



# Effect of emergency department fast track on emergency department length of stay: a case–control study

J Considine,<sup>1</sup> M Kropman,<sup>2</sup> E Kelly,<sup>2</sup> C Winter<sup>2</sup>

<sup>1</sup> Deakin University, Northern Health Clinical Partnership, Victoria, Australia; <sup>2</sup> Emergency Department, the Northern Hospital, Northern Health, Victoria, Australia

Correspondence to: Dr J Considine, Deakin University, Northern Health Clinical Partnership, Burwood, Victoria 3125, Australia; julie.considine@deakin.edu.au

Accepted 2 May 2008

## ABSTRACT

**Objective:** To examine the effect of fast track on emergency department (ED) length of stay (LOS).

**Design and setting:** Pair-matched case–control design in a public teaching hospital in metropolitan Melbourne, Australia.

**Participants:** Patients treated by the ED fast track (cases) between 1 January and 31 March 2007 were compared with patients treated by the usual ED processes (controls) from 1 July to 15 November 2006 (n = 822 matched pairs).

**Intervention:** ED fast track was established in November 2006 and focused on the management of patients with non-urgent complaints.

**Main outcome measures:** The primary outcome measure was ED LOS for fast-track patients. Secondary outcomes were waiting times and ED LOS for other ED patients.

**Results:** Median ED LOS for non-admitted patients was 132 minutes (interquartile range (IQR) 83–205.25) for controls and 116 minutes (IQR 75.5–159.0) for cases (p<0.01). Fast-track patients had a significantly higher incidence of discharge within 2 h (53% vs 44%, p<0.01) and 4 h (92% vs 84%, p<0.01).

**Conclusions:** ED fast track decreased ED LOS for non-admitted patients without compromising waiting times and ED LOS for other ED patients.

Emergency department (ED) fast-track systems “stream” patients with non-urgent complaints to treatment in a dedicated area and aim to decrease waiting times and ED length of stay (LOS), reduce ED overcrowding and increase patient and staff satisfaction.<sup>1–5</sup> Fast-track systems are designed to improve ED capacity during peak demand from seasonal or diurnal variation in presentations.<sup>6</sup> Fast-track systems are usually staffed by senior medical and nursing personnel underpinned by the notion that senior staff can make timely discharge decisions and that limiting staff running fast track will expedite care by decreasing handovers and fragmentation of care.<sup>5</sup>

Australian ED have used fast-track systems to manage emergency demand since the early 2000s. A 2004 study of 17 Melbourne public hospitals showed that 58.8% of ED had a fast-track system in place.<sup>3</sup> Detailed analysis of four fast-track models by the Victorian auditor general showed that whereas each fast-track model had similar aims, there was variability as each model was designed to meet local needs.<sup>1</sup> All of the fast-track models reviewed were designed to manage single system, non-urgent, uncomplicated complaints

and all had dedicated nursing staff; however, there was variability in time of operation, availability of a dedicated area and whether there was dedicated or shared medical staff.<sup>1</sup>

There is a number of benefits associated with ED fast track including reductions in waiting times,<sup>6,7</sup> decreased ED LOS,<sup>4, 8–14</sup> financial savings,<sup>10</sup> increased patient satisfaction<sup>8</sup> and decreased left-without-being-seen rates.<sup>7, 14</sup> Despite the rapid growth of ED fast-track systems in Australia, their impact is poorly understood. Most published evaluations of ED fast track are limited to single-site studies using uncontrolled descriptive designs<sup>2</sup> and there is a lack of controlled studies related to ED fast-track outcomes. The aim of this study was to evaluate the effect of ED fast track on ED patient flow using a pair-matched case–control design. The primary outcome measure was ED LOS of fast-track patients. Secondary outcome measures were waiting times and ED LOS of other ED (non-fast-track) patients.

## METHODS

### Study design

A pair-matched case–control design was used. Approval was obtained from the Human Research and Ethics Committee before undertaking this study. ED waiting time was defined as the difference between arrival time and time of initial medical or nurse practitioner assessment and ED LOS was defined as the difference between arrival time and departure time.<sup>15</sup>

### Setting

The Northern Hospital is a 262-bed metropolitan teaching hospital in Melbourne, Australia. The ED at the Northern Hospital has 39 treatment areas and provides care for over 70 000 patients annually. Approximately one quarter of presentations is children and the admission rate is approximately 25% including short-stay unit and medical assessment and planning unit admissions. Australasian triage scale (ATS) categories 4 and 5 patients make up a considerable proportion of the total patient census (fig 1).

