared to other times of the year.

DESIGN: Retrospective, using data from the hospital integrated clinical information system.

SETTING: Tertiary care institution in Riyadh, Saudi Arabia.

PATIENTS AND METHODS: All ED visits during the Islamic calendar years of 1431-1434 (December 18, 2009-October 13, 2013) were analyzed.

MAIN OUTCOME MEASURES: Patient volume, acuity, demographics and admission rate variability between Ramadan and other months.

RESULTS: During the study period of 4 years, of 226,075 ED patients, 129,178 (57.14%) patients were seen during the day shift (07:00 to 18:59). During Ramadan, 10,293 (60%) patients presented during the night shift compared with the day shift (P<.0001). This trend was seen consistently with no statistically significant differences in admissions 7%, triage acuity or when compared with other months.

CONCLUSION: During Ramadan, ED attendance changes as more patients present during the night shift. In Saudi Arabia and possibly other Muslim countries, appropriate resources should be allocated during Ramadan to manage the nocturnal ED patient surge.

LIMITATIONS: We believe that the majority of our patients fast, but it is not known how many ED patients were actually fasting during the study period. This study was conducted in a tertiary care hospital and the patient population presenting to our ED is predominantly Muslim; therefore, the results may not be generalized to populations that are not predominantly Muslim.

Emergency Department (ED) patient visits have an inherent natural variability through the day and month to month. The demand for services changes due to seasonal and weekly patterns. ED patient attendance patterns may change during local community events, school holidays, sudden influxes of visitors in town or a festivity such as Ramadan (Muslim month of fasting). To optimize the quality of patient care, efficient patient flow, shorten waiting times and length of stay, a balance between the supply of emergency resources and demand for services must be maintained. Cost-effective ED staffing plans account for historic patient volumes during peak and trough hours. Also, due to a worldwide shortage of trained and qualified emergency staff, physicians, mid-level providers and nurses, appropriate staffing schedules are required for optimal patient outcomes.

During Ramadan, healthy Muslims do not eat, drink, smoke or have sexual intercourse from dawn to sunset. Muslims follow a lunar calendar and Ramadan is the 9th month. Depending on the sighting of the moon, this may be 29 or 30 days. As a lunar calen-
dar is shorter than the Gregorian calendar by 11 days, Ramadan may fall any time of the year. During summer months the fasting period may be 18 hours long in the region. During Ramadan the change in the sleep-wake cycle is associated with changes in meal schedules, increased food consumption during the night, a decrease in daytime alertness and psychomotor performance and an increase in the intensity of certain diseases.\(^5\) Islam does not mandate fasting for sick persons, children, elderly, travelers, insane, pregnant or lactating and menstruating women.\(^6,7\) However, many of these individuals attempt fasting to fulfill their religious obligations.\(^8\) One epidemiologic study indicated that a majority (79%) of patients with type 2 diabetes fasted for at least 15 days during Ramadan and in another study over half (58%) of peritoneal dialysis patients elected to fast.\(^9,10\) It is quite conceivable that some of these patients may present to an ED with sickness or injury.\(^11\) During Ramadan, social activities like shopping and family recreational activities are more frequent after people have broken their fast and during the night time.

This retrospective study is an attempt to find out whether these social, cultural and religious factors during the month of Ramadan impact ED volume, triage acuity, admission rate and patient demographics in a tertiary care hospital in Riyadh, Saudi Arabia. The patient population presenting to this hospital is predominantly Muslim. To our knowledge, such data from Saudi Arabia has not been published before.

**PATIENTS AND METHODS**

Electronic data on patient visits to the ED of King Faisal Specialist Hospital and Research Centre in the city of Riyadh, Saudi Arabia were retrospectively collected from the Integrated Clinical Information System (ICIS). Permission from the Research Advisory Council (RAC # 2131 154) was obtained before accessing hospital data. The data from February 15, 2010 to October 6, 2013 corresponding to Islamic Calendar Rabi-al-awal 1, 1431 to Dhu-al-Hijja 30, 1434 were collected and analyzed. All ED visits were included and direct admissions to the hospital were excluded. Descriptive statistics for the continuous variables are reported as mean and standard deviation and categorical variables are summarized as frequencies and percentages. Continuous variables were compared by the independent t test or ANOVA as appropriate, while categorical variables were compared by chi-square test. The level of statistical significance was set at \(P<.05\). The statistical analysis was done by using the software package Statistical Analysis System (SAS version 9.4).

