Impact of an emergency short stay unit on emergency department performance of poisoned patients.

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Abstract

Objectives

This was a before and after study which sought to assess the impact of opening an ED short stay unit (ESSU) on the ED performance of poisoned patients.

Methods

Data was collected from two groups of adult patients presenting to an ED with a tertiary referral inpatient Toxicology unit from the 2009 and 2012 calendar years, to assess the impact of the ESSU. The toxicology unit clinical database and hospital electronic medical records were interrogated for demographic, clinical and hospital flow details of presentations. The primary outcome was ED length of stay (LOS). Other outcomes included proportion of patients remaining in ED for their admission, 28 day re-presentations and hospital LOS.

Results

During 2009, 795 patients met inclusion criteria, and during 2012, 762. The median LOS in ED was reduced from 8.5h (IQR:4.7–14h) to 2.7h (IQR:1.6–4.6;p<0.0001). The proportion of patients remaining in ED for their entire hospital stay was reduced from 515/795 (65%) to 56/762 (7.3%)[Absolute difference: 57%; 95%CI: 53 to 62%; p<0.0001]. Total hospital LOS increased from 14.5h (IQR:8.4–21.8h) to 16.7h (IQR:11.5–23;p<0.0001), but there was a decrease in re-presentations with self-poisoning within 28 days from 6.9% in 2009 to 4.5% in 2012 (p<0.038). There was no difference between disposition destination or toxins causing exposure between the two groups.

Conclusions

The ESSU led to a significant improvement in ED performance of poisoned patients. It also potentially assisted in reducing ED overcrowding.

Introduction

Acute poisoning is a relatively common presenting complaint to the emergency department (ED) with one recent Australian study attributing approximately 0.7% of all ED presentations to this category. (1) Previous studies have demonstrated that the care of poisoned patients can be streamlined with a shorter overall length of stay when the inpatient care is delivered by a specialist toxicology service (2) (3) There is a dearth of research investigating the optimum location within acute healthcare facilities where inpatient care for poisoned patients is best undertaken.

In recent times, ED short stay units (ESSU) have become widespread and allowed a number of ED presentations to be fast tracked for an abbreviated period of inpatient care provided appropriate criteria are met. (4) Some of the perceived benefits of short stay units are a reduction in length of stay and a reduction in ED overcrowding.(5) (6) Overcrowding in the ED is known to be associated with increased hospital mortality and was one of the factors responsible for the introduction of the National Emergency Access Targets within Australian hospitals, aimed at getting specific proportions of ED patients either discharged or admitted to hospital within 4 hours of ED presentation. (7)

Much of the medical literature evaluating short stay units has focused on individual ED presentation groups and how these compare with conventional inpatient management. (8) At our facility, an ESSU was opened in 2010 with admission criteria focused around patient complexity and likelihood of discharge within 24 hours. Such criteria would appropriately cover a number of patient groups such as low risk chest pain. (9) Poisoned patients were likewise a favourable group having a significantly lower median age when compared with

other acute, adult presentation groups, as well as a median hospital length of stay of less than 24 hours. (10)

Following the opening of ESSU it was decided that poisoned patients requiring ongoing care who met the aforementioned criteria would be admitted. This was a change from the prior arrangement whereby the ongoing care of poisoned patient was carried out in a medical inpatient ward within the hospital. The aim of this study was to assess the impact of the opening of an ESSU on the hospital journey of poisoned patients.

Methods

Design and Setting

We undertook a retrospective review of all poisoned patients admitted to a tertiary toxicology unit via the ED. Our toxicology service provides an adult inpatient care and tertiary referral service to health care facilities in the surrounding region comprising a population of approximately 620,000. A telephone consultation service is also provided for paediatric and adolescent presentations as well as adults who are not ultimately transferred to our inpatient facility. The ED at our facility is classified as an urban district ED by the Australasian College for Emergency Medicine and has an annual census of approximately 36,000.

Prior to the ESSU opening, poisoned patients were admitted to an inpatient medical ward following discussion with the toxicologist on duty and provided they did not require ongoing critical care in which case ICU admission was undertaken. In some cases the lack of an available inpatient ward bed meant patients remained within the ED for the entirety of their inpatient stay. Prior to 2010 allocation of inpatient beds was the task of duty nursing administration staff in the hospital and thus beyond the control of both the toxicologist and ED staff.

