Necessity of trauma referrals to the emergency department

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Abstract
Background: Patients with traumatic injuries presenting to the emergency department (ED) may be referred to another hospital for further management. Unnecessary referrals can inflate health-care costs and workload, as well as reduce provider and patient satisfaction.

Objectives: In this study, we determined the proportion of unnecessary trauma referrals and described the characteristics of this patient population.

Methods: A retrospective chart review was carried out between 1 January and 31 December 2016. Data regarding demographics, diagnosis and clinical course at the ED were collected in standardised forms. A referral was defined as unnecessary if the patient was discharged from the ED without a therapeutic procedure performed.

Results: There were 121 trauma referrals. The mean age was 39.0 ± 18.3 years old, and 94 (77.7%) patients were male. Seventy-eight (64.5%) of the referrals were from EDs in the same health-care cluster. Overall, 15 (12.3%) referrals were unnecessary, and of these, nine patients had sustained burns or were suffering from smoke inhalation. The length of stay of these unnecessary referrals was 197.0 ± 96.2 minutes. Referring ED outside the health-care cluster was significantly associated with unnecessary referrals (odds ratio=4.42, 95% confidence interval 1.40–13.97, p=0.007).

Conclusion: More than 1 in 10 trauma referrals were unnecessary. Further collaborative prospective studies with other EDs are needed to elucidate the underlying reasons for such unnecessary referrals so that targeted solutions can be implemented to reduce them in the future.

Keywords
Trauma, emergency, transfer

Introduction
Emergency departments (EDs) in Singapore are seeing an increase in attendances year-on-year, with 2018 having more than one million patient visits.1 Traumatic injuries account for about 30% of all attendances at the ED.2 Some of these patients may be referred from other health-care institutions, as their condition may require management which is not available at the primary site where the patient presents. At the end of this spectrum, there are severely injured patients who will benefit from admission to a tertiary hospital with specialist consultation, and life- and limb-saving procedures.3 However, more than a third of patients with traumatic conditions referred to another ED are discharged without the need for admission or therapeutic procedures.4 This phenomenon is known as secondary over-triage. Secondary over-triage incurs significant financial costs to the patient, ambulance services and the receiving hospitals.5,6 In addition, these cases increase the workload in the ED, divert attention and resources away from other ill patients, increase health-care worker stress and reduce patient satisfaction.7,8

To our knowledge, there has not been a published study exploring the phenomenon of secondary over-triage of adult trauma patients in the local context. Therefore, we aimed to determine the proportion of secondary over-triage and examine the necessity of these trauma referrals to the ED by describing the nature of these referrals. The results will help
identify potential areas for improvement in the delivery of trauma care.

**Methods**

**Settings**

The study was conducted in the ED of a restructured hospital in Singapore with an annual attendance of about 135,000. This tertiary hospital is supported by national specialty centres and clinical specialties relevant to trauma care.

**Design**

A retrospective chart review was carried out. Patients presenting to the ED between 1 January and 31 December 2016 were included if they were referred by the ED of another restructured hospital and the ED diagnosis in their electronic medical records was categorised under trauma. Data extraction was performed using a standardised form for demographics, referral source, triage acuity, diagnosis, therapeutic procedure done (if any) and disposition. We excluded patients who reattended to the ED (defined as patients who return within 72 hours of discharge from the ED), as well as referral sources without an emergency medicine physician on site such as private hospitals, general practitioners, polyclinics, military camps and specialist outpatient clinics.

The definition for therapeutic procedures was modified from Medford-Davis et al. and included the following: fracture and/or joint dislocation management (i.e. casting, splinting, reduction), wound management (i.e. laceration closure, nailbed repair) and foreign-body removal. We excluded point-of-care, laboratory and imaging tests, as these were considered to be standard investigations available in general EDs. We also excluded critical-care procedures (i.e. intubation, mechanical ventilation, central line and chest tube insertion), period of observation in the ED and administration of medications, as these were essential capabilities of general EDs. Lastly, procedures done in the operating theatre were excluded, as the patients who required them would be admitted to the hospital. A referral was defined as unnecessary if the patient was discharged from the ED without a therapeutic procedure performed.

This study was approved by Institutional Review Board at SingHealth (CIRB reference 2018/2296).

