

# Impact of triage in accident and emergency departments in Bahrain

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تأثير الفرز في أقسام الحوادث والطوارئ في البحرين  
بهاء الدين عبد الحميد فتحة وعبد العزيز يوسف حمزة

**الخلاصة:** استهدفنا تقييم تأثير الفرز الذي يقوم به الأطباء على عبء العمل وعلى التكاليف في قسم الحوادث والطوارئ بمجمع السلمانية الطبي بالبحرين. وقد قمنا بتحليل ثلاث مجموعات من المعطيات هي: تردد المرضى على قسم الحوادث والطوارئ في فترة مقدارها 9 أشهر؛ وترددهم عليه قبل سنة؛ وعدد الزيارات المتوقعة على مدى 9 أشهر ابتداء من تموز/يوليو 1999. وقد انخفض عدد حالات إحالة المرضى إلى غرف قسم الحوادث والطوارئ بنسبة 54.4% بعد تنفيذ الفرز، كما كان انخفاض عبء العمل انخفاضاً يُعتدّ به إحصائياً. إذ يقدر الانخفاض في الإنفاق على الرعاية الصحية بما يتراوح بين 15.3% و 17.3%. ونخلص من ذلك إلى أن قيام الأطباء بالفرز يمكن أن يكون عالي المردود، كما يمكن أن يخفف من عبء العمل الملحق على عاتق قسم الحوادث والطوارئ، على نحو يتيح المزيد من الوقت للتدبير العلاجي للحالات العاجلة التي تهدد أرواح المرضى.

**ABSTRACT** We aimed to assess the impact of triage by physicians on the workload and expenditure of the Accident and Emergency (AE) Department of Salmaniya Medical Complex, Bahrain. We analysed three sets of data: patient visits to the AE Department over a 9-month period; patient visits 1 year previously; and forecast patient visits over 9 months starting from July 1999. The referral of patients to AE cubicles was reduced by 54.4% after the implementation of the triage, and reduction in the workload was statistically significant. The reduction in health care expenditure was estimated at between 15.3% and 17.3%. We conclude that triage by physicians can be cost-effective and can reduce the AE Department workload, freeing more time to manage life-threatening and urgent cases.

## L'impact du triage des blessés dans les services des urgences à Bahreïn

**RESUME** Notre objectif était d'évaluer l'impact du triage par les médecins sur la charge de travail et les dépenses du service des urgences du Complexe médical Salmaniya (Bahreïn). Nous avons analysé trois ensembles de données : les consultations de patients au service des urgences sur une période de 9 mois ; les consultations de patients un an auparavant et les prévisions de consultations de patients sur 9 mois à partir de juillet 1999. L'orientation des patients vers les box des urgences a été réduit de 54,4 % après l'application du triage, et la réduction de la charge de travail était significative sur le plan statistique. La réduction des dépenses de soins de santé était estimée entre 15,3 % et 17,3 %. Nous concluons que le triage des blessés par le médecin peut être rentable et peut réduire la charge de travail du service des urgences, libérant davantage de temps pour la prise en charge des cas urgents et parfois mortels.

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## Introduction

The health care system in Bahrain is based on an extensive network of primary health care (PHC) centres covering all populated areas. These centres are linked to secondary and tertiary care facilities through a referral system, which allows PHC physicians to refer patients for second opinion, hospitalization, and/or sophisticated diagnostic tests. The Salmaniya Medical Complex (SMC) is a 1000-bed acute general hospital, and is the main government hospital in Bahrain. Data from SMC indicate that nearly 45% of all referrals from PHC between 1995 and 1999 were sent to the Accident and Emergency (AE) Department [1].

Overcrowding at AE departments is a problem in many countries [2-4]. The SMC AE Department has been experiencing heavy and increasing demand. The registered annual patient visits to the AE Department increased from 160 000 in 1995 to 208 861 in 1999 [1,5-7]. The average cost of a patient visit to the AE at SMC is approximately 23 Bahraini dinars (BD) (US\$ 1 = 0.377 BD) [1]. This cost represents the recurrent expenditure only, and does not include depreciation of the building or equipment. By contrast, the average cost of a PHC visit is BD 2.7 [1].