### Participants

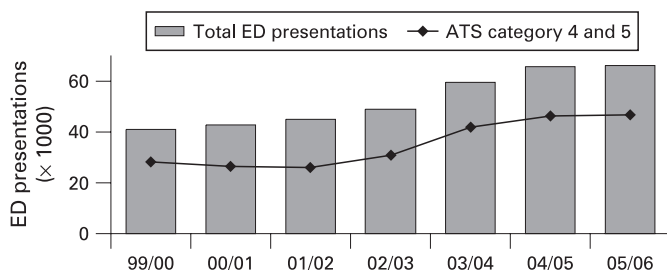
Data were sourced from the ED information system. Cases were all patients triaged to fast track between 10:00 and 02:00 hours from 1 January to 31 March 2007 (n = 1296). Controls were selected from patients who presented to the ED between 10:00 and 02:00 hours from 1 July to 15 November 2006 (before the implementation of

fast track). Each case was matched to one control according to age within 3 years, gender, triage category and ED discharge diagnosis. Of the 1296 eligible cases, 822 cases (63%) were successfully matched using these criteria: the remaining cases were unable to be matched. These time periods were selected for pragmatic reasons. First, fast track was implemented in late November 2006 as an urgent measure to manage ED demand. A 6-week period immediately following the implementation of fast track was allowed to enable normalisation of fast-track processes and practices, therefore post-implementation data collection commenced in January 2007. There were no other changes to ED processes during the periods studied. Second, given the difficulties of case matching a larger pool of patients from which to select controls was considered desirable.

Power calculations were based on the average ED LOS for discharged patients (120 minutes, SD 67). To detect a 15% decrease in ED LOS with a significance level of 0.050 (two-sided) and power of 0.80, 252 patients were required in each group. Post hoc power calculations showed the average ED LOS for discharged patients was 152.06 minutes (SD 93.94) for controls and 129.08 minutes (SD 77.04) for cases. Effect size was 0.24 (mean difference 22.98 minutes divided by standard deviation of the control group 93.94 minutes). Sample size tables for the two sample t test, a significance level of 0.050 (two-sided) and power of 0.80 indicated that at least 252 participants per group were required to detect a between-group difference.<sup>16</sup> As the efficiency loss using the Mann–Whitney U test in preference to the t test is estimated to be 10%,<sup>17</sup> 10% was added to each group to compensate for the use of non-parametric tests. The minimum sample size for each group was 278 patients. This study had 822 patients in each group so exceeded the minimum sample size numbers needed for a statistical power of 0.80.

### Intervention

The study intervention was ED fast track, implemented in November 2006. Fast track was established using existing ED physical and staffing resources. Fast track was set up in an existing area of the ED that had five armchairs, was adjacent to the plaster and procedure rooms and was close to the radiology department. Fast track was staffed with a senior emergency nurse who was competent at triage and an ED registrar or nurse practitioner. Before fast track, two nurses were responsible for patients in the five armchairs and also patients in three general adult cubicles with trolleys, there were no guidelines regarding patients triaged to chairs and there was no dedicated medical or nurse practitioner staffing, resulting in high levels of variability in the level of medical staff attending patients in this area. Few nurses allocated to this area before fast track had postgraduate emergency nursing qualifications. Fast track operated from 10:00 to 02:00 hours to match peak presentation times and



**Figure 1** Emergency department (ED) presentation data. ATS, Australasian triage scale.

focused on the management of patients with specific non-urgent complaints who were expected to be discharged from the ED, had an expected ED LOS of less than 60 minutes and did not require trolley care, intravenous analgesia or intravenous fluids. Patients suitable for fast track were identified by the triage nurse.

### Data collection

The following data were extracted for each case and control: patient age, gender, ED discharge diagnosis, waiting time, ED LOS and patient disposition. Waiting time and ED LOS for patients not triaged to fast track were also examined to determine the implications of the implementation of ED fast track for other ED patients. Analyses of non-fast-track patients compared ED LOS data from July and August 2006 (before the implementation of fast track,  $n = 10\,559$ ) with data from January and March 2007 (following the implementation of ED fast track,  $n = 10\,095$ ).