**Statistical methods**

Statistical analysis was performed using IBM SPSS Statistics for Windows v22 (IBM Corp., Armonk, NY). Categorical and continuous data are presented as frequencies with percentages and means with standard deviations, respectively. Associations between categorical variables were assessed using the chi-square test, while associations between continuous variables were assessed using the Wilcoxon rank-sum test. The level of significance was taken as 0.05.

**Results**

During the study period, there were a total of 19,399 trauma cases. Of these, 121 (0.6%) patients were referred from the ED of another restructured hospital. Table 1 shows the patient characteristics.

**Diagnoses and acuity of cases**

The majority of the referrals were for open wounds, consisting of abrasions and lacerations (31.4%), burns or smoke inhalation (28.1%) and fracture or dislocation (17.4%; Table 2). There were 20 (16.5%) immediate (priority 1) cases, 65 urgent (priority 2) cases and 36 delayed (priority 3) cases.

**Outcome of cases and necessity of referrals**

There were 104 (86.0%) patients who were admitted to the hospital. Seventeen (14.0%) patients were discharged from the ED – three patients were discharged against medical advice. Among these patients discharged from the ED, only two had procedures performed in the ED. Both patients required toilet and suturing of their lacerations. The length of stay in the ED for these unnecessary referrals was 197.0 ± 96.2 minutes from time of triage to disposition.

### Table 1. Patient characteristics.

| Age (years), M±SD   | 39.0±18.3 |
|---------------------|-----------|
| Sex, n (%)          |           |
| Male                | 94 (77.7) |
| Female              | 27 (22.3) |
| Race, n (%)         |           |
| Chinese             | 66 (54.5) |
| Malay               | 14 (11.6) |
| Indian              | 14 (11.6) |
| Other races         | 27 (22.3) |
| Source of referral, n (%) |          |
| ED in same health-care cluster | 78 (64.5) |
| ED in different health-care cluster | 43 (35.5) |

SD: standard deviation; ED: emergency department.

### Table 2. Discharge diagnosis of cases.

| Diagnosis                                      | Cases, n (%) |
|------------------------------------------------|--------------|
| Open wound (e.g. abrasion/laceration)          | 38 (31.4)    |
| Burns or smoke inhalation                      | 34 (28.1)    |
| Fracture or dislocation                        | 21 (17.4)    |
| Amputation or crush injury                     | 18 (14.9)    |
| Soft-tissue injury (e.g. contusion/sprain/strain) | 5 (4.1)     |
| Others                                         | 3 (2.5)      |
| Head injury                                    | 1 (0.8)      |
| Spinal cord injury                             | 1 (0.8)      |

SD: standard deviation; ED: emergency department.
Given the unique nature of these referrals, guidance for hospitals within and outside the health-care cluster. Similarly, patients with spine injuries are referred to this ED, as well as substance within Singapore. Patients with hand and spine injuries can be disseminated to the EDs of other restructured hospitals to help identify patients requiring a referral for further management. This can be supplemented by regular activities for continuous medical education to promote awareness and reduce unnecessary referral. Audits may also be carried out to track outcomes of referrals and ensure adherence to guidelines.

Telemedicine can also be explored as a solution to reduce the proportion of unnecessary referrals. By using real-time video conference consult with the receiving hospital’s specialists, patients can benefit from this remote review of focused physical examination and relevant investigations. This has been shown to reduce unnecessary referrals, length of stay and the costs of inter-hospital referrals. Studies have supported its use in various types of trauma, including burn injuries and hand injuries. As it is relatively nascent in the local context, potential issues about patient confidentiality, cybersecurity, medico-legal coverage and subvention will need to be duly considered and discussed between all stakeholders before trial and implementation.

Discussion

More than 10% of the trauma patients referred from the ED of other restructured hospitals were unnecessary, as they were eventually discharged without a therapeutic procedure being performed. Burns or smoke inhalation accounted for the majority of these referrals, and these visits resulted in a consult time averaging at least three hours.

In a study by Medford-Davis et al., the proportion of unnecessary referral, similarly defined as discharged from the ED without therapeutic procedure performed, was higher at 36% for the USA. This difference could be explained by the inclusion of EDs and hospitals from both urban and rural settings, where there were significant variations in capabilities and resources to evaluate and manage trauma patients, thus accounting for a higher proportion of referrals and, consequently, unnecessary referrals. This variation in clinical setting was less significant in our study, as we included EDs of restructured hospitals in Singapore which were all part of tertiary hospitals supported by clinical specialties.