The increasing demand on the AE Department was threatening to undermine the services provided by the department to patients who genuinely require emergency care. Previous studies at the Ministry of Health indicated that nearly 55% of patients attending the AE Department were non-urgent cases and did not require specialized emergency care. Furthermore, over 80% of patients attending the AE Department were walk-ins without referral [8]. This situation created undue pressure on the department, and more physicians were as-

signed from other SMC locations to provide care to the increasing number of AE patients. In July 1999, the AE Department started a new programme of triage by medical staff, in which physicians initially examined patients attending the AE Department. A special protocol was used to assess patients' clinical status. Cases that did not require emergency or urgent intervention were sent back home or referred to a PHC. Only emergency cases were allowed to proceed to AE cubicles (AEC).

We describe the impact of triage by physicians on the workload of the AE Department and the estimated effect on expenditure during the first 9 months of implementing the programme.

## Methods

In order to address the main objectives of the study, we required three sets of data:

- All patient visits to the AE Department from the start of triage in July 1999 to March 2000;
- Patient visits to the AE Department over a 9-month period from July 1998 to March 1999, i.e. a period exactly 1 year prior to the implementation of the triage system;
- Forecasted data of hypothetical patient visits, should the system continue to operate without the triage programme.

We used the two-tailed *t*-test to identify the statistical significance of the differences between the observed patient visits to AEC after the implementation of the triage system, with the observed visits 1 year earlier and with the forecasted data. We also used the cost of patient visits to the AE Department as the basis to calculate the impact of triage on the expenditure of the department. Since detailed costing was not

available at SMC, we assumed that the cost of a visit to the AE Department was composed of 70% fixed cost and 30% variable cost. Statistical analyses were performed using a MINITAB statistical package, version 12.

## Results

Table 1 shows the registered average daily patient visits to the AE Department from January 1998 to March 2000, and the average number of patients seen in AEC over the same period. There was an apparent decrease in the number of patient visits from an average of 680 patients per day in June 1999 to 509 patients in March 2000.

Table 2 illustrates the impact of the triage programme on the workload, and its effect on expenditure of the AE Department. It shows the average number of cases referred to AEC after the implementation of the triage, the average daily number of patient visits one year prior to the start of triage, and the average forecast number of daily patient visits should the AE Department continue to operate without the triage. The forecast set of data was generated by linear trend time series analysis using a Holt-Winters model, in order to cope with the seasonal variation in attendance. The default smoothing constants were applied: alpha (level) 0.2, gamma (trend) 0.2, and delta (season) 0.2. The multiplicative Holt-Winters model produced a better fit than the additive one. The graph of the model is shown in Figure 1.

A two-tailed *t*-test revealed that the difference between the average number of daily patient visits to the AE Department before and after implementation of the triage programme was statistically significant ( $P = 0.0007$ ). There was an overall reduction of 54.4% in the average number of patients seen daily in AEC during the study

**Table 1 Registered average daily patient visits to the Accident and Emergency (AE) Department, and cases referred to AE cubicles, Salmaniya Medical Complex, January 1998 to March 2000**

Month and year	Average visits per day	Average cases seen at AE cubicles per day
January 1998	614	614
February 1998	677	677
March 1998	735	735
April 1998	648	648
May 1998	661	661
June 1998	635	635
July 1998	621	621
August 1998	619	619
September 1998	626	626
October 1998	652	652
November 1998	676	676
December 1998	705	705
January 1999	727	727
February 1999	683	683
March 1999	789	789
April 1999	774	774
May 1999	740	740
June 1999	680	680
July 1999	530	248
August 1999	543	282
September 1999	578	360
October 1999	604	415
November 1999	663	432
December 1999	616	405
January 2000	567	236
February 2000	502	177
March 2000	509	225

period. The difference between the average number of patients seen daily in AEC before and after the implementation of the triage