### Data analysis

Data were analysed using SPSS for Windows 14.0. An alpha coefficient of 0.05 was accepted as indicating statistical significance. Distributions were examined using the Kolmogorov–Smirnov test of normality. As data were not normally distributed, median times and interquartile ranges are presented and non-parametric tests (Mann–Whitney U test and  $\chi^2$  test) were used to compare groups.<sup>18–20</sup>

## RESULTS

### Characteristics of study subjects

A total of 1296 patients was triaged to fast track from 1 January to 31 March 2007. The median number of fast-track patients per day was 20 (range 4–33) and 66% were men. The average age of fast-track patients was 30.1 years (SD 19.3). The ATS category distribution of fast-track patients was 3% category 3 ( $n = 36$ ), 60% category 4 ( $n = 767$ ) and 38% category 5 ( $n = 493$ ). There were 822 fast-track patients for whom controls were matched.

The characteristics of cases and controls are summarised in table 1. Case–control comparison showed no significant between-group differences in age, gender, triage category distribution, waiting times or departure destination. Waiting times for both groups were within the times mandated by the ATS.

There was a significant reduction in ED LOS for non-admitted patients managed by ED fast track. The median ED LOS for non-admitted patients was 132 minutes (interquartile range (IQR) 83–205.25) for controls and 116 minutes (IQR 75.5–159.0) for cases ( $p < 0.01$ ). Discharge in 60 minutes or less was achieved for 14% of both cases ( $n = 112$ ) and controls ( $n = 107$ ;  $p = 0.80$ ). Significantly more fast-track patients were discharged within 2 h (53%,  $n = 404$  vs 44%,  $n = 333$ ;  $p < 0.01$ ) and 4 h (92%,  $n = 702$ , 84%,  $n = 629$ ;  $p < 0.01$ ). There were no significant differences in ED LOS for patients requiring admission. The median ED LOS of admitted cases was 309.0 minutes (IQR 192.5–435.0) versus 313.51 minutes (IQR 171.0–485.0) for admitted controls ( $p = 0.89$ ; table 1).

Comparison of the two time periods studied was undertaken to establish the equivalence of ED activity and acuity per and post implementation of ED fast track. Given that the two time periods compared were of uneven duration, ED activity was established using the number of presentations per day for each period. From 1 July to 15 November 2006, 24 111 patients were

**Table 1** Patient characteristics (cases vs controls)

	Controls (n = 822)			Cases (n = 822)			p Value
	n	%		n	%		
Gender							
Male	580	70.6		580	70.6		1.0
Female	242	29.4		242	29.4		
Disposition							
Discharged from ED	750	91.2		761	92.6		0.32
	n	Median	IQR	n	Median	IQR	p Value
Age, years	822	24	13–39	822	24	13–39	0.88
Triage categories and waiting times							
ATS category 3	18	12.0	9.7–28.7	18	13.5	8.0–24.0	0.74
ATS category 4	540	31.0	13.0–67.7	540	29.0	14.0–63.0	0.73
ATS category 5	264	25.0	12.0–64.0	264	26.0	11.0–62.0	0.66
ED length of stay							
Discharged patients	750	132	83–205.25	761	116	75.5–159.0	<0.01
Admitted patients	72	313.51	171.0–485.0	61	309.0	192.5–435.0	0.89

ATS, Australasian triage scale; ED, emergency department; IQR, interquartile range.

seen in 138 days (median 174 patients per day, IQR 165–184). From January to March 2007, 15 915 patients were seen in 90 days (median 173 patients per day, IQR 166.75–184.25). These differences in ED activity were not statistically significant ( $p = 0.63$ ). ED acuity was examined using triage categories and there were no statistically significant differences in ED acuity during the two data collection periods. ATS categories 1 and 2 comprised 8% of patients in both data collection periods (2006  $n = 2117$ ; 2007  $n = 1257$ ;  $p = 0.86$ ). During the 2006 period, 27% of patients were triaged to ATS category 3 ( $n = 7101$ ) compared with 26% of patients in the 2007 period ( $n = 4224$ ;  $p = 0.80$ ). ATS categories 4 and 5 comprised 65% of patients in both periods (2006  $n = 17 409$ ; 2007  $n = 10 434$ ;  $p = 0.64$ ). There were statistically significant differences in median waiting times between pre and post-test periods; however, the maximum difference was 3 minutes, which may be argued as clinically insignificant (table 2).

