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ORIGINAL ARTICLE

Quality improvement study in emergency department waiting room times in a private hospital in Kuwait

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ABSTRACT

Background: The emergency department (ED) waiting room duration has been a challenge in many EDs. This study has implemented a focus plan-do-study-act (PDSA) cycle study on ED waiting room patients in a private hospital in Kuwait. Each PDSA cycle included one of the following interventions: hospitality measures, number of triage nurses, number of ED physicians, and number of receptionists to see their impact on the ED waiting times.

Methods: The waiting times were collected per patient coming into the ED and their assigned Canadian Triage Acuity Scale (CTAS) level over a 12-month period, as well as the number of patients left without being seen (LWBS). Each intervention was introduced into the ED and a 2-month period following each was given to see the effect on the waiting time.

Results: As divided per CTAS level, there were 38,157 patients included in the analysis. The results showed that for every increase in one triage nurse, there was a reduction of 15.09, 20.7, and 20.8 minutes for CTAS 3, 4, and 5 patients, respectively, and for every increase in one doctor there was a reduction in the total ED waiting room time of 11.4, 10.0, and 8.6 minutes for CTAS 3, 4, and 5 patients, respectively, keeping all other variables constant. These quality parameters reduced the LWBS from 6.1% to 2.5%.

Conclusion: This study concluded that increasing triage nurses and ED physicians successfully reduces total ED waiting room times and reduces the number of patients LWBS.

Keywords: Quality improvement, emergency department, waiting room times, emergency medicine, CTAS.

Introduction

Emergency departments (EDs) are the gateway to many healthcare systems that see acute care patients. ED waiting room time is a challenge faced by many departments. The average waiting time in the ED for a patient is 3-4 hours [1]. Prolonged waiting times could adversely affect patients, in terms of longer inpatient stays, higher mortality rates, and an increase in the cost of care [2-4]. Prolonged ED waiting times are also associated with decreased patient satisfaction [5-7]. Prolonged waiting time is an important factor in negative attitudes toward the hospital and healthcare service providers, and is considered a major challenge to the public's trust in the healthcare system. There are many reasons for a prolonged waiting time in ED waiting rooms [8-10]. The time a patient takes from the door to consultation is dependent on multiple factors; these include the acuity of the patient presentation, availability of staff to see the patient, and ED waiting room policies such as those that process registration of the patient.

The Kuwait healthcare system is no exception. Prolonged ED waiting room times have become problematic, leading to complaints and decreased patient satisfaction [5-7]. This has also been the subject of debate in local newspapers. Kuwait has two predominant healthcare systems, the public and private sectors. Taiba Hospital,

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which belongs to the private sector, has faced challenges with ED waiting room times which were evident from the patient feedback system. The patient feedback system is a link that the patient receives after their visit to the ED to rate their stay in terms of time and quality of services received [5-11]. Complaints are received per month from the patient feedback system about waiting too long in the ED waiting room in Taiba Hospital. While some complaints focus on the patient wanting to be accommodated to be seen quickly for minor presentations, other complaints focus on their waiting time exceeding that of their acuity level. The goal of emergency care providers is to provide timely access to care; however, challenges such as high patient volumes, frequent influxes in ED arrivals, and capacity limitations mean that long waiting times are inevitable. Reducing waiting time in the ED is challenging. Acceptable ED waiting times are dependent on the acuity of the case, which is measured according to the patient's presenting complaint and vital signs. There are multiple scales to measure acuity. The one applied in Taiba Hospital is the Canadian Triage Acuity Scale (CTAS) [12].

The aim of the project was to measure the waiting time after applying the CTAS system, by comparing real waiting times with the standard waiting times, which was the primary outcome, and to reduce the 'left without being seen' (LWBS) number, which was the secondary outcome. These outcomes were chosen to ensure patient safety; as for the primary outcome, the triaged patients did not exceed the accepted time to consultation, and the 'LWBS' was the secondary outcome as a quality parameter. Patient mortality or deterioration was also monitored with these indicators. Thus, the objective of this study was to determine if ED waiting times in Taiba Hospital fall within the range of the acceptable time intervals for each acuity as depicted by CTAS, along with identifying bottlenecks at each interval. An initiative was started in June 2018 after a cardiac arrest that occurred as a result of waiting time.

Subjects and Methods

Taiba Hospital ED was a new department with the project initiated in April 2018. In February 2019, a study was launched to help understand and reduce ED waiting times. During this time, 11.4% of the total complaints from the ED in Taiba Hospital were coming from the waiting room. The majority of these complaints were due to dissatisfaction with waiting room times. Furthermore, two cases of patient safety were documented, when the ED waiting time resulted in cardiac arrest, in February and June 2018. The gap between April 2018 and February 2019 was utilized to ensure that the necessary safety parameters were enforced; namely setting up the triaging system in the hospital. Twenty one nurses were trained in CTAS triaging system during this time, in October and November 2018, and the Canadian ED information system application was installed in the triage computers. This is a computer program that calculates CTAS through an automated algorithm using vital signs and patient presenting complaint. Nurses were monitored to ensure that triage was applied to the patients coming into the department.

