

# Improving door-to-doctor and door-to-analgesia time in a tertiary teaching hospital emergency department through a novel 'Red Box' system

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## ABSTRACT

**الأهداف:** تقييم فعالية نظام تدفق المرضى الجدد ( الصندوق الأحمر) على جودة رعاية المرضى فيما يتعلق بالوقت المستغرق للرعاية التي يتلقاها المرضى.

**الطريقة:** أجريت دراسة مبدئية لمعرفة الأوقات المستغرقة لطبيب الطوارئ ( DTD) و التسكين ( DTA) للحالات التي تظهر في قسم الطوارئ في مستشفى التعليمي الجامعي - الجامعة الوطنية للمركز الماليزي الطبي - خلال الفترة الزمنية ما بين يوليو و سبتمبر 2005م خلاف الفترة الزمنية ما بين يوليو و سبتمبر 2008م. وقد تم جمع البيانات الديموغرافية، ووقت مجيء الطوارئ، ووقت التشخيص الأولي، ووقت التسكين الأولي في كلا الفترتين وتحليلها.

**النتائج:** سجلت الدراسة مجموع 1000 حالة، حيث تتألف كل من مجموعة (أ) ومجموعة (ب) 500 حالة. متوسط الوقت الذي استغرقه طبيب الطوارئ في مجموعة (أ) ما يقارب 29 دقيقة (SD ± 3 minutes) في حين استغرق 3 دقائق في مجموعة (ب) (SD ± 1 minutes) مع انخفاض بنسبة 98.8% ( $p < 0.001$ ). بالنسبة للتسكين، متوسط الوقت الذي سجلته مجموعة (أ) 46 دقيقة (SD ± 3 minutes) في حين سجلت مجموعة (ب) 9 دقائق (SD ± 2 minutes) مع انخفاض بنسبة 80.4% ( $p < 0.001$ ).

**الخلاصة:** أسهم تطبيق نظام تدفق مرضى الجدد ( الصندوق الأحمر) على تحسين جودة رعاية المرضى للحالات الطارئة بقسم الطوارئ في مستشفى التعليمي الجامعي كما تبين من خلال الإنخفاض الكبير في الوقت المستهلك لطبيب الطوارئ والتسكين.

**Objectives:** To evaluate the effectiveness of a new patient flow system, 'The Red Box' on the quality of patient care in respect of the time taken for the care to be delivered to the patient.

**Methods:** A pre-post study was conducted looking at the door-to-doctor (DTD) and door-to-analgesia

(DTA) times for cases presenting to the Emergency Department (ED) of a tertiary teaching hospital, The National University of Malaysia Medical Center, Kuala Lumpur, Malaysia, between the periods of July and September 2005 against July and September 2008. Demographic data, ED presentation time, time seen by first doctor, and time first analgesia given were collected in both periods and analyzed.

**Results:** A total of 1,000 cases were enrolled. Group A (pre-Red Box) and group B (post-Red Box) comprised 500 cases each. The mean DTD time for group A was 29 minutes (SD ± 3 minutes) and for group B was 3 minutes (SD ± 1 minute), with a 98.8% reduction ( $p < 0.001$ ). For DTA time, group A recorded a mean of 46 minutes (SD ± 3 minutes), and group B recorded a mean of 9 minutes (SD ± 2 minutes), an 80.4% reduction ( $p < 0.001$ ).

**Conclusion:** The implementation of a red box system improved the quality of emergency patient care in the ED of a tertiary teaching hospital as evidenced by significant reductions in DTD and DTA time.