The trauma referrals in our study were predominantly from EDs within the same health-care cluster. Along with the nature of referrals, this is indicative of the system-based practices within Singapore. Patients with hand and spine injuries are referred to this ED, as hand and spine surgeons at this hospital provide coverage for other hospitals within the health-care cluster. Similarly, patients with smoke inhalation and burn injuries are referred to this ED, as there is a national burns centre in this hospital, providing support for hospitals within and outside the health-care cluster. Given the unique nature of these referrals, guidelines with well-defined criteria for patients with burns, hand and spine injuries can be disseminated to the EDs of other restructured hospitals to help identify patients requiring a referral for further management. This can be

Limitations

This was a single-centre retrospective study. Hence, details such as the exact diagnoses and management at the referring EDs, as well as specific reasons for inter-hospital referral could not be reliably obtained. Furthermore, the decision for referrals may have been influenced by other factors such as the capabilities of the referring EDs and patients’ access to transportation and medical care at the EDs. As a result, although our study identified the issue of secondary over-triage, we were unable to propose specific solutions to the problem, as the underlying reasons were not immediately clear. Future collaborative studies with other institutions would be crucial to review this issue on the necessity of adult trauma referrals and to streamline the delivery of trauma care.

We were not able to estimate the costs of the unnecessary referral owing to insufficient information on the costs of ambulance transport and the procedures performed in the ED. We were not able to measure the impact of the increased patient load on the health-care workers and the care of other patients objectively. Instead, we used length of stay in the ED as a surrogate marker of the inconvenience caused to the patient and health-care provider.

Figure 1. Outcome of cases.

The odds ratio of unnecessary referrals from EDs in a different cluster compared to EDs in the same cluster was 4.42 (95% confidence interval 1.40–13.97, p=0.007).

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Most physicians are not cognisant of the economics and costs involved in interhospital referrals. Therefore, a possible intervention could be to promote awareness amongst referring physicians of the downstream financial costs to patients, departments, hospitals and the health-care system, as well as inconvenience to patients and their caregivers. This may then motivate physicians in taking active efforts in preventing unnecessary referrals.

Lastly, given that a significant proportion of these referrals required admission, potential solutions could include streaming these patients to a fast-track service in the ED or to have them bypass the ED and be directly admitted to the wards or operating theatre. This would minimise the unnecessary wait in ED for definitive care. However, collaboration between the various hospitals’ EDs and inpatient services would be necessary, and this would probably be more feasible for hospitals within the same health-care cluster due to a higher likelihood of similar workflows.

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Finally, although it may seem the absolute number of unnecessary referrals is a relatively small percentage of the total number of trauma cases, it must be emphasised that our study was limited to referrals from the EDs of other restructured hospitals. If we consider the potentially unnecessary referrals from other sources such as private hospitals, polyclinics and general practitioners, the magnitude of the problem could be much larger. This could be a potential avenue for future studies.

Conclusion
Our study showed that more than 1 in 10 trauma referrals were unnecessary, as these patients were discharged from the ED without a therapeutic procedure being performed. It is important to avoid such referrals, as they put a strain on the receiving ED and would lead to substantial costs for patients and the health-care system. Further prospective studies are needed in collaboration with other hospitals to elucidate the underlying reasons for these unnecessary referrals so that targeted solutions can be put in place to reduce them.

Acknowledgements
NA

Funding
The authors received no financial support for the research, authorship and/or publication of this article.

Availability of data and materials
The data of this study would not be available in accordance to approval by Institutional Review Board at SingHealth, Singapore.

Authors’ contributions
C.L. interpreted the results and prepared the manuscript. P.Y. collected the data and prepared the manuscript. J.W.C.P. interpreted the results and prepared the manuscript. H.P.J designed the study, collected the data, undertook the statistical analysis, interpreted the results and prepared the manuscript.

Conflict of interest
The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Informed consent
Waiver of consent was granted by Institutional Review Board at SingHealth, Singapore.

Ethical approval
This study was approved by Institutional Review Board at SingHealth, Singapore (CIRB Reference Number 2018/2296).

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