The ESSU opened in November 2010 after which poisoned patients not requiring ongoing critical care were admitted. An excerpt from the guideline document outlining admission criteria for all patient groups is detailed in Figure 1. No additional requirements were applied for admitting poisoned patients other than discussion with the toxicologist prior to transfer as had occurred previously. One key operational difference after the ESSU opened was that senior ED nursing staff, not hospital nursing administration, had the authority to allocate a bed in the ESSU.

The ESSU comprises 12 beds with 3 dedicated nursing staff members during the day and 2 members of nursing staff in the evening and overnight. A specific medical officer is allocated to the ESSU also for each shift worked. Both medical and nursing staff come from within the workforce of the co-located ED thus reinforcing the principle of the ongoing care in ESSU being a continuation of the patient journey which began on presentation. These patients were looked after jointly by ED staff with appropriate input and ongoing care from the Toxicology service. Patients are admitted to ESSU 24 hours a day but generally not discharged between midnight and 8 am. This is due to the frequent difficulty in ensuring that post presentation support and follow up services are in place at such times as required by the relevant state policy directive. (11)

Data on all ED presentations with poisoning to our facility are entered prospectively into a relational database. The database was set up for quality assurance purposes and collection and entry of data has long term and ongoing approval from the local ethics committee and has been described in more detail previously (10) The methodology used in our study adhered closely to the SQUIRE guidelines for reporting data related to quality improvement in healthcare. (12)

Selection of Participants

The database was searched for information on two cohorts of patients, aged 16 years and over, who presented with acute poisoning within the calendar years 2009 and 2012.

We selected 2009 as the year immediately prior to ESSU opening when all non-critically ill poisoned patients were admitted to a medical inpatient ward from the ED. We chose 2012, the second year after the ESSU opening, as the comparison year because it was felt that 2011 would be transitional and definitive processes for patient care within the ESSU might not have been established.

Criteria for admission to the ESSU were identical to those used for inpatient medical ward disposition prior to 2010. Thus all poisoned patients requiring hospital admission for ongoing treatment, observation as well as a mental health assessment if appropriate. Patients who required endotracheal intubation, inotropes or vasopressors to manage haemodynamic instability or ongoing critical care monitoring were admitted to ICU and thus excluded from both admission to ESSU and inpatient medical ward.

In addition the ED admission data for toxicology admissions (hospital flow information from the electronic medical records) was searched for the same periods. Data from the toxicology database was then linked to the ED data using the unique patient medical record number. Cases were excluded if they were admitted to ICU or were directly transferred to an inpatient ward from another hospital, thus bypassing the ED.

Data Collection

Data extracted from the toxicology database included demographic data (age, sex), type of poison or toxin and disposition details with regard to whether the patient was discharged home as opposed to transferred to a psychiatric inpatient or other facility. The number of admissions attributable to a particular patient within the stated time periods was also extracted noting in particular any representations within a 28 day period post discharge.

The toxicology data was supplemented with ED data, including time of arrival in and time of discharge from ED, whether the presentation occurred during daylight hours (8am to 6pm), total length of stay in the ED and total hospital length of stay.

Outcomes

The primary outcome was the ED length of stay. Other outcomes included the proportion of patients remaining in the ED for the duration of their admission, 28 day re-presentations, hospital length of stay and time of discharge from ED.

Statistical Analysis

Medians with interquartile ranges (IQR) are reported for continuous variables, whilst proportions expressed as percentages were calculated for categorical variables including 95% confidence intervals (CI). Continuous data was compared with the Mann-Whitney test and dichotomous outcomes with Chi-square testing taking $p<0.05$ as significant. All statistical analyses were done in GraphPad Prism version 6.03 for Windows (GraphPad Software, San Diego California USA, www.graphpad.com).

Results

There were 883 admissions to the toxicology service during 2009 of whom 88 were excluded and thus 795 met the inclusion criteria. In 2012 there were 832 admissions to the toxicology service of whom 70 were excluded, leaving 762 for the final analysis (Figure 2). Exclusions were mainly due to direct admission to ICU and transfer to an inpatient ward from an external facility.

There were no differences in age or sex between the two groups but a greater proportion of the 2009 cohort presented outside of daylight hours (Table 1).