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The Emergency Department (ED) is the main access point for definitive and secondary care for patients with acute and emergency presentations. The numbers of patients attending EDs are increasing in Malaysia and worldwide.<sup>1</sup> The necessity of providing the highest quality of care, together with the increasing number of attendees inevitably leads to difficulties, and there is evidence of increasing dissatisfaction, among patients and relatives, relating to the care received in EDs.<sup>2</sup> Issues such as long waiting times,<sup>3</sup> delays in attending to patients,<sup>4</sup> poor pain management,<sup>5,6</sup> treatment errors, and poor interpersonal communication<sup>7</sup> are the leading complaints. The 2 major areas of concern are delays in attending to patients, and pain management. Linked with these aspects is the concept of Quality of Care (QOC). Quality of care has differing definitions,<sup>8</sup> but commonly includes the combination of the technical, interpersonal, and organizational aspects in patient management.<sup>9</sup> Within the practice of emergency medicine, QOC extends through the whole of the ED care including triage, resuscitation/stabilization, investigation, treatment, and disposition phases. Long waiting times to see an ED doctor and leaving without being seen (LWBS) are a major source of patient complaints. A study from Ontario<sup>10</sup> showed that patients with longer Emergency Room waiting times, and who were subsequently discharged home had a higher mortality. Numerous strategies to address this problem have been suggested including 2 levels of triage (primary and secondary), fast tracking of patients, assigning a doctor in the triage area, and team triaging.<sup>4,11</sup> Adequacy of pain management may be a good indicator of patient care since it is the primary symptom in the majority of ED attendees.<sup>12</sup> Delay in receiving analgesia or inadequate provision of analgesia (oligoanalgesia) are frequently mentioned when discussing poor care quality.<sup>12</sup> Patient care satisfaction increases when early attention is given to pain relief, and in one study 84% of patients were satisfied when they received pain relief at triage.<sup>13</sup> Our institution also experiences similar issues in patient care, especially long waiting times and delays in receiving analgesia. A recent local study highlighted the issue of inadequacy of analgesia received by emergency patients.<sup>14</sup> This study

is focused on the quality of patients' care by assessing the time lapse for initiation of care, and the rapidity of pain relief administration through the introduction of an innovative system - the RED BOX system, which was implemented in our institution.

**Methods.** A pre-post study of a new system was conducted among emergency patients who attended the Emergency Department of Universiti Kebangsaan Malaysia Medical Centre (ED UKMMC), Kuala Lumpur, Malaysia. The pre-group cases (group A) were collected between July and September 2005, and the post-group (group B) cases were collected between July and September 2008; group matching was carried out on the same variables (time and day of presentation). The RED BOX system was introduced in mid-2006. Therefore, time for familiarization and adjustment to implement the system was allowed before the study was performed. The control arm was designated as group A, the study arm as group B. This study was approved by the research and ethical committee of UKMMC. The principles of the Helsinki Declaration were strictly adhered to.