ED LOS of all patients was examined to determine if reductions in ED LOS for fast-track patients was at the expense of other ED patients. ED LOS analyses were performed with and without cases to account for the potential confounding effect of decreased ED LOS for non-admitted fast-track patients described previously. When data from all ED patients from the two time periods were compared there was no significant change in ED LOS for non-admitted patients but a 55-minute reduction in median ED LOS for admitted patients ( $p < 0.01$ ). Repeat analysis excluding cases showed an 11-minute increase in median ED LOS for non-admitted patients ( $p < 0.01$ ) and the same 55-minute decrease in median ED LOS for admitted patients ( $p < 0.01$ ; table 3).

## DISCUSSION

The first major finding of this study was a 16-minute reduction in ED LOS for non-admitted patients managed by fast track. Given there was a median of 20 patients seen in fast track per day during the study period, this finding is important as it indicates 5.3 h (320 minutes) of saved clinical resources and improved access to emergency care per day. Reductions in ED LOS following implementation of fast-track initiatives have been demonstrated in other studies from Australia, the UK, Europe, Canada and the USA.<sup>4 8–14</sup> In one of the few randomised controlled studies of fast track, Kilic *et al*<sup>8</sup> showed that median ED LOS for fast-track patients was 36 minutes compared with 63 minutes for the control group. Given that ED LOS for fast-track patients was just under 2 h, the practicality of the 60-minute target currently in the fast-track criteria is questionable. The results of other studies have also shown failure of fast-track systems to meet a 60-minute target, with reported ED LOS for fast-track patients ranging from 94 minutes to over 4 h.<sup>11 12 14 21</sup> Given that discharge in less than 2 h was achieved for just over half the fast-track patients in this study and the majority of reported ED LOS for fast-track patients (including this study) is less than 4 h, a time to discharge target of 2–4 h may be more realistic.

The second major finding of this study was that fast track did not dramatically affect waiting times or ED LOS for other ED patients. There were significant 3-minute increases in median waiting times for ATS 4 and 5 patients following the implementation of fast track; however, the clinical significance of this delay is questionable. There was no difference in ED LOS for discharged patients following the implementation of fast

**Table 2** Median waiting times per triage category (all ED patients)

	July–November 2006			January–March 2007			p Value
	n	Median	IQR	n	Median	IQR	
ATS category							
1	163	0.0	0.0–1.0	100	0.0	0.0–0.0	<0.01
2	1950	8.0	5.0–13.0	1153	7.0	4.0–10.0	<0.01
3	6979	19.0	11.0–32.0	4142	20.0	12.0–32.0	0.090
4	12 203	38.0	17.0–75.0	6898	41.0	17.0–81.0	<0.01
5	3171	23.0	10.0–58.0	1922	26.0	11.0–62.0	0.04

ATS, Australasian triage scale; ED, emergency department; IQR, interquartile range.

**Table 3** Median ED length of stay for all ED patients

	July–November 2006			January–March 2007			p Value
	n	Median	IQR	n	Median	IQR	
All ED patients							
Discharged	16827	157.0	(92.0–238.0)	10439	159.0	(91.0–241.0)	0.06
Admitted	9818	349.0	(191.0–594.0)	5476	294.0	(137.0–503.7)	<0.01
All ED patients excluding all cases (n = 1296)							
Discharged	16827	157.0	(92.0–238.0)	9233	168.0	(94.5–250.0)	<0.01
Admitted	9818	349.0	(191.0–594.0)	5386	294.0	(134.75–507.2)	<0.01

ED, emergency department; IQR, interquartile range.

track; however, it may be argued that that finding was confounded by the demonstrated reduction in ED LOS of fast-track patients. Repeat analysis of ED LOS excluding fast-track patients showed a significant 11-minute increase in ED LOS for discharged patients after ED fast track was implemented, but again the clinical significance of this finding is unclear. There was a significant 55-minute reduction in ED LOS for admitted patients following the implementation of ED fast track and this finding remained constant with and without cases. The impact of fast track on other ED patients, particularly patients with significant illness or injury, is a major clinical risk issue, and the efficient management of patients with minor complaints by senior clinicians should not be at the expense of other patient groups. The results of other studies published in the international literature have also demonstrated that fast-track systems did not adversely affect patients with more urgent needs.<sup>4 7 10 22</sup>