The 795 cases in 2009 had a total of 2114 toxin exposures. Of these 169 (21.1%) had ingested a single toxin ingestion versus 629 (78.9%) ingesting more than one toxin. In 2012 the 764 cases had 2155 toxin exposures of which 165 (21.6 %) involved a toxin ingestion versus 599 (78.4%) involving more than one agent. Of the 28 categories of toxins, 8 of these accounted for 81.9% and 79.6% in 2009 and 2012 respectively whilst a further 20 categories collectively accounted for the remaining toxin exposures in each cohort (Table 2). There was no differences between the two cohorts in types of drugs ingested.

The ED length of stay was significantly reduced, from 8.5 hours (IQR: 4.7 to 14.1h) in 2009 to 2.7 hours (IQR: 1.6 to 4.7h) in 2012 ($p<0.0001$) (Table 3). The proportion of patients who remained in ED for the length of their admission was dramatically reduced from 515/795 (65%) in 2009 to 56/762 (7.4%) in 2012 [Absolute difference: 57%; 95%CI: 53 to 62%; $p<0.0001$].

In contrast, the total hospital LOS increased from a median of 14.5 hours (IQR: 8.4 to 22h) in 2009 to 16.7 hours (IQR: 11.5 to 23h) in 2012 ($p<0.0001$). There was a modest reduction in the re-admission rate within 28 days which decreased from 55/795 (6.9%) in 2009 to 34/762 (4.5%) in 2012 (Absolute difference: 2.5%; 95%CI: 0.1% to 4.8%; $p=0.038$).

There were no differences between the two groups in disposition location with regard to the proportion of patients discharged home versus those transferred to an inpatient mental health unit. However, there was a significant difference in the time of day at which the patients were discharged with 315/529 (60%) of the 2009 group being discharged within daylight hours versus 455/518 (88%) in 2012 [(Absolute difference: 28%; 95%CI: 27 to 29%; $p<0.0001$). There was one death which occurred in 2012. This was a patient with a lethal chemical ingestion who died an unexpected death within hours of arrival in the ED.

Discussion

Our data support the opening of an ESSU as improving the ED performance of poisoned patients with earlier transfer out of ED and a decrease in proportion of those remaining in ED for their entire stay after the ESSU opening.

The significance of early transfer from the ED is apparent in a recent study by Sullivan et al analysing the impact of compliance with National Emergency Access Targets across 59 hospitals in Australia and its relation to hospital standardised mortality rates. (13) This study concluded that with increasing compliance with the National Emergency Access Targets, the hospital standardised mortality rate was reduced for patients admitted to all inpatient units, including ESSU, with maximum benefit at a compliance rate of 63%. (13) The overall mortality rate for poisoning in Australia is approximately 0.5% (10) and almost all of these deaths occur in a critical care environment. Thus the potential mortality reduction benefits of ESSU opening do not apply to poisoned patients as such, but to other acutely unwell patients having increased access to ED beds that might previously have been occupied by poisoned patients for a more prolonged period of time.

Previous literature has questioned the introduction of a new protocol for specific patient groups as a potential confounder in improvements attributed to short stay units. (6) However, in this case no new protocol specific for poisoning was introduced beyond the generic protocol for ESSU admission at our facility. A key feature of short stay units is that the admission process must be under administrative control of senior ED staff. (14) (4) The shift in control of this process for poisoned patients away from hospital administration staff after the ESSU opened is likely to have contributed significantly to the decreased ED length of stay we observed.

The proportion of poisoned patients spending the entirety of their stay in ED also decreased. This was likely due to the relative lack of access to inpatient beds prior to ESSU opening, due to access block. (15) Poisoned patients may be looked at unfavourably for bed admission by hospital administration staff due to the relatively short duration of stay for which an inpatient bed is needed compared to other acute medical cases.

Hospital length of stay was modestly increased by a median of 2 hours following the opening of the ESSU. We believe this reflects a greater proportion of the 2012 cohort accessing inpatient care within the ESSU as opposed to having all of their inpatient care delivered within the ED. Whilst this could be interpreted as a less efficient delivery in patient care post opening of ESSU, this may also plausibly reflect poisoned patients making less of a contribution to ED overcrowding and thus putting less pressure on ED staff to push for discharge at unsocial hours. This in turn may ensure that all aspects of care are addressed prior to discharge as per the New South Wales state policy. (11) A previous study suggested that up to 25% of ED poisoning ingestions who were cleared for psychiatric evaluation had an inadequate observation period post-ingestion. (16)

The proportion of patients being discharged home during normal business hours was significantly increased following the opening of the ESSU. This also most likely reflects a greater proportion being cared for in an inpatient capacity post ESSU opening.