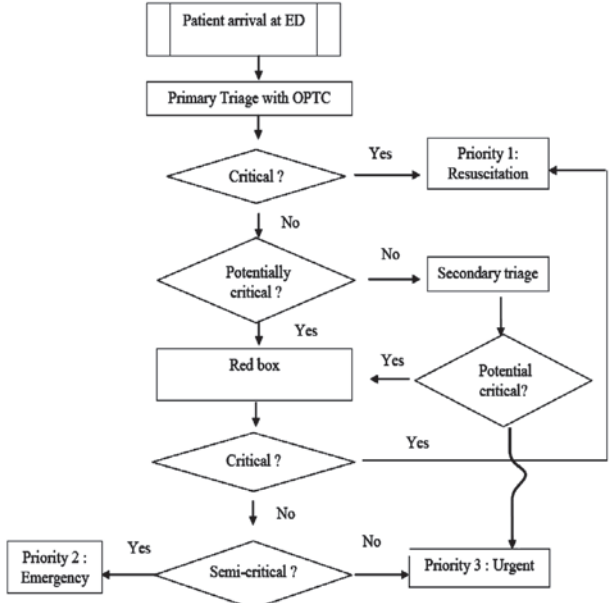
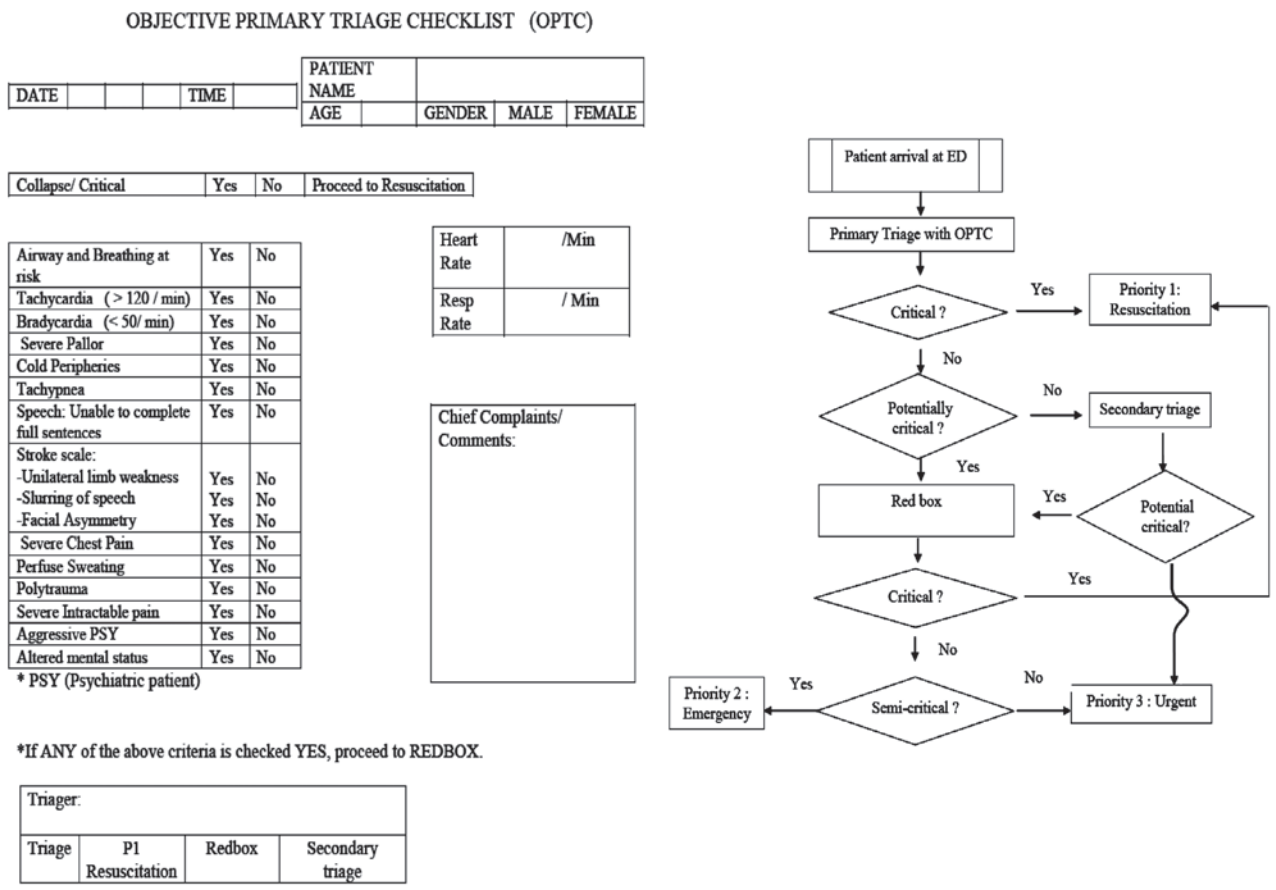
All emergency patients aged 18 years old and above who were fully conscious (Glasgow coma scale 15/15), requiring pain relief, and attending the ED during the study period were included. Patients who required immediate resuscitation and those with non-emergency visits, psychiatric consultation, or who had received analgesia prior to the ED attendance were excluded. Data for the control patients were collected from ED medical records and triage cards, which included patient demography; time of arrival, time seen by first doctor, time of first administration of analgesia, and time of ED disposition. These values were used to determine the door-to-doctor (DTD), and door-to-analgesia (DTA) times. The DTD time refers to time taken from arrival at ED UKMMC until seen by the first ED doctor. The DTA time refers to time of patient's arrival at the ED until the time analgesia was first administered.