**RESULTS**

Data for the Islamic year 1431 comprises of 10 months (15 February to 7 November 2010). During this period, a total of 48 466 patients were seen in the ED. Of
this total, 27,195 (56%) were seen during the day shift (07:00 to 18:59) and 21,271 (44%) were seen during the night shift (19:00 to 06:59). This day to night shift variability in patient volume was statistically significant ($P < .0001$). More patients were seen during the day shift in all months except during Ramadan, when more patients were seen during the night shift. This difference was also statistically significant when compared with all other months as well as when compared with average for the whole year ($P < .0001$) (Figure 1).

No statistically significant difference was noted among other variables studied between Ramadan and the rest of the year. A total of 44,677 (92%) ED patients were discharged home. There were 37,338 (77%) adults (14 years and above) and 11,128 (23%) pediatric. There were 25,435 females (52%) and 23,018 males (48%). No statistically significant differences were noted when Ramadan was compared with the rest of the months and the entire year (Table 1). A similar trend was seen during the year 1432 (7 December 2010 to 23 October 2011) as noted in Figure 2 and Table 2. During the year 1433 (26 November 2011 to 17 October 2012) similar trend was noted (Figure 3, Table 3). For the year 1434 (15 November 2012 to 6 October 2013) the patient presentation pattern is shown by Figure 4 and Table 4.

During the study period, 1431-1434 (December 2009 to October 2013), a total of 226,075 patients were seen in the ED, 129,178 (57%) patients were seen during the day shift and 96,897 (43%) were seen during the night shift ($P < .0001$). However, during the month of Ramadan, more patients presented to the ED during the night shift after breaking their fast, as compared with all other months or the average of the entire year ($P < .0001$) (Figure 5).

A total of 211,217 (93%) ED patients were discharged home. There were 176,120 (78%) adults and 49,955 (22%) pediatrics. Female ED patient visits included 118,562 (52%) while male patients were 107,476 (48%). Among these variables a similar trend continued during Ramadan months. The cumulative results are shown in the Table 5.

Patient triage acuity based on Canadian Triage and Acuity Scale (CTAS) was analyzed for Ramadan and the rest of the months through 1431 to 1434. No association was found in the number of category 1 and 2 (emergency) patients, Category 3 (urgent) patient volume was increased while the category 4 (non-urgent) patient volume was noted to have decreased during Ramadan as compared with the rest of the months (Figure 6).

**DISCUSSION**

During the months of Ramadan, the majority of the patients presented to the ED during the night shift after breaking their fast. This change corresponds to the nocturnal culture pattern that develops during this month in a Middle Eastern society. Use of the ED by patients...
is based upon convenience, inability to access primary care, lack of insurance or patient perception of an urgent medical condition. This study shows a sudden reversal of the ED patient arrival pattern during the month of Ramadan suggesting that social and cultural factors have a strong influence on the use of the ED by the patients.

To maintain quality of care, resource allocation must match patient care demands. Accurate predictions of future demand and workload can enable optimal staff scheduling and resource allocation. The staff scheduling for the ED shifts can be done by using mathematical calculations, analytical analysis, hospital website activ-