Dedicated medical and nursing staffing is pivotal to the success of fast-track systems.<sup>1 21</sup> Failure to staff fast-track areas with appropriate medical staff results in the cessation of, or interruptions to, fast-track programmes<sup>1</sup> and interruptions occur more frequently when medical staff were expected to work between fast-track and other ED treatment areas.<sup>1</sup> Fast-track systems are designed to run at times of peak demand and using medical staff availability to determine hours of fast-track operation may result in an inefficient use of ED resources.<sup>1</sup> There is also a number of studies that support the role of emergency nurse practitioners in fast-track programmes<sup>23–25</sup> and nurse practitioners dedicated to fast track may be an alternative model of care delivery for specific patient groups. It is also important to recognise that interruptions to fast track create a number of whole ED system issues. For example, triage may be disrupted when triage nurses do not know whether fast track is operating and large numbers of patients triaged to the waiting room increase overcrowding and patient frustration and aggression. The use of senior medical and nursing staff is also important to ensure timely and effective decision making.<sup>5</sup>

The following limitations must be considered when interpreting the results of this study. First, the study was conducted immediately after the implementation of fast track so no claims about the sustainability of these findings can be made. Second, there was a number of cases for whom a control could not be matched, resulting in a decreased sample size. Despite limitations to matched pairs, the study sample was still adequate in terms of statistical power. Finally, the specific environmental, staffing and process factors of fast track at the Northern Hospital may limit the generalisability of these findings to other ED.

## CONCLUSION

ED fast track can decrease LOS for non-admitted patients with non-urgent complaints without compromising the care of other

ED patients. Although the prioritisation of patients with non-urgent complaints conflicts with traditional notions of triage, effective strategies to manage large volumes of non-urgent patients and provide high quality emergency care in a financially responsible manner are now a key feature in sustainable models of emergency care delivery.

**Funding:** This study was generously funded by a 2007 Northern Health small research grant.

**Competing interests:** None.

**Ethics approval:** Approval was obtained from the Human Research and Ethics Committee before undertaking this study.

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## Images in emergency medicine

### Apical left extrapleural cap: an early and important sign on chest radiographs

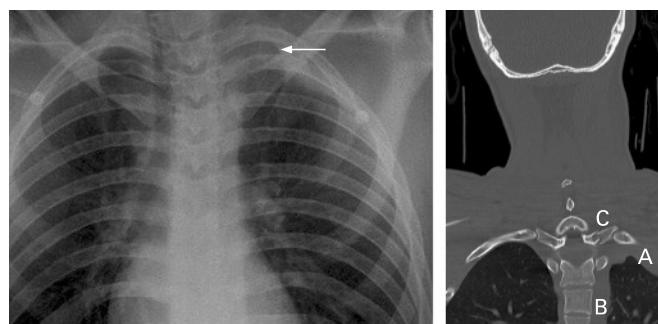
A 20-year-old male, non-restrained car driver was brought to casualty following a road traffic accident, with complaints of pain in the left arm and chest. Chest radiograph showed a left pleural apical cap. Computed tomography scan confirmed this along with transverse process fractures of the first and second thoracic vertebrae with paraspinous haematoma (see fig 1).

Extrapleural extension of mediastinal bleeding over the apex of the left lung was seen as an apical cap on the chest radiograph. Apical left extrapleural cap can be one of the earliest x ray manifestations of aortic rupture and should be excluded in the trauma setting. However, this may also be caused by haematoma from the rib or clavicular fractures, bleeding from the left subclavian vessels after line insertion or trauma, brachial plexuses injury and pleural thickening from inflammatory diseases.<sup>1</sup> Evaluating the initial chest radiograph performed in casualty is of immense value in the early recognition and further management of these injuries.

**A Kirwadi,<sup>1</sup> V B Pakala,<sup>2</sup> D Suresh Kumar,<sup>3</sup> P A Evans<sup>4</sup>**

<sup>1</sup>Department of Trauma and Orthopaedics, Morrision Hospital, Swansea, UK;

<sup>2</sup>Department of Plastic Surgery, Morrision Hospital, Swansea, UK; <sup>3</sup>Department of Radiology, Morrision Hospital, Swansea, UK; <sup>4</sup>Department of Accident and Emergency, Morrision Hospital, Swansea, UK



**Figure 1** Chest radiograph showing left apical pleural cap (arrow). Reconstructed computed tomography scan showing A, apical extrapleural cap; B, paraspinous haematoma and C, fracture of transverse process.

**Correspondence to:** Mr A Kirwadi, Department of Trauma and Orthopaedics, Morrision Hospital, Swansea, 29 Golwg Y Waun, Birchgrove, Swansea SA7 0HE, UK; [anandkirwadi@doctors.org.uk](mailto:anandkirwadi@doctors.org.uk)

**Competing interests:** None declared.

**Patient consent:** Obtained.

*Emerg Med J* 2008;**25**:819. doi:10.1136/emj.2007.057620

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