All data collected was tabulated, and statistical analysis was carried out using the Statistical Package for Social Sciences version 21 (IBM Corp., Armonk, NY, USA). Descriptive analysis was conducted on the data to obtain frequency and percentage. The comparison of the mean of the variables was statistically analyzed using a t-test. Bias was kept to a minimal since no new form or procedures were introduced during data collection, and the system had been in place and operational for more than a year, therefore avoiding a Hawthorne effect.

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**The Red Box System.** The Red Box system is a flow management system applied to every emergency patient in the ED of UKMMC. All patients are screened at the Primary Triage area using the Objective Primary Triage Checklist (OPTC) (Figure 1). This checklist consists of 14 "red flag" signs and symptoms developed following our unpublished local study. The OPTC was first implemented in our ED in August 2003 to reduce missed or under triage of emergency patients by junior or inexperienced triage officers. In the ED of UKMMC, the triage officers are mainly Assistant Medical Officers-Physician Assistants and staff nurses. More than 2,000 cases where the final triage outcome was priority one or priority 2 were collected and analyzed. The final triage outcome was used regardless of the initial triage category given. Data were collected over a period of 3 months. Finally, 14 common presenting symptoms and signs were identified and used as the basis of the OPTC. All data are recorded in a single page format for ease of carrying out management orders by nursing and paramedical staff (Figure 1). Subsequently the OPTC

has been used by all triage officers. When patients arrive, they are first assessed using the OPTC. The presence of any of the clinical features listed in the OPTC designates the patient as a 'potentially critical' case, and they are immediately sent to a specifically designated zone - the 'RED BOX'. Patients who have none of the features listed in the OPTC are sent to the secondary triage area (Figure 1). Prior to this system being implemented, patients who had 'potentially critical' features were placed in one of the treatment cubicles either in the priority one or priority 2 areas for a doctor to assess and treat. The Red Box zone is continuously manned by the most senior doctor (Red Box Officer, RBO) on the ED floor, usually a medical officer of more than 3 years experience. Here, the RBO initiates the '3Fs approach'; a focused-history, focused-assessment, and focused-treatment. Focused-history relates to the specific history of the presenting problem. In focused-assessment the evaluation is geared toward the primary complaint with a focused physical examination, and the use of adjuncts or bedside investigations; for example, 12-lead ECG,



**Figure 1** - The objective primary triage checklist (OPTC) (left) and Red Box system flow-chart (right). ED - emergency department

focus assessment with sonography in trauma (FAST) or extended FAST, blood glucose checks, and so forth. The focused treatment refers to initiation of a care plan to alleviate the presenting symptoms/signs, for example, oxygenation, intravenous access, and analgesia.

Other investigations that can be requested in the Red Box zone include laboratory blood investigations and imaging including plain radiology and brain CT scan, for example, for stroke patients. To prevent over congestion of the area, and expedite patient care; the maximum time spent in the Red Box zone should not exceed 5 minutes. If the attending doctor exceeds the time he/she will be reminded by the shift-team leader who is the emergency physician in-charge of the floor, to move the patient to an appropriate area of the ED, or a second doctor will be called to assist. The patient's care is then designated to an allocated treatment zone: priority one (resuscitation), priority 2 (emergency), or priority 3 (urgent) according to the perceived clinical priority for more detailed clinical assessment, investigation, and treatment.

Between the 2 study periods, there were no changes in the number or seniority of staff working in the ED during a shift; however, in the study period, the most senior doctor was assigned as the RBO.