A project team was formed in February 2019, using the focus Plan-Do-Study-Act (PDSA) cycle format of quality improvement studies [12]. An inter-professional team was organized to firstly map the current process in the ED waiting room, then to collect data on the waiting times, and lastly to add interventions to see how the waiting times were affected by the interventions.

Data measurements took place from February 1st, 2019 to January 31st, 2020. The unit of observation had the following data: dependent variable was ED waiting time. The waiting time was subdivided into (1) waiting time 1 (wait 1 in Rcode). This was the time interval the patient took from the reception, point of first encounter, to the time the triage finished. (2) Waiting time 2 (wait 2 in Rcode). This was the time interval from the end of triage to the time the patient was registered under a doctor's name. Both wait 1 and wait 2 were obtained directly from the IT system. Independent variables were the number of days since the start of the study (day in Rcode). It was calculated in excel as the number of days after February 1st, 2019, the first day of data collection.

CTAS level is the acuity level of the patient presenting to the ED. CTAS level would allow the patient to "jump the line" based on how sick they were. A patient waiting in the ED waiting room should not exceed 30 minutes if categorized as CTAS 3, 60 minutes if CTAS 4, and 120 minutes if CTAS 5. Additional columns were added to the data set as they represented the timeline of each intervention. Each intervention was a dummy variable, and each observation was assigned 0 if that intervention was not carried out and 1 if the intervention was carried out.

The number of patients that were LWBS was also collected per month and was in a different data set. Deterioration in the waiting room was defined as any patient in the waiting room with a change in presentation as detected by the patient, patient companion, receptionist, or triage nurse. The change in presentation was if the patient looked or felt worse, such as becoming drowsy or collapsing. The triage nurse would then assess these patients for vital sign deterioration and recalculate their acuity as per the CTAS level to see if it increased in acuity.

The time from registration to consultation was obtained retrospectively from the electronic health records of the patients. This parameter was from when the receptionist opened a queue for the patient to the time the ED doctor opened the consultation. Physicians were instructed to open the consultation queue just prior to seeing the patient as the patient was booked under that doctor. This time was recorded in the electronic health record as registration-to-triage and triage-to-consultation time.

The patient first comes to the waiting room and receives a queue number from the queue number machine. The patient then waits for the number to be called to present to the ED reception where the file is opened. They then get called by the triage nurse for triage on a first-come-first-serve basis, unless the receptionist alerts the triage nurse that the patient looks worrisome. Receptionists are trained in pre-triage with criteria that include unconscious patients and those with active bleeding or physical deformity. The patient is then triaged by the

triage nurse and then informed of his triage level and associated expected time. Patients are not informed of their expected waiting time as per the Joint Commission International (JCI) standards (Figure 1).

In each interval, the possible bottlenecks were identified as given by the patient feedback system. Interval A is the time interval between the patient taking a queue number and reaching the reception to open a file. There was usually only one receptionist at any given time in the ED since the time this project first commenced. Receptionists were at times busy with other patients at their desks or were not available at the desk as they were processing the payment of observation patients at the bedside of their rooms. This prolonged the time duration in which the reception would be available to open a file. Interval B is the time from opening a file until the time to present to a triage nurse. At the time of the study's initiation, there was one nurse available at the triage. These nurses were made familiar with a triage process but received no formal training or certification. The process relied mostly on vital signs and nursing gestalt. Interval C is the time from the triage to the time seen by a physician. At the time the study was initiated, there was only one physician in the ED (Figure 2).

The organization of the team was chosen to ensure that each part of the process was represented. An ED physician, ED flow officer, two receptionists, a triage nurse, and two quality officers were included. The data were analyzed by compiling the complaints that occurred on the electronic feedback system. The solutions were proposed to reduce each time interval. The solutions for the reduction of time at interval A were increasing the number of receptionists to two, one for payment and one for processing files. A card reader was placed to help speed the file processing step that scans the civil ID rather than manually inserting the data. The solutions to reduce the time at interval B were an extra triage room, which was completed in September 2018, with two nurses placed, one in each triage room to speed the triage process. The solutions to reduce the time at interval C were to increase the number of physicians and nursing staff that operate the ED.