| Table 1. Patient demographic data, Islamic year 1431. |
|-----------------------------------------------------|
| Months                               | Total | Arrival Time | Disposition | Age | Gender |
|                                      |       | Day | Night | Home | Admit | Adult | Peds | Female | Male |
| Muharram                              | 5665  | 3439| 2226 | 5243 | 423  | 4123  | 1542 | 3047   | 2623 |
| Safar                                 | 4947  | 2930| 2017 | 4586 | 361  | 3747  | 1200 | 2614   | 2332 |
| Rab-al-awal                           | 4804  | 2877| 1927 | 4440 | 364  | 3702  | 1102 | 2484   | 2204 |
| Rab-al-thani                          | 5020  | 3001| 2019 | 4615 | 405  | 3881  | 1139 | 2615   | 2405 |
| Jumada-al-awal                        | 4840  | 2818| 2022 | 4406 | 434  | 3750  | 1090 | 2494   | 2342 |
| Jumada-al-Thani                       | 5104  | 2948| 2156 | 4676 | 428  | 3966  | 1138 | 2625   | 2479 |
| Rajab                                 | 4506  | 2496| 2010 | 4109 | 397  | 3564  | 942  | 2353   | 2153 |
| Shaaban                               | 4508  | 2463| 2045 | 4029 | 479  | 3633  | 875  | 2312   | 2196 |
| Ramadan                               | 4181  | 2164| 2567 | 3743 | 438  | 3379  | 802  | 2172   | 2009 |
| Shawwal                               | 4865  | 2766| 2099 | 43147| 518  | 3842  | 1023 | 2571   | 2292 |
| Dhu-al-qada                           | 5293  | 3223| 2070 | 4842 | 451  | 4091  | 1209 | 2737   | 2556 |
| Dhu-al-hijja                          | 5126  | 3027| 2099 | 4682 | 444  | 3873  | 1253 | 2684   | 2441 |
| Total                                 | 58859 | 33602|25257|53718|5142 |45551 |13315|36564 |28142 |
| Percentage                            | 100   | 56  | 44   | 92   | 8   | 77    | 23   | 52     | 48   |

| Table 2. Patient demographic data, Islamic year 1432. |
|-----------------------------------------------------|
| Months                               | Total | Arrival Time | Disposition | Age | Gender |
|                                      |       | Day | Night | Home | Inpatient | Adult | Peds | Female | Male |
| Muharram                              | 5665  | 3439| 2226 | 5243 | 423  | 4123  | 1542 | 3047   | 2623 |
| Safar                                 | 4947  | 2930| 2017 | 4586 | 361  | 3747  | 1200 | 2614   | 2332 |
| Rab-al-awal                           | 4804  | 2877| 1927 | 4440 | 364  | 3702  | 1102 | 2484   | 2204 |
| Rab-al-thani                          | 5020  | 3001| 2019 | 4615 | 405  | 3881  | 1139 | 2615   | 2405 |
| Jumada-al-awal                        | 4840  | 2818| 2022 | 4406 | 434  | 3750  | 1090 | 2494   | 2342 |
| Jumada-al-Thani                       | 5104  | 2948| 2156 | 4676 | 428  | 3966  | 1138 | 2625   | 2479 |
| Rajab                                 | 4506  | 2496| 2010 | 4109 | 397  | 3564  | 942  | 2353   | 2153 |
| Shaaban                               | 4508  | 2463| 2045 | 4029 | 479  | 3633  | 875  | 2312   | 2196 |
| Ramadan                               | 4181  | 2164| 2567 | 3743 | 438  | 3379  | 802  | 2172   | 2009 |
| Shawwal                               | 4865  | 2766| 2099 | 43147| 518  | 3842  | 1023 | 2571   | 2292 |
| Dhu-al-qada                           | 5293  | 3223| 2070 | 4842 | 451  | 4091  | 1209 | 2737   | 2556 |
| Dhu-al-hijja                          | 5126  | 3027| 2099 | 4682 | 444  | 3873  | 1253 | 2684   | 2441 |
| Total                                 | 58859 | 33602|25257|53718|5142 |45551 |13315|36564 |28142 |
| Percentage                            | 100   | 56  | 44   | 92   | 8   | 77    | 23   | 52     | 48   |
Table 3. Patient demographic data, Islamic year 1433.