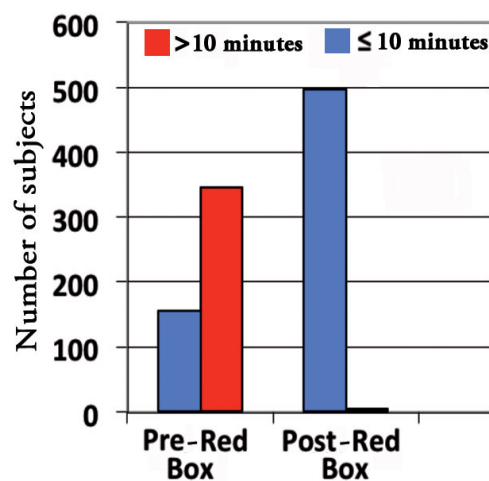
**Results.** Out of 1,000 cases that attended the ED and fulfilled the criteria during this study period, 500 cases were included in group A, and 500 in group B. There were no significant differences in terms of gender and type of cases. The demographic features of both groups are shown in Table 1. In the control group the time for a patient presenting to the ED to be first seen by a doctor (DTD time) ranged from 0-241 minutes, mean  $29 \pm 3$  minutes. For the post-Red Box (Group B) patients, the DTD time range was 0-17 minutes, mean  $3 \pm 1$  minutes. Figure 2 shows the effect of the Red Box system on the time taken to achieve assessment. In the pre-Red Box period 345 patients waited more than 10 minutes for assessment; after implementation this dropped to 4 cases, a reduction of 98.8% ( $p < 0.001$ ). In group A the DTA time, range from 2-271 minutes, mean  $46 \pm 3$  minutes. In Group B, the range was 1-25 minutes, mean  $9 \pm 2$  minutes, a reduction of 80.4% ( $p < 0.001$ ). Those who received analgesia in less than 10 minutes was 34 cases in group A and 438 cases in group B (Figure 3).

**Discussion.** Timely care in particular the DTD time, is a hallmark issue for every ED, and strongly correlates with patient satisfaction.<sup>15</sup> Having patients moved in a timely fashion (usually <30 minutes) to the

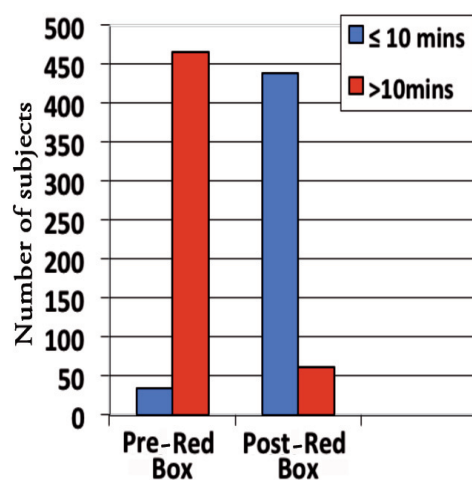
**Table 1** - Demographic distribution of patients (n=1000) presenting to the emergency department of tertiary teaching hospital.

Variable	Group A (n=500) (Pre-Red Box)	Group B (n=500) (Post-Red Box)	*P-value
<i>Gender, n (%)</i>			
Male	275 (55)	274 (54.8)	0.95
Female	225 (45)	226 (45.2)	
Age (mean $\pm$ SD) years	41.62 ( $\pm$ 11.69)	44.20 ( $\pm$ 16.11)	0.004
<i>Type of case, n (%)</i>			
Trauma	205 (41)	226 (45.2)	0.18
Non-trauma	295 (59)	274 (54.8)	

\* Independent t-test for continuous data, chi-square test for categorical data.



**Figure 2** - Showing pre and post-Red Box effect on the time taken to achieve assessment for door-to-doctor (n=500) in the emergency department.