The last group of solutions looked at the patient factors that enabled them to wait longer. These were suggestions

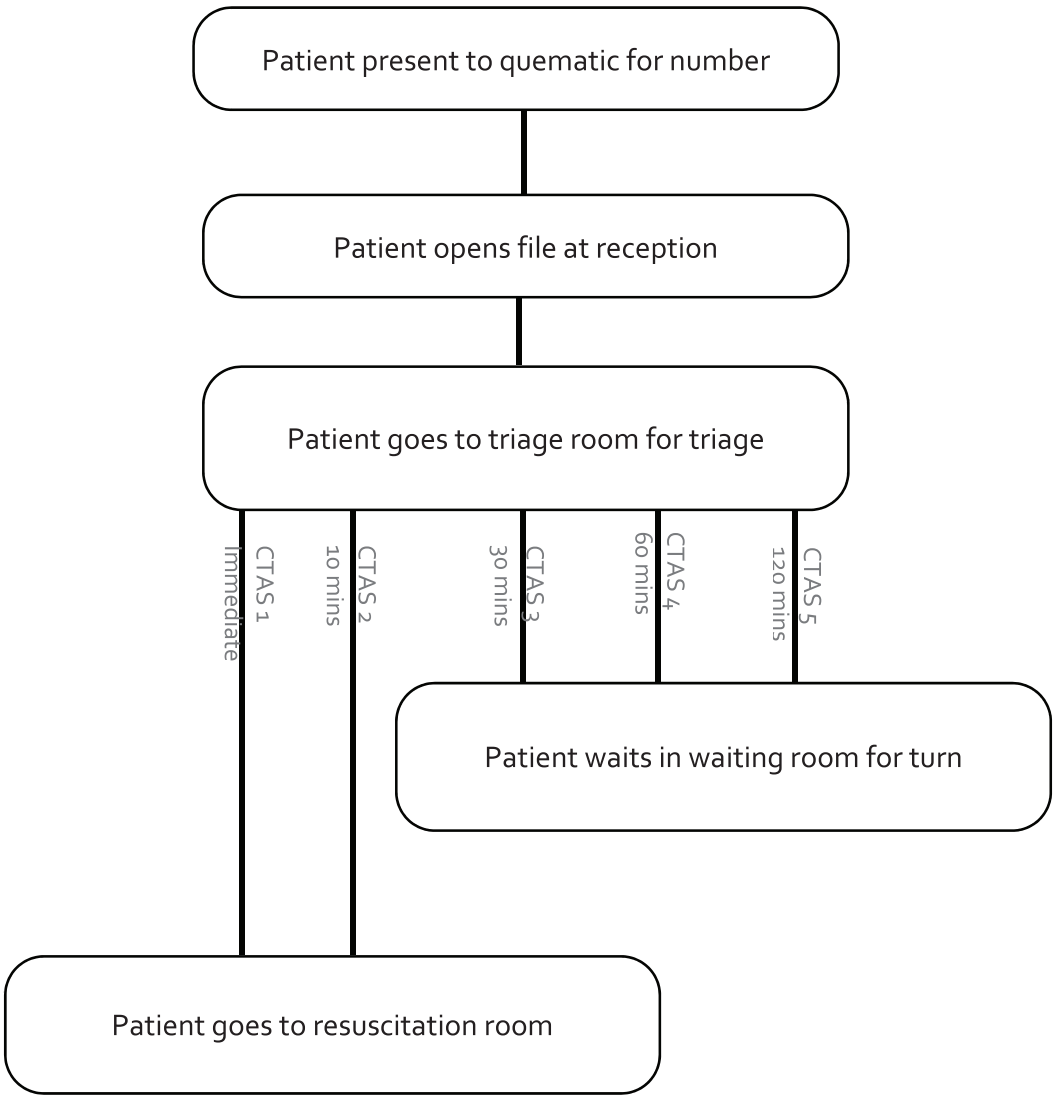

Figure 1. *The process mapping of ED waiting room flow.*

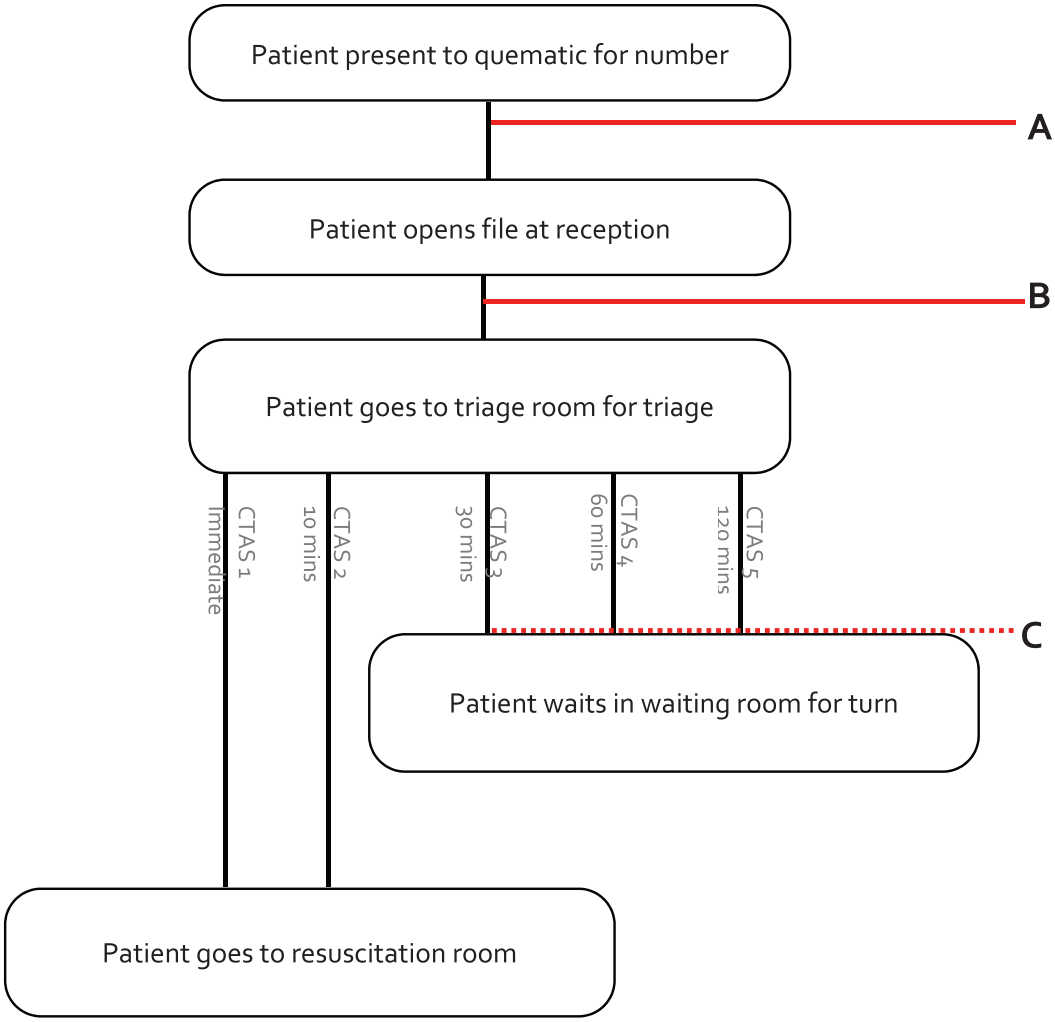

Figure 2. *The bottlenecks of each procedure.*

and feedback from receptionists as well as triage nurse. Feedback from both these groups was deemed necessary as they were involved in direct supervision of the ED waiting rooms. Suggestions included distracting measures for children, whether the children were the patients or not. Many patients complained to the receptionists that the ED waiting rooms did not have a pleasant smell. The last suggestion was having a kitchen staff serve dates and coffee in the waiting room, as this was a house welcoming custom in the region. Collectively, they were called hospitality measures.

The feasibility to implement change in terms of logistics was also observed. Changes were challenging as the patient population was continuously growing and time was needed to apply the change in the least disruptive way. The timeline of changes was as follows: on May 1st, hospitality measures were introduced. On July 1st, two doctors joined the ED and an ED marketing strategy was launched. On September 1st, two triage nurses were placed. On November 1st, two receptionists were placed and card readers were introduced to the reception. There were no changes which occurred in April as to understand what the baseline was for the ED.

A marketing strategy was initiated for the patient population to help educate them about the triage and waiting process via a video display screen as video information and advertisements in the waiting room. A color-coded wrist band started to be placed on the patients' wrist to further remind the patient of his CTAS level and associated waiting time. This fulfilled the JCI standards (Figure 3).

The changes that were implemented came out of analyzing the patient feedback system. Each patient feedback was placed in the bottleneck interval it was associated with. If a patient complained that there was only one receptionist, this complaint was placed in interval A so a possible solution was to increase the number of receptionists.

Results

During the time of the study, there were 44,425 observations included in the data set as extracted for the period of February 1st, 2019 to January 31st, 2020 from the hospital IT system. The regression chosen in this study was for a random effect nested data structure. This was because of the fact that each patient had a different CTAS level assigned. Around 38,157 observations were included in the analysis, after removing the CTAS 1-2, duplicate entries, and outliers. Outliers of the data were defined as anyone waiting greater than 240 minutes. Although 240 minutes was chosen as the cut-off as the