| Months            | Total | Arrival time | Disposition | Age | Gender |
|-------------------|-------|--------------|-------------|-----|--------|
|                   |       | Day | Night | Home | Inpatient | Adult | Peds | Female | Male |
| Muharram          | 5522  | 3379| 2143 | 5046 | 476     | 4195  | 1327 | 2829   | 2693 |
| Safar             | 5118  | 3056| 2062 | 4584 | 534     | 3813  | 1305 | 2614   | 2332 |
| Rab-al-awal       | 5068  | 3075| 1993 | 4545 | 523     | 3878  | 1190 | 2647   | 2421 |
| Rab-al-thani      | 5280  | 3116| 2164 | 4781 | 499     | 4044  | 1236 | 1805   | 2475 |
| Jumada-al-awal    | 4972  | 2901| 2071 | 4466 | 506     | 3860  | 1112 | 2679   | 2293 |
| Jumada-al-thani   | 5192  | 3065| 2127 | 4632 | 560     | 4070  | 1122 | 2707   | 2481 |
| Rajab             | 4634  | 2616| 2018 | 4132 | 502     | 3701  | 933  | 2523   | 2110 |
| Shaaban           | 4372  | 2380| 1992 | 3891 | 481     | 3508  | 864  | 2306   | 2068 |
| Ramadan           | 4342  | 1724| 2618 | 3907 | 435     | 3507  | 835  | 2323   | 2019 |
| Shawwal           | 4600  | 2612| 1988 | 4119 | 481     | 3762  | 838  | 2425   | 2172 |
| Dhu-al-qada       | 4243  | 3138| 2105 | 4777 | 466     | 4121  | 1122 | 2759   | 2481 |
| Dhu-al-hijja      | 5041  | 2955| 2086 | 4542 | 499     | 3921  | 1120 | 2658   | 2382 |
| Total             | 59384 | 34017| 25367| 53422| 5962    | 46380 | 13004| 31417  | 27957|
| Percentage        | 100   | 57  | 43   | 90   | 10      | 78   | 22   | 53     | 47   |

Table 4. Patient demographic data, Islamic year 1434.

| Months            | Total | Arrival time | Disposition | Age | Gender |
|-------------------|-------|--------------|-------------|-----|--------|
|                   |       | Day | Night | Home | Inpatient | Adult | Peds | Female | Male |
| Muharram          | 5308  | 3225| 2083 | 4762 | 546     | 4040  | 1268 | 2759   | 2549 |
| Safar             | 5250  | 3198| 2052 | 4715 | 535     | 4002  | 1248 | 2759   | 2494 |
| Rabi-al-awal      | 4671  | 5746| 1925 | 4164 | 507     | 3689  | 982  | 2480   | 2119 |
| Rabi-al-thani     | 5203  | 3138| 2065 | 4693 | 510     | 4034  | 1169 | 2704   | 2499 |
| Jumada-al-awal    | 5062  | 2985| 2077 | 4545 | 517     | 3898  | 1164 | 2684   | 2370 |
| Jumada-al-thani   | 5036  | 2969| 2067 | 4554 | 482     | 3939  | 1097 | 2622   | 2413 |
| Rajab             | 4970  | 2894| 2076 | 4463 | 507     | 3911  | 1059 | 2633   | 2336 |
| Shaaban           | 4315  | 2476| 1839 | 3862 | 453     | 3532  | 783  | 2225   | 2090 |
| Ramadan           | 4406  | 1846| 2560 | 3943 | 463     | 3642  | 764  | 2260   | 2146 |
| Shawwal           | 4747  | 2653| 2094 | 4215 | 532     | 3928  | 819  | 2458   | 2288 |
| Dhu-al-qada       | 5082  | 3052| 2030 | 4572 | 510     | 4042  | 1040 | 2608   | 2470 |
| Dhu-al-hijja      | 5316  | 3182| 2134 | 4804 | 512     | 4194  | 1122 | 2806   | 2509 |
| Total             | 59366 | 34364| 25002| 53292| 6074    | 46851 | 12515| 30998  | 28283|
| Percentage        | 100   | 58  | 42   | 90   | 10      | 79   | 21   | 52     | 48   |
Table 5. Patient demographic data, Islamic year 1431-1434.