**Figure 3** - Showing pre and post-Red Box effect on the time taken to achieve assessment for door-to-analgesia (n=500) in the emergency department.

appropriate care area for doctor's evaluation, is the usual norm followed for any patient.<sup>16</sup> As the time interval from ED DTD evaluation increases, the rate at which patients LWBS increases linearly.<sup>17</sup> The DTD also relates to patient dissatisfaction and potentially increases mortality or morbidity. To compound this situation, dissatisfied patients tend not to comply with treatment regimes,<sup>18</sup> leading to further reduction in quality of care. Our study showed that a simple Red Box system produced an almost 10-fold reduction in the time taken for a patient to see the doctor. Prior to implementation the DTD time range was very wide, from one to 241 minutes. Several factors contributed to this, mainly our system of patient flow. In the pre-Red Box era, once the patient had undergone triage and if labeled as emergency, the patient would be placed in the emergency zone. Subsequently, the patients would be attended by a doctor who would clerk and treat them. When there were no or few patients, a new patient could be seen immediately by the attending doctor. However, during busy periods and when fewer staff were available, waiting times were remarkably increased. Patients triaged to the emergency zone were sometimes overlooked leading to delays in assessment and treatment. Admission to this zone led to a false sense of assurance among medical and nursing staff, and relatives that the patient had been attended to.

Pain relief is one of the important aspects in the management of emergency patients.<sup>19</sup> Several factors have been noted to contribute to delays in receiving analgesia, which includes patients age, triage code, seniority of treating doctor, patients diagnosis, and ED disposition.<sup>20</sup> Our Red Box system addresses the issue of inadequate pain assessment and treatment. We found that the mean DTA time post-Red Box implementation for patients who required analgesia was shortened by 80.4%. The prompt administration of analgesia results in higher rates of pain relief and higher patient satisfaction.<sup>6</sup> This leads to improved compliance with treatment and ultimately better outcomes.<sup>6,21</sup>

There were several limitations to this study. From the 2,070 cases available, only 1,000 were recruited due to data completeness. Incomplete information and illegible handwriting were the most common reasons. This study was conducted after the system had been implemented for more than one year. Therefore, we used historical data for the control patient group. Further studies are advised to ascertain the limitation encountered in the present study. The reductions in DTD and DTA achieved in this study may be due to its implementation in a high-volume tertiary referral center. Similar effects might not be achieved in a low-volume ED where waiting times are not an issue.

In conclusion, the implementation of a novel Red Box system has significantly reduced the DTD and DTA times for emergency cases presenting to an ED in a tertiary teaching hospital. This system has the potential to contribute to an overall improvement in quality of ED patient care.

## References

1. Ministry of Health Malaysia. Annual Report 2012. [Accessed 2013 April 11]. Available from: [http://vlib.moh.gov.my/cms/content.jsp?id=com.tms.cms.section.Section\\_cc7aebb6-c0a81049-18ac8000-11671d74](http://vlib.moh.gov.my/cms/content.jsp?id=com.tms.cms.section.Section_cc7aebb6-c0a81049-18ac8000-11671d74)
2. Press Ganey Associates. Emergency Department Pulse Report 2010. The Status of emergency Department Satisfaction - Five-Year Trend in ED Patient Satisfaction. [Accessed 2013 April 12]. Available from: <http://www.acep.org/uploadedFiles/ACEP/newsroom/NewsMediaResources/StatisticsData/2010%20ED%20Pulse%20Report%20wait%20times.pdf>
3. Welch S, Dalto J. Improving Door-to-Physician times in 2 community hospital emergency departments. *Am J Med Qual* 2011; 26: 138-144.
4. Subash F, Dunn F, McNicholl B, Marlow J. Team triage improves emergency department efficiency. *Emerg Med J* 2004; 21: 542-544.
5. Scheeres H, Slade D, Manidis M, McGregor J, Matthiessen C. Communicating in hospital emergency departments. *Prospect* 2008; 23: 13-22.
6. Kelly AM. A process approach to improving pain management in the emergency department: development and evaluation. *J Accid Emerg Med* 2000; 17: 185-187.
7. Trzeciak S, Rivers EP. Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. *Emerg Med J* 2003; 20: 402-405.
8. Muntlin A. Identifying and Improving Quality of Care at an Emergency Department: Patient and Healthcare Professional Perspectives. *Acta Universitatis Upsaliensis Uppsala* 2009; 499: 1-78.
9. Murante AM. Patient Satisfaction: A Strategic Tool for Health Services Management. *Scuola Superiore Sant' Anna* 2010. [Accessed 2013 April 22]. Available from: [http://www.phdmanagement.ssup.it/documenti/awarded/murante\\_thesis.pdf](http://www.phdmanagement.ssup.it/documenti/awarded/murante_thesis.pdf)
10. Erin A. When Doctors Make Bad Calls. The Globe and Mail [Internet]. 2012 September 6 [Accessed 2013 April 22]. Available from: <http://www.theglobeandmail.com/life/health-and-fitness/when-doctors-make-bad-calls/article549084/?page=all>
11. Travers JP, Lee FC. Avoiding prolonged waiting time during busy periods in the emergency department: Is there a role for the senior emergency physician in triage? *Eur J Emerg Med* 2006; 13: 324-328
12. Decosterd I, Hugli O, Tamchès E, Blanc C, Mouhsine E, Givel JC, et al. Oligoanalgesia in the emergency department: short-term beneficial effects of an education program on acute pain. *Ann Emerg Med* 2007; 50: 462-471.
13. Tanabe P, Thomas R, Paice J, Spiller M, Marcantonio R. The effect of standard care, ibuprofen, and music on pain relief and patient satisfaction in adults with musculoskeletal trauma. *J Emerg Nurs* 2001; 27: 124-131.