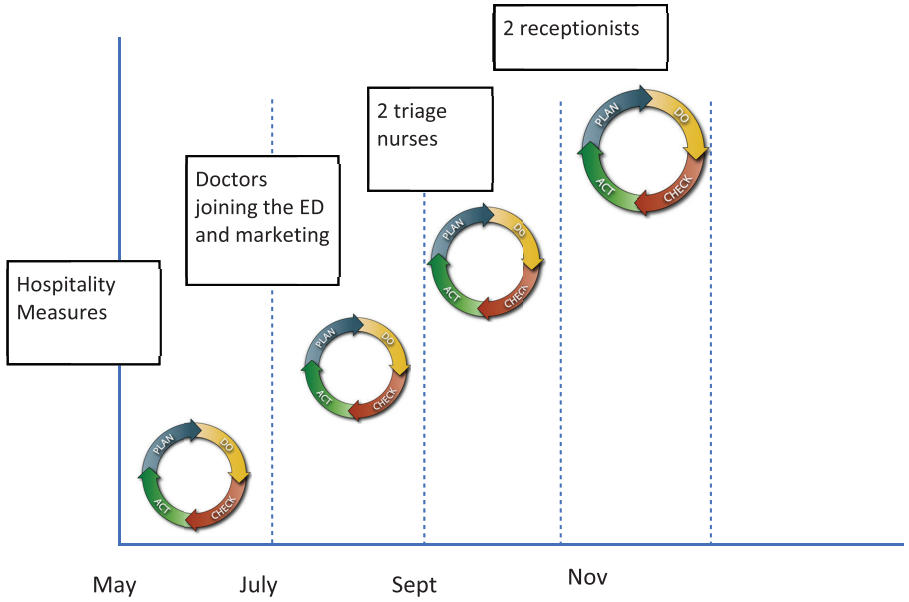

Figure 3. *A schematic diagram after the changes took place.*

lowest acuity of CTAS 5 would wait a maximum of 120 minutes, the cut-off was double this time. Some patients would come to the ED and register and would then opt to leave the hospital and come back a few hours later. The regression shows for every increase in one triage nurse there is a reduction of 15.09 minutes for CTAS 3 patients, and 20.7 minutes for CTAS 4 patients, and 20.8 minutes for CTAS 5 patients, keeping all other variables constant.

Tnurse is shown with the increase in triage nurse as 1 and prior to the intervention of adding an additional triage nurse of Tnurse 0. The interquartile range of Tnurse 0 is 15-40 minutes compared to 5-15 minutes postintervention for CTAS 3 (Figure 4A).

A similar change for CTAS4 was shown, where wait 1 had an interquartile range of 10-45 minutes prior to Tnurse intervention and 10-15 minutes postintervention (Figure 4B).

However, the box plot for CTAS 5 showed that wait 1 has an interquartile range of 10-45 minutes prior to Tnurse intervention and 10-15 minutes postintervention (Figure 4C).

Thus, all boxes were positively skewed. However, the intervention of Tnurse showed a reduction in wait 1 for CTAS 3, 4, and 5. This might not have results in the change of total time spent in the ED waiting room. A given patient might have been seen quicker by a triage nurse but ended up spending the same time in the waiting room waiting to be called to been seen by a doctor. A second regression was carried out for the total time spent in the waiting room.

The box plot was also plotted for the sumwait against Tnurse for CTAS 3, 4, and 5. Tnurse was shown with the increase in triage nurse as 1 and prior to the intervention of adding an additional triage nurse of Tnurse, 0. The interquartile range of Tnurse 0 was 15-50 minutes compared to 10-20 minutes postintervention for CTAS 3 (Figure 5A).

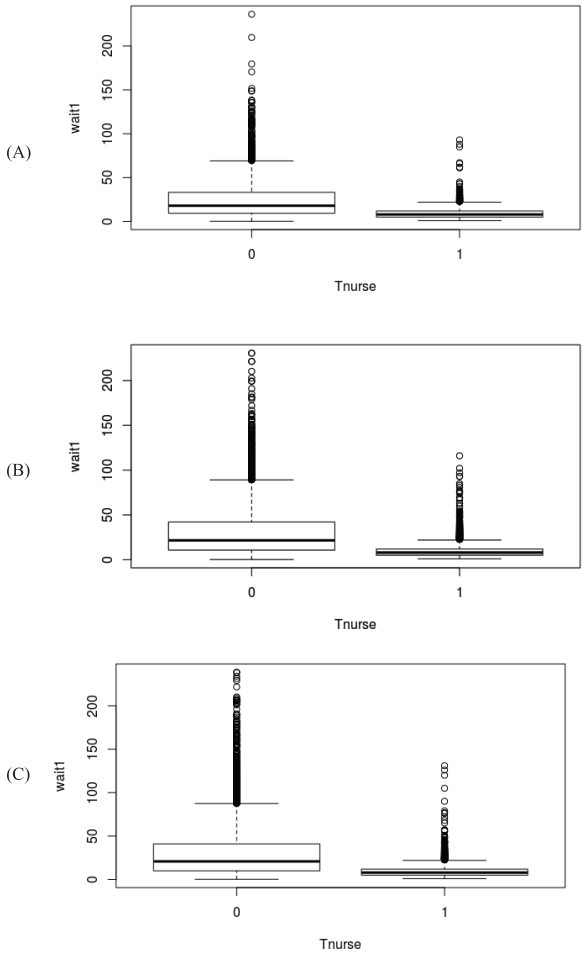

Figure 4. *(A) The wait 1 plotted against Tnurse for CTAS level 3. (B) The wait 1 plotted against Tnurse for CTAS level 4. (C) The wait 1 plotted against Tnurse for CTAS level 5.*