| Months             | Total | Arrival Time | Disposition | Age | Gender |
|--------------------|-------|--------------|-------------|-----|--------|
|                    |       | Day          | Night       | Home| Inpatient| Adult| Peds| Female| Male |
| Muharram           | 16495 | 10043        | 6452        | 15572| 923     | 12358| 4137| 8635  | 7859 |
| Safar              | 15315 | 9184         | 6131        | 14404| 911     | 11562| 3753| 8126  | 7188 |
| Rabi-al-awal       | 19966 | 11892        | 8074        | 18794| 1172    | 15353| 4613| 10407 | 9555 |
| Rabi-al-thani      | 20675 | 12237        | 8438        | 19316| 1359    | 15844| 4831| 10805 | 9868 |
| Jumada-al-awal     | 19821 | 11564        | 8257        | 18403| 1418    | 15348| 4473| 10483 | 9337 |
| Jumada-al-thani    | 20097 | 11786        | 8311        | 18728| 1369    | 15690| 4407| 10387 | 9705 |
| Rajab              | 18437 | 10454        | 7983        | 17208| 1229    | 14562| 3875| 9832  | 8603 |
| Shaaban            | 17169 | 9536         | 7633        | 15885| 1284    | 13877| 3292| 8892  | 8276 |
| Ramadan            | 17100 | 6807         | 10293       | 15824| 1276    | 13828| 3272| 8986  | 8112 |
| Shawwal            | 18863 | 10582        | 8281        | 17394| 1469    | 15228| 3635| 9863  | 8997 |
| Dhu-al-qada        | 21062 | 12613        | 8449        | 19783| 1279    | 16340| 4722| 11029 | 10023|
| Dhu-al-hijja       | 21075 | 12480        | 8595        | 19909| 1169    | 16130| 4945| 11117 | 9953 |
| Total              | 226075| 129178       | 96897       | 211220| 14858   | 176120| 49955| 118562| 107476|
| Percentage         | 100   | 57           | 43          | 93   | 7       | 78   | 22  | 52    | 48   |

Patient acuity, complexity and often social status may affect physician workload. Whereas sicker patients may take more physician time with procedures and consultations, patients with higher social status might require more time for disease discussion and reassurance. To maintain a balance between resource allocation and quality of care, future staff planning should be based on historic patient arrival patterns, day and night visit variability, number of admissions, patient acuity, variation in gender and adult-to-pediatric visit ratio.

ED patient arrival has natural variability while the operating room (OR) schedule has artificial variability. Smoothing the OR schedule can improve ED patient flow. It would be interesting to see if a similar variability is present in the scheduling of surgeries during Ramadan. Likewise, other supporting departments like radiology, pathology, respiratory services, admitting services and others must align their staffing to ED patient care demands. During the month of Ramadan, we change the emergency physician schedule for both the fast track and the main department. Shifts are arranged to match the higher incoming patient volume during the night, without actually increasing the total daily hours of coverage. This study supports our practice as the total volume of patients during Ramadan did not change. In our ED, the on-call and back-up staffing is maintained without any change throughout the year.

Intermittent fasting during the month of Ramadan has been shown to cause various health effects, including changes in serum glucose, glycosylated hemoglobin, physiological and psychological responses of athletes, LDL cholesterol, electrolyte, seizure frequency and caffeine withdrawal headaches. These health effects did not increase ED patient volume in our study.

Patients who are fasting, usually avoid visiting the ED during the day time, and prefer to visit after breaking their fast because if someone is fasting, taking oral medications and intravenous fluids with calories will break the fast. Intramuscular injections and IV fluids without calories are often permitted by religious authorities, but in our experience are commonly avoided by our patients.

As a tertiary hospital, our patient population is quite complex. However, the acuity of illness based on the CTAS did not change significantly during Ramadan. Other variables that did not change significantly included admission rate, discharge rate, gender and age distribution. These findings suggest no significant health effects in our patient population.

We believe that the majority of our patients fast but it is not known as to how many ED patients were actually fasting during the study period. This study was conducted in a tertiary care hospital and the patient popu-
lation presenting to our ED is predominantly Muslim; therefore, the results may not be generalized.