**Table 2 Estimated impact of the triage-by-physician system on patient load and expenditure at the Accident and Emergency Department, Salmaniya Medical Complex, August 1999 to March 2000**

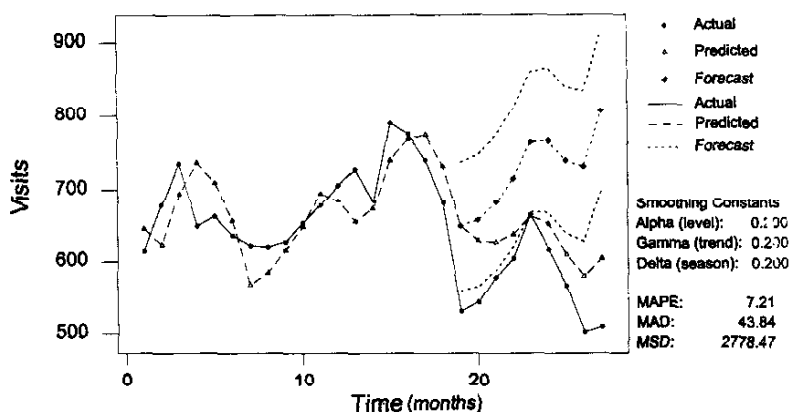
Month and year	Average referrals to AEC per day	Average visits to AEC per day, one year earlier	Holt-Winters forecasted visits to AEC per day (95% CI)	Estimated saving based on observed visits to AEC <sup>a</sup> (Bahraini dinars)	Estimated saving based on Holt-Winters model <sup>b</sup> (Bahraini dinars)
July 1999	248	621	648 (559-736)	73 557.4	79 332.7
August 1999	282	619	655 (565-746)	65 003.3	72 703.7
September 1999	360	626	680 (588-773)	46 314.0	57 492.0
October 1999	415	652	714 (619-808)	40 273.7	53 535.5
November 1999	432	676	763 (666-859)	40 010.4	58 019.4
December 1999	405	705	765 (666-864)	54 000.5	66 834.5
January 2000	236	727	738 (637-840)	99 098.9	101 451.8
February 2000	177	683	730 (626-834)	97 092.9	106 497.6
March 2000	225	789	806 (699-913)	114 989.9	118 626.2

AEC = Accident and Emergency cubicle.

US\$ 1 = 0.377 Bahraini dinars.

<sup>a</sup>Based on the following formula:  $\{(column\ 2 \times 23.0) - (column\ 1 \times 25.7)\} \times \text{days of the month} \times 0.3$ , for variable fraction of cost.

<sup>b</sup>Based on the following formula:  $\{(column\ 3 \times 23.0) - (column\ 1 \times 25.7)\} \times \text{days of the month} \times 0.3$ , for variable fraction of cost.



**Figure 1 Holt-Winters forecasting model**

was statistically significant ( $P < 0.0001$ ). There was also a statistically significant difference between the average number of patients seen at AEC and the forecast visits generated by the Holt-Winters model ( $P < 0.0001$ ).

The economic impact of the triage was based on its effect on the recurrent expenditure of the AE Department. In 1998, the total number of patient visits reached 239 000 with an estimated recurrent cost of BD 5 497 000. The estimated recurrent expenditure for a 9-month period was BD 4 122 750. The estimated saving during the 9-month study period, based on the data of actual visits before and after the triage, was BD 630 340.9, or nearly 15.3% of the total AE expenditure during a comparable 9-month period in 1998. This figure could rise to BD 714 493.4, or nearly 17.3% for the same period if we consider the difference between the observed and the forecast patient visits generated by the Holt-Winters approach.

It must be noted that we used an arbitrary figure of 30% for the variable cost of a visit to AEC. The expenditure based on the actual fixed and variable costs per visit should yield more accurate results. Unfortunately, as mentioned earlier, these unit cost details were not available at SMC during the study period.

