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# Unwarranted clinical variation in the care of children and young people hospitalised for injury: a population-based cohort study

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### ABSTRACT

*Introduction:* Injury is a leading cause of death and disability among children and young people. Recovery may be negatively affected by unwarranted clinical variation such as representation to an emergency department (ED), readmission to a hospital, and mortality. The aim of this study was to examine unwarranted clinical variation across providers of care of children and young people who were hospitalised for injury in New South Wales (NSW).

*Materials and Methods:* Retrospective population-based cohort study using linked ED, hospital, and mortality data of all children and young people aged  $\leq 25$  years who were injured and hospitalised during 1 January 2010–30 June 2014 in NSW. Unwarranted clinical variation across providers was examined using three indicators. That is, for each hospital that treated  $\geq 100$  cases per year, risk standardised ratios were calculated with 95% and 99.8% confidence limits using the number of observed and expected events of (1) representations to ED within 72 h, (2) unplanned readmissions to hospital within 28 days, and (3) all-cause mortality within 30 days.

*Results:* There were 189,990 injury-related hospitalisations of children and young people. Of these, 4.4% represented to an ED, 8.7% were readmitted to hospital, and 0.2% died. Of the 45 public hospitals that treated  $\geq$ 100 cases per year, higher than expected rates of ED representations, hospital readmissions, and mortality were observed in eleven, six, and two hospitals, respectively.

*Conclusion:* The rates of ED representations, hospital readmissions, and mortality among children and young people hospitalised for injury in NSW were similar to the rates reported in other countries. However, unwarranted clinical variation across public hospitals was observed for all three indicators. These findings suggest that by improving routine follow-up support services post-discharge for children and young people and their families, it may be possible to reduce unwarranted clinical variation and improve health outcomes.

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### Introduction

Injury is a leading cause of death and disability among children and young people worldwide [1,2]. The most common mechanisms of injury-related death among young people are road injuries, self-harm, interpersonal violence, and falls [1]. Depending on the type and severity of the injury, a portion of injured children and young people will be hospitalised to receive treatment.

During hospitalised treatment for an injury, a young person's recovery may be negatively affected by medical complications that could lead to representation to emergency department (ED),

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unplanned readmission to hospital, and mortality [3,4]. For instance, inadequate transfer of patient data to primary care providers may lead to outpatient clinicians lacking critical information (e.g., test results) and patients not receiving scheduled evaluations and follow-up tests [5]. In some cases, young patients may not be adequately prepared at discharge from hospital (e.g., limited understanding of their principal diagnoses and discharge medications)5.

In a world with limited resources and increasing demands for accountability, evaluating the quality of care has become increasingly important to providers, regulators, and the public [6,7]. There is a need to monitor healthcare quality indicators to identify where unwarranted clinical variation is occurring, design preventive measures and quality improvement strategies, and set priorities for policy or strategic planning [7]. Monitoring indicators also allows for comparing outcomes over time and evaluate the

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impact of quality improvement efforts [7]. The extent of unwarranted clinical variation across providers of care of children and young people who were injured and hospitalised in Australia has not been identified.

The overall objective of this study was to examine unwarranted clinical variation across providers of care of children and young people who were hospitalised for injury in New South Wales (NSW), Australia, using three indicators: (1) representations to an ED within 72 h after admission; (2) unplanned readmissions to hospital within 28 days after discharge; and (3) all-cause mortality within 30 days after hospital admission.

# Methods

# Study design

This was a retrospective population-based cohort study of children and young people aged  $\leq 25$  years who had an injury-related hospital admission in NSW during 1 January 2010–30 June 2014. NSW is the most populous state in Australia, accounting for almost one third of the country's 24 million residents (7.6 million), including an estimated 2.5 million children and young people aged  $\leq 25$  years [8].

# Data sources and linkage

This cohort study used linked ED presentation, hospital admission, and mortality data. The ED presentation data contained information collected in the majority of public hospital EDs, while the hospitalisation data contained information on all inpatient

### Table 1

Chronic health conditions and ICD-10-AM classifications.

admissions from all public and private hospitals. Diagnoses and external cause codes in the hospitalisation data were classified using the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM). The mortality data contains demographic data and fact of death on all registered deaths, along with the cause of death.

The data linkage process was conducted by the Centre for Health Record Linkage (CHeReL). The CHeReL used computerised probabilistic matching of identifying information (e.g., name, address, date of birth, and sex), supplemented by a manual clerical review of uncertain matches, to link ED presentation, hospitalisation, and mortality records [9].

### Identification of index injury records

Index injury hospitalisation records were selected using the following criteria: a hospital admission date from 1 January 2010 to 30 June 2014; a principal diagnosis of injury (i.e., ICD-10-AM: S00-T78); and a patient aged  $\leq$ 25 years, which aligns with the World Health Organization's definition of children or young people [10].

### Indicators of unwarranted clinical variation

Unwarranted clinical variation was examined using the following three indicators: (1) representation to a public hospital ED within 1–72 hours after the presentation/admission of the index injury; (2) unplanned readmission to hospital within 28 days after the date of discharge for the index injury; and (3) mortality occurring within 30 days after the date of admission for the index injury. Unplanned hospital readmissions were identified if the

Condition	ICD-10-AM classifications
Circulatory system	
Hypertension	I10-I15
Congenital malformations	
All congenital malformations	Q00-Q99
Congenital malformation of the heart and great arteries	Q20-Q25
Digestive system and allergies	
Celiac disease and other serious allergies	K52.2, K90.0, T78.0, T78.2, T78.4
Endocrine, nutritional and metabolic conditions	
Diabetes	E09-E14
Obesity	E66
Cystic fibrosis	E84
Immune system conditions and coagulation defects	
Anaemia	D50-D53 and D55-D64
Coagulation defects (e.g., haemophilia)	D65-C68
Mental health conditions	
Autism spectrum disorders	F84
Behavioural and emotional disorders of childhood	F90-F98
Cognitive and behavioural delay	F80-F83 and F88-F89
Eating disorders	F50
Hyperkinetic disorder	F90
Mental retardation	F70-F79
Mood affective disorders	F30-F39
Neurotic, stress-related and somatoform disorders	F40-F48
Personality disorders	F60-F69
Schizophrenia, schizotypal and delusions disorders	F20-F29
Neoplasms	
All malignancies	C00-D48
Acute lymphoblastic leukaemia and acute myeloid leukaemia	C91.0, C92.0
Brain cancer	C71
Nervous system conditions	
Cerebral palsy	G80
Epilepsy	G40
Renal conditions	112.0, 113.1, NO3, NO5, N18-N19, N25.0, Z49, Z94.0, Z99.2
Respiratory conditions	
Chronic lower respiratory disease	J40-J47
Asthma	J45

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