In conclusion, despite natural variability, the monthly ED patient volume, age, gender and the admission rate remained constant throughout the years. There was a significant change in the patient presentation pattern during the month of Ramadan, with a greater number of patients presenting to the ED after sunset and through the night shift. This nocturnal arrival pattern may be related to religious, social and cultural factors in the region. EDs and other hospital support services in Saudi Arabia and possibly other Muslim countries in the region should adjust their staff schedules accordingly.

REFERENCES
1. Jones, Spencer S., et al. Forecasting daily patient volumes in the emergency department. Academic Emergency Medicine 2008;15(2):159-170.
2. Hall, Randolph, et al. Modeling Patient Flows Through the Health care System. Patient Flow. Springer US, 2013:3-42.
3. Kirsch, Thomas D, et al. The development of international emergency medicine: a role for US emergency physicians and organizations. Acad Emer Med. 1997;4(10):996-1001.
4. Topacoglu H, et al. Impact of Ramadan on demographics and frequencies of disease-related visits in the emergency department. Int J Clin Pract. 2001;59(8):900-905.
5. Fazel, M. Medical implications of controlled fasting. J Royal Soc Med. 1998;91(5):260.
6. Azizi F. Ann Nutr Metab. Islamic fasting and health. 2010;56(4):273-82.
7. Yasemin B. Gomceli , Gulnihal Kutlu, Leyla Cavdar, Levent e. inan. does the seizure frequency increase in Ramadan? Seizure 2008; 17:671-676.
8. Jamilian M, et al. The Effect of Ramadan Fasting on Outcome of Pregnancy. Middle-East Journal of Scientific Research 2015;23(7):1270-1275.
9. Wiley-Blackwell, John Wiley & Sons. The incidence of hypoglycaemia in Muslim patients with type 2 diabetes treated with sitagliptin or a sulphonylurea during Ramadan: a randomised trial. Int J Clin Pract. 2011 November; 65(11): 1132-1140.
10. Al Wafeel J, Minwalli AH, Alsuwaida A, Al Ghonaim M, Usama S, Hayat A, Shah IH. Recommendations for fasting in Ramadan for patients on peritoneal dialysis. Perit Dial Int. 2013 Jan-Feb;33(1):86-91.
11. E J Langford, M A Ishaque, J Fothergill, and R Touquet. The effect of the fast of Ramadan on accident and emergency attendances. J R Soc Med. 1994 September; 87(9):517-518.
12. M Fazel. Medical implications of controlled fasting. J R Soc Med. 1998 May; 91(5):260-263.
13. Bogdan A1, Bouchareb B, Touitou Y. Ramadan fasting alters endocrine and neuroendocrine circadian patterns. Meal-time as a synchronizer in humans? Life Sci. 2001 Feb 23;68(14):1607-15. BMC Emerg Med. 2009; 9:1.
14. Sun, Yan, et al. Forecasting daily attendances at an emergency department to aid resource planning. BMC emergency medicine 2009;9(1).
15. Litvak, Eugene. “Optimizing patient flow by managing its variability.” front office to front line: Essential issues for health care Leaders. Oakbrook Terrace, IL: Joint Commission Resources 2005: 91-111.
16. Saada, D. Ait, et al. Effect of Ramadan fasting on glucose, glycosylated haemoglobin, insulin, lipids and proteinous concentrations in women with non-insulin dependent diabetes mellitus. African Journal of Biotechnology. 2010;9(1).
17. Azizi F, Rassouli HA. Serum glucose, billirubin, calcium, phosphorus, protein and albumin concentrations during Ramadan. MJIRI 1987;1(1): 38-41.
18. Salehi M, Neghab M. Effects of fasting and a medium calorie balanced diet during the holy month Ramadan on weight, BMI and some blood parameters of overweight males. Pak J Biol Sci. 2007;10(6):968-71.
19. Chaouachi A, Leiper JB, Chitourou H, Aziz AR, Chamari K. The effects of Ramadan intermittent fasting on athletic performance: recommendations for the maintenance of physical fitness. J Sports Sci. 2012;30 Suppl 1:S53-73.
20. Ibrahim Abu-Salameh, Ygal Plakh, Gal Ilfergane. Migraine exacerbation during Ramadan fasting. The Journal of Headache and Pain 2010;11(6):513-517.