Our data demonstrated a modest reduction in unplanned representations to the toxicology service within 28 days between the groups. Representations are common within deliberate self-poisoning patients and interventions targeting this have been the focus of a number of previous studies. (17) Unplanned representation within this time period is an Australian healthcare key performance indicator. (18) Whilst we did not measure representations outside of the toxicology service, the demographic of our study population is such that

representation rates to another inpatient medical specialty would be expected to be very low.

A number of studies have focused on different patient populations in ESSU although these have generally not included poisoned patients. Szajnkrycer et al describe the development of a protocol for admission of poisoned patients to a short stay unit but their results were preliminary and only six patients were admitted during a 12 month period. (16) Beauchamp and colleagues also describe observation unit admission as an appropriate alternative to inpatient care specifically for acetaminophen poisoning requiring intravenous acetylcysteine. (19) The Western Australian Toxicology Service report delivering care of poisoned patients in an observation unit, but this is in the context of a narrative article which does not provide any specific data. (20)

A descriptive study by Teo and Cooper analysed poisoning admissions to a United Kingdom short stay unit over a 12 month period (21) However this study focuses on describing the trends observed in diagnosis and management carried out and does not attempt to evaluate the impact of the ESSU from a quality improvement perspective and thus cannot be directly compared to our data. Our exposure data indicate that there was no significant change in the pattern of toxin exposure from 2009 to 2012 that might otherwise explain our findings.

Limitations

There are some limitations that must be borne in mind when interpreting our study findings. We did not attempt to measure patient satisfaction with the ESSU model of care and it is theoretically possible that patient satisfaction may have been less than what it was under the previous model of care. This work was undertaken in a facility with a tertiary referral toxicology unit and thus findings may not necessarily be applicable to facilities who do not have this level of support. We cannot exclude the possibility that the improved

performance may also have been observed had resources been used to enhance the number of inpatient beds rather than opening an ESSU.

The period of study reflects a time when a lot of attention within healthcare was targeting a maximum stay of four hours for patients within the ED. We thus cannot conclusively say that other, general measures implemented to achieve this, did not contribute to the reduction in ED overcrowding which our study reports. We also presume accurate data entry into both the toxicology database as well as the hospital electronic medical record.

Conclusions

The ESSU had a positive impact on the ED performance of poisoned patients by shortening ED length of stay and substantially reducing the number of patients who spend all of their admission time within the ED at the expense of a modestly increased hospital length of stay. Admitting poisoned patients to the ESSU also had potential benefits for non-poisoned patients by helping increase bed availability within the ED.

Figure 1

Patients should only be admitted to the ESSU where it is anticipated they will be discharged within 24 hours.

Examples include the following BUT are not limited to:

- Allergic reactions
- Minor head injuries
- Renal colic
- Billiary colic
- Mild asthma
- Gastroenteritis with mild dehydration
- Low risk chest pain
- Migraine management
- Post sedation care
- Awaiting CT, ultrasound
- Patients awaiting transfer to another hospital, **NOT** a critical care unit
- Those who require longer than 4 hours assessment observation
- Older, vulnerable or at risk patients who require multiple, additional assessments
- Patients who's management requires further time to define response to treatment eg antibiotics, asthma, analgesics
- Intoxication
- Envenomation
- Minor injuries requiring prolonged treatment (dislocated shoulders, extensive suturing)
- Toxicology patients (after discussion with the toxicologist on duty)

Unsuitable Patients

In general patients should not be admitted to ESSU where they clearly require hospital admission for over 24 hours or a specialty service*. The principles of the most appropriate place for the patient should be followed. The patients' journey through the health system should be foreword moving, with this in mind some other examples of unsuitable patients include:-

- Patients with no clear management plan, including disposition
- Patients who are considered unstable
- Patients less than 16 years of age
- Post operative patients
- **Patients waiting for a critical care bed**
- Patients requiring CPAP and NIV Ventilation
- Elderly patients who are unable to mobilise, if they were previously able to mobilise
- Violent / Behaviourally Disturbed patients