A similar change for CTAS4 was observed where sumwait had an interquartile range of 20-50 minutes prior to Tnurse intervention and 15-40 minutes postintervention (Figure

5B). The box plot for CTAS5 showed the sumwait has an interquartile range of 15-50 minutes prior to Tnurse intervention and 10-40 minutes postintervention (Figure 5C). All boxes were positively skewed.

For the slopes of each regression indicated for each of the CTAS 3-5, there was a decrease in the waiting time in both the total time in the ED waiting room and in time interval from registration to triage. To ensure there is no association with hospitality 2 and wait 1, and that it was solely due to Tnurse, hospitality 2 was chosen as a possible co-factor. A second regression was run which included the dummy variable hospitality 2. Bayesian information criterion were compared for both regressions which were 331.631 for the regression with hospitality and 330.406 for without hospitality, indicating that they are very close in range, and since the multicollinearity coefficient is 1.004, this means there was no relationship between Tnurse and hospitality 2 (as it is less than 4). The total waiting time in the ED waiting room was reduced postintervention of adding doctors. The total time of sumwait was chosen rather than the time interval wait 1 because the doctor consultation was the end point of sumwait (Table 1).

Furthermore, it showed that the increase in doctors was 1 prior to the intervention of adding an additional doctor which was 0. The interquartile range of doctors 0 is 15-50 minutes compared to 10-30 minutes postintervention for CTAS 3 (Figure 6A).

A similar change for CTAS 4 was observed, as sumwait has an interquartile range of 20-55 minutes prior to doctor's intervention and 10-15 minutes postintervention (Figure 6B).

The box plot for CTAS 5 show that sumwait has an interquartile range of 20-55 minutes prior to doctor's intervention and 10-15 minutes postintervention (Figure 6C). All boxes were positively skewed.

Multicollinearity was assessed for each doctor, Tnurse and hospitality 2, which resulted in 1.247129, 1.152610,

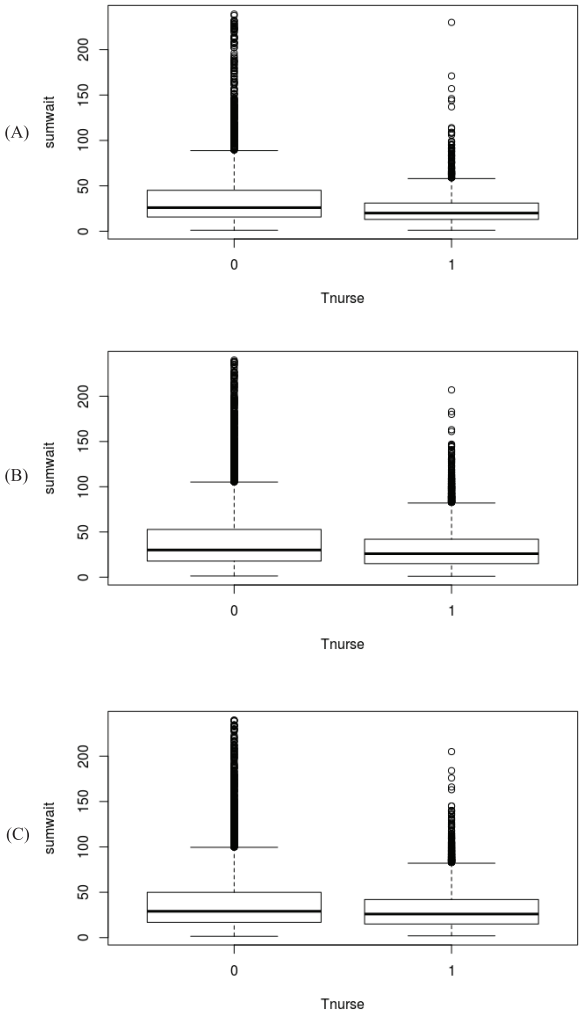

Figure 5. *(A) The sumwait plotted against Tnurse for CTAS level 3. (B) The sumwait plotted against Tnurse for CTAS level 4. (C) The sumwait plotted against Tnurse for CTAS level 5.*

Table 1. *Slopes of each regression indicating for each of the CTAS 3-5.*

CTAS level	Wait 1	Sumwait pre-intervention	Sumwait postintervention
3	−10.40954	−8.637737	−11.388029
4	−16.38682	−5.508260	−9.978836
5	−15.98048	−4.309223	−8.688576