14. Fathil SM, Soong NS, Mustafa NM, Arith A, Ng WN, Bahrum NA, et al. Audit of pain management in the emergency department. *Med J Malaysia* 2011; 66: 89-91.
15. Welch SJ. Door-to-Doctor Times: All Patients Really Want is a Physician. *Emergency Medicine News* 2006; 28: 10. [Accessed 2013 April 27]. Available from: <http://journals.lww.com/em-news/toc/2006/11000#-735870476>
16. Miró O, Sánchez M, Espinosa G, Coll-Vinent B, Bragulat E, Millá J. Analysis of patients flow in the emergency department and the effect of an extensive reorganisation. *Emerg Med J* 2003; 20: 143-148.
17. Clarey AJ, Cooke MV. Patients who leave emergency departments without being seen: literature review and English data analysis. *Emerg Med J* 2012; 29: 617-621.
18. Saiboon I, Eng HS, Krishnan B, Ali SN, Murad N, Pathnathan A, et al. A Study of Patient's Satisfaction with the Emergency Department (ED) of Hospital Universiti Kebangsaan Malaysia. *Medicine & Health* 2008; 3: 7-13.
19. Choi YF, Wong TW, Lau CC. Triage rapid initial assessment by doctor (TRIAD) improves waiting time and processing time of the emergency department. *Emerg Med J* 2006; 23: 262-265.
20. Arendts G, Fry M. Factors associated with delay to opiate analgesia in emergency departments. *J Pain* 2006; 7: 682-686.
21. Tcherny-Lessenot S, Karwowski-Soulié F, Lamarche-Vadel A, Ginsburg C, Brunet F, Vidal-Trecan G. Management and relief of pain in an emergency department from the adult patients' perspective. *J Pain Symptom Manage* 2003; 25: 539-546.

#### Related Articles

Tu J, Cai W, Zhang M, Yang X, Chen H, Zhou S, et al. Effect of the China-America Union Pre-Hospital Emergency Care Training Program on the emergency knowledge and skills of Chinese paramedics. *Saudi Med J* 2013; 34: 177-180.

Eroglu SE, Toprak SN, Urgan O, Onur OE, Denizbasi A, Akoglu H, et al. Evaluation of non-urgent visits to a busy urban emergency department. *Saudi Med J* 2012; 33: 967-972.

Rehmani RS. Pain practices in a Saudi emergency department. *Saudi Med J* 2010; 31: 539-544.