*Patients jointly admitted with the Toxicology service are an exception

Figure 2

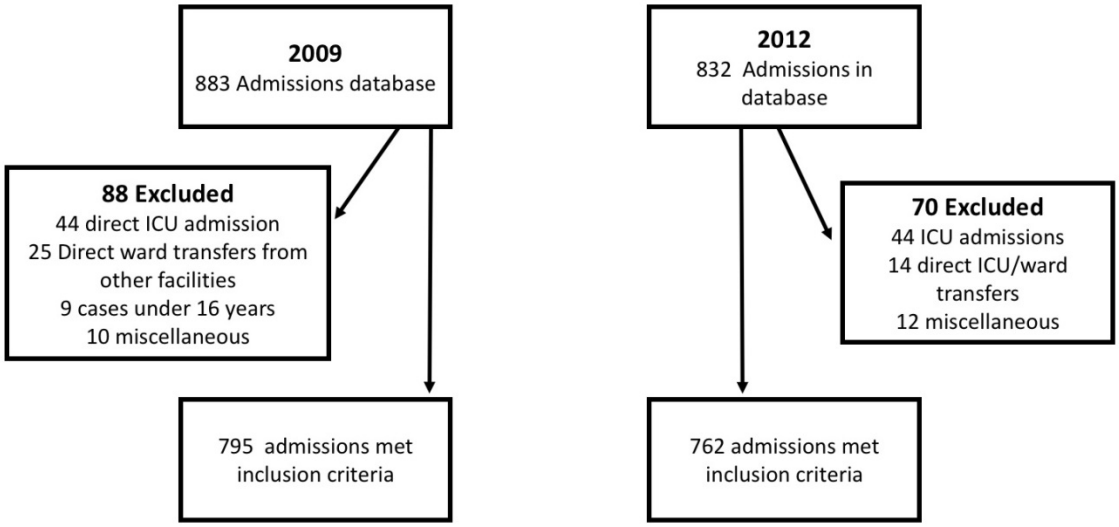
2009
883 Admissions database
88 Excluded
44 direct ICU admission
25 Direct ward transfers from other facilities
9 cases under 16 years
10 miscellaneous
795 admissions met inclusion criteria
2012
832 Admissions in database
70 Excluded
44 ICU admissions
14 direct ICU/ward transfers
12 miscellaneous
762 admissions met inclusion criteria

Table 1 : baseline features	**2009**	**2012**	
Ingestion of greater than one toxin (%)	626/795 (78.8)	597/762 (78.3)	-
Psychotropics	607 (28.8)	642 (29.9)	
Alcohol	305 (14.5)	261 (12.2)	
Paracetamol	244 (11.6)	272 (12.7)	
Benzodiazepines	199 (9.5)	206 (9.6)	
Anticonvulsants	104 (4.9)	76 (3.5)	
Cardiovascular agents	96 (4.6)	76 (3.5)	
Opioids	85 (4)	89 (4.1)	
NSAIDs	84 (4)	85 (4)	
Sub Total	**1724 (81.9)**	**1707 (79.6)**	
Miscellaneous*	379 (18)	438 (20.4)	
Total	**2104 (100)**	**2145 (100)**	

Table 2 : Categories of toxin exposures	**2009**	**2012**	
Ingestion of greater than one toxin (%)	626/795 (78.8)	597/762 (78.3)	-
Psychotropics	607 (28.8)	642 (29.9)	
Alcohol	305 (14.5)	261 (12.2)	
Paracetamol	244 (11.6)	272 (12.7)	
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Sub Total	**1724 (81.9)**	**1707 (79.6)**	
Miscellaneous*	379 (18)	438 (20.4)	
Total	**2104 (100)**	**2145 (100)**	

*comprises 20 categories of toxin exposures

Table 3 : Outcomes	**2009**	**2012**	
Median ED Length of stay in hours (IQR)	8.5 (4.7 – 14)	2.7 (1.6 – 4.6)	P<0.0001
Admissions who never left the ED (%)	515 (65%)	56 (7.4%)	P<0.0001; Absolute difference: 57% (95%CI: 53 to 62%)
Median Hospital length of stay (IQR)	14.5 (8.4 – 21.8)	16.7 (11.5 – 23)	P<0.0001
Representation Rate (%)	55/795 (6.9)	34/762 (4.5)	P<0.038 Absolute difference: 2.5% (95%CI: 0.1 to 4.8%)
Discharged home (%)	529 (67)	518 (68)	P=0.55
Discharged time 08:00-18:00 (%)	315 (60)	455 (88)	P<0.0001; absolute diff: 28% (95%CI: 27 to 29%)
Transferred to psychiatric facility (%)	235 (30)	215 (28)	-
Other disposition (%)	31 (4)	28 (3.6)	-
Deaths	0	1	-

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