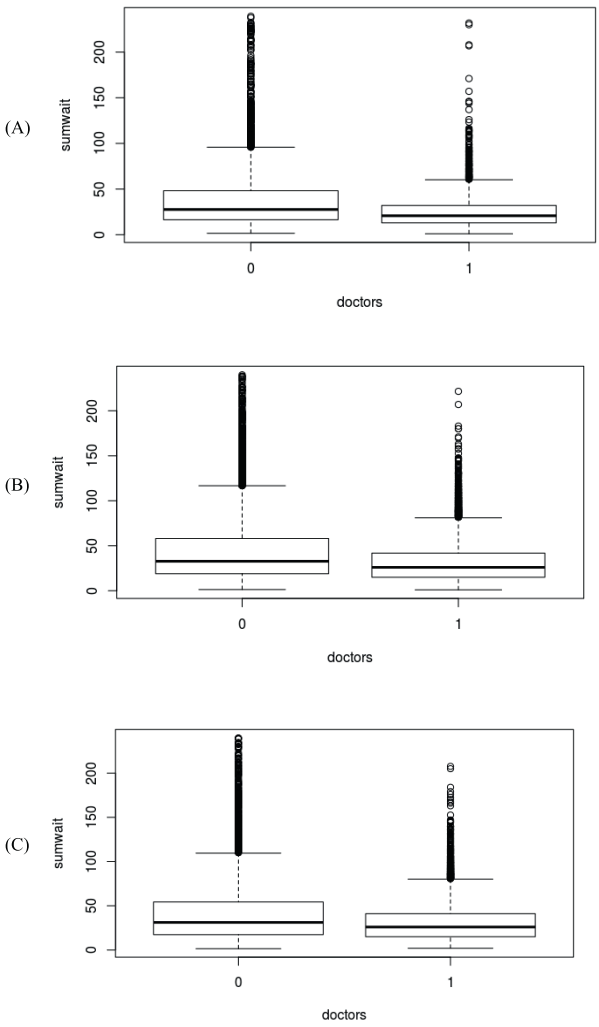

Figure 6. *(A) The sumwait plotted against doctors for CTAS level 3. (B) The sumwait plotted against doctors for CTAS level 4. (C) The sumwait plotted against doctors for CTAS level 5.*

Table 2. *The percentage of left without being seen pre- and postintervention.*

Month in 2019	Total number of patients	Left without being seen	Percentage left without being seen
April	3,730	230	6.1%
May	4,095	236	5.7%
June	3,743	270	7.2%
July	3,164	158	4.9%
August	3,177	190	5.9%
September	3,416	148	4.3%
October	4,158	242	5.8%
November	4,446	169	3.8%
December	3,680	135	3.6%
January 2020	3,248	83	2.5%

and 1.094558, respectively. This indicated that there was no relationship between the interventions. It was also shown that the percentage of LWBS cases in the ED noted a significant drop in 'LWBS' rates after implementing the recommendations of the project team mentioned earlier (Table 2).

Discussion

The data collected were assumed as the time the patient entered in the ED was identical for all patients. The first example to this is the time the registration took place. This would be the start time to the first time interval of the registration-to-triage time interval. In majority of the cases, the patient would first register, then wait a few minutes before going into the triage room. However, when the waiting room is completely empty, e.g., in the early hours in the morning 3-4 am, receptionist might take the patients' ID and directly take them to the triage to get assessed, while they register them into the system. The nurse will then triage them and direct take them to an observation bed to be assessed by the doctor and would wait for the receptionist to finish the registration, 5-10 minutes, to place the triage note. This means even though the patient waited zero time in the waiting room, the system would register the 5-10 minutes interval. This would be a small percentage of the data, as most times there would be at least one patient in the waiting room and so the patient would need to wait. Also, this was an overestimation of the time that would make the interventions not be used; patients did not utilize the coffee because they did not wait in the waiting room to have an effect.

Another assumption exists between the relationship with time interval 1: registration-to-triage time and time interval 2: triage-to-consultation time. Triage time signifies the end of interval 1 and the start of interval 2. Any delay in the triage nurse clocking the triage would make interval 1 appear longer and interval 2 appearing shorter, for example, a nurse going on a quick bathroom break.

The third assumption is that there was no overestimating or underestimating of CTAS level. This is a human interpretation rather than a computer calculation. CTAS is calculated using multiple parameters: vital signs, pain score, age, and presenting complaint. A patient might be presented to the ED and the pain score might be underestimated. A pain score of 1-4 out of 10 is a CTAS 5 and 5-7 out of 10 is a CTAS 4. Pain is a subjective feeling, the same pain stimulus on two different patients might be scored differently affecting the CTAS; one patient might give it a 4 and another might give it a 6. To try and minimize this utilization of a pain score and to place anchors for some levels could be carried out, e.g., 10 being that of childbirth.