## Discussion

Ministry of Health officials in Bahrain have addressed the problem of increasing loads on the AE Department as a systems problem rather than an internal departmental issue. The Ministry of Health decided in 1995 to extend the working hours of some key PHC centres beyond the regular 07:00 hours to 14:15 hours work schedule in order to shift some of the load from the AE Department to the PHC centres. By 1997 at

least one major health centre in each city in Bahrain was operating until midnight. However, the workload at the AE Department changed only marginally, and the number of patient visits continued to increase. As a consequence, a programme of triage by medical staff was considered a potential solution.

A previous system of triage of patients had been implemented at the SMC AE Department, in 1994. It was run by qualified nursing staff who were sent to Ireland for a 2-year training. The system did not succeed, for cultural reasons. People in Bahrain are accustomed to being seen and examined by medical doctors, and the patients and their families did not accept the idea of triage by nurses. Moreover, Bahrain's legislature concerning nursing practitioners does not allow nurses to diagnose, prescribe or refer patients to other health care facilities without strict supervision by physicians [9]. Physicians at SMC were sceptical of triage by nurses, as some studies have indicated that such triage is significantly less predictive of the final diagnosis than assessment by physicians [10].

We found that triage by medical staff led to a significant reduction in the total number of patients attending the AE Department at SMC. Data from the AE register indicated that the number of patients attending the AE Department fell by an average of 19.3% from August 1999 to March 2000, compared to the 9-month figures one year earlier. Moreover, only 45.6% of the patients attending the AE Department were seen at the cubicles, while the triage physician sent the remaining 54.4% of patients home or to the nearest PHC centre. The referral to AEC was much higher in our study than in the study of Kempe et al., who found that after second level physician triage the overall urgent referral rate was 11% [11]. On the other

hand, Derlet et al. found that only 18% of visits to the emergency department were defined as non-urgent and were referred elsewhere [12].

The apparent reduction in the average number of all patients attending the AE Department was attributed to the mass-media campaign associated with the introduction of the triage-by-physician programme. Patients were advised that all non-emergency cases would be examined by qualified medical staff, but would most probably be referred to the nearest PHC centre for management, or simply discharged home from the triage clinic. This would free the AEC to deal with emergency cases only.

The economic impact was calculated using the recurrent expenditure of the AE Department for 1998. In that year, the total number of patient visits reached 239 000 with an estimated recurrent cost of BD 5 497 000. The estimated recurrent expenditure for a 9-month period was BD 4 122 750. The estimated saving during the 9-month study period ranged from BD 630 340.9, or nearly 15.3% of the total AE Department expenditure during the comparable period in 1998, based on the differ-

ence between the study period and 1 year earlier, to BD 711 793.3, or nearly 17.3% of the total expenditure of the AE Department, based on the difference between the observed and the forecast patient visits. Our findings that the triage programme had a positive economic impact concur with the results of other studies. Baker and Baker found that in the United States, the annual excess cost of providing non-emergency care in the emergency departments was between 5 and 7 seven billion dollars in 1993 [13]. Similarly, Fleming and Jones found that care at emergency departments was significantly more expensive for the treatment of similar non-urgent conditions [14].

In conclusion, triage of AE patients by physicians was found to be a cost-effective method of improving the use of services at SMC, Bahrain. The reduction in the total number of cases attending the AE Department and in the number of non-emergency patients seen in the AEC means that more time was available for genuine emergency patients. It is vital, however, that the population is aware of the programme in order to realize and maintain its full objectives.

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### Primary health care support and support to secondary and tertiary care

In collaboration with WHO headquarters, and as part of the global study to review hospital performance, a study was conducted in Cyprus, Egypt, Lebanon, Morocco and Syrian Arab Republic. The study covered the policies of ministries of health in respect to hospitals, hospital economics, organization and delivery of care.

*Source:* The work of the WHO in the Eastern Mediterranean Region. Annual Report of the Regional Director. 1 January–31 December 2001. *Page 36*.