There were no code blue or rapid response team activated for a waiting room patient from the start of the study. The limitations are that even though it appeared that increasing triage nurses did reduce the wait between registration and triage, it might not have reduced the total waiting time of the patient, the time lost in this waiting interval might have been compensated in waiting from being triaged to being seen by a doctor, which equates that the patient has waited the same totaled time in the ED waiting room. Another limitation would be to assess other interventions such as the number of doctors or receptionists did not have a relationship with that of triage nurse. When looking at the methodical limitations of the study, hospitality measures can be broken down into each independent hospitality measure of beverages and aromatherapy independently to see if each had an association with waiting times.

Conclusion

There was a direct effect on the waiting time from registration to assessment by triage nurse. This waiting time was reduced when intervention was added by increasing the number of triage nurse from 1 to 2. This was a true effect without being affected by hospitality measures and was applicable for CTAS 3, 4, and 5. Increasing triage nurses not only decreased the time interval from reception to triage but also the total time of ED waiting room, this might be due to more coordination with patients by nursing colleagues. Increasing doctors in the ED had resulted in a reduction in the total time spent in the ED waiting room for all of CTAS 3, 4, and 5.

List of Abbreviations

CTAS	Canadian triage acuity scale
ED	Emergency department
LWBS	Left without being seen
PDSA	Plan-do-study-act

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this study.

Funding

None.

Consent to participate

Not applicable.

Ethical approval

Ethical approval was granted by the Institutional Review Board via Ref No. 01/1804/QMO dated: 10th April 2018.

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References

1. Guttmann A, Schull MJ, Vermeulen MJ, Stukel TA. Association between waiting times and short term mortality and hospital admission after departure from emergency department: population based cohort study from Ontario, Canada. BMJ. 2011;342:d2983. https://doi.org/10.1136/bmj.d2983
2. Richardson DB. The access-block effect: relationship between delay to reaching an inpatient bed and inpatient length of stay. Med J Aust. 2002;177(9):492–5. https://doi.org/10.5694/j.1326-5377.2002.tb04917.x
3. Plunkett PK, Byrne DG, Breslin T, Bennett K, Silke B. Increasing wait times predict in-creasing mortality for emergency medical admissions. Eur J Emerg Med. 2011;18(4):192–6. https://doi.org/10.1097/MEJ.0b013e328344917e
4. Sun BC, Hsia RY, Weiss RE, Zingmond D, Liang LJ, Han W, et al. Effect of emergency department crowding on outcomes of admitted patients. Ann Emerg Med. 2013;61(6):605–11. https://doi.org/10.1016/j.annemergmed.2012.10.026
5. Berg LM, Ehrenberg A, Florin J, Östergren J, Discacciati A, Göransson KE. Associations between crowding and 10-day mortality among patients allocated lower triage acuity levels without need of acute hospital care on departure from the emergency department. Ann Emerg Med. 2019;74(3):345–56. https://doi.org/10.1016/j.annemergmed.2019.04.012
6. Salway RJ, Valenzuela R, Shoenberger JM, Mallon WK, Viccellio A. Emergency depart-ment (ED) overcrowding: evidence-based answers to frequently asked questions. Rev Méd Clín Las Condes. 2017;28(2):213–9. https://doi.org/10.1016/j.rmclc.2017.04.008
7. Bullard MJ, Musgrave E, Warren D, Unger B, Skeldon T, Grierson R, et al. Revisions to the Canadian emergency department triage and acuity scale (CTAS) guidelines 2016. Can J Emerg Med. 2017;19(S2):S18–27. https://doi.org/10.1017/cem.2017.365
8. Househ M, Yunus F. Emergency Department Waiting Times (EDWaT): a patient flow management and quality of care rating mHealth application. Stud Health Technol informatics. 2014;202:229–32.
9. Jayaprakash N, O'Sullivan R, Bey T, Ahmed SS, Lotfipour S. Crowding and delivery of healthcare in emergency departments: the European perspective. West J Emerg Med. 2009;10(4):233.
10. Kamali MF, Jain M, Jain AR, Schneider SM. Emergency department waiting room: many requests, many insured and many primary care physician referrals. Int J Emerg Med. 2013;6(1):1–7. https://doi.org/10.1186/1865-1380-6-35
11. Christoff P. Running PDSA cycles. Curr Probl Pediatr Adolesc Health Care. 2018;48(8):198–201. https://doi.org/10.1016/j.cppeds.2018.08.006
12. Love RA, Murphy JA, Lietz TE, Jordan KS. The effectiveness of a provider in triage in the emergency department: a quality improvement initiative to improve patient flow. Adv Emerg Nurs J. 2012;34(1):65–74. https://doi.org/10.1097/TME.0b013e3182435543