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A 3-year retrospective review of hospital admissions involving opioid toxicity in South Australia

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Abstract

Introduction: This article aims to characterise hospital admissions involving opioid toxicity across South Australia to guide future implementation and evaluation of risk mitigation strategies.

Methods: International Classification of Diseases, 10th Edition codes (T40.0–T40.4) were used to identify admissions involving pre-hospital opioid toxicity in public hospitals across South Australia from 1 June 2017 to 30 August 2020. Demographic and episode of care data were extracted and summarised using descriptive statistics. Admission cost estimates were calculated using Independent Hospital Pricing Authority data.

Results: A total of 2046 cases met the criteria for inclusion; over half (56%) were female and median age on admission was 44 years (interquartile range 27 years). Where opioid toxicity was the primary diagnosis, 70% of admissions did not specify the responsible opioid and 23% were related to heroin use. One-fifth of admissions occurred outside of metropolitan Adelaide. Individuals living in an area of relative socio-economic disadvantage were over-represented. Over half of admissions required a stay >24 h; 19% were admitted for ≥5 days, 22% required intensive care and ~10% required mechanical ventilation. The total estimated cost of admissions involving opioid toxicity in South Australia over the 3-year period was $18,230,546.50, equating to $5.6 million per annum.

Discussions and Conclusions: These findings highlight the significant personal, fiscal, and systemic impacts of opioid toxicity-related hospital admissions in South Australia and provide a baseline to evaluate the effectiveness of initiatives to reduce opioid-related harm, including real-time prescription monitoring and take-home naloxone supply.

KEYWORDS
opioid toxicity, preventative healthcare, risk mitigation

Key Points

- This article provides South Australia-specific data detailing the characteristics of hospital admissions involving opioid-toxicity, quantifies the financial impact of admissions involving opioid-toxicity in the state and explores potential risk mitigation strategies.

- The findings of this study will allow practitioners and policymakers to tailor implementation of risk mitigation strategies to maximise benefits for the community and health system.

1 | INTRODUCTION

Opioids continue to be the most commonly identified substances involved in drug-induced overdose deaths in Australia, accounting for almost 60% of all drug-induced overdose deaths in 2021 [1]. In Australia, between 2006 and 2018, heroin-related deaths increased by 500%; oxycodone, morphine and/or codeine-related deaths increased by 89%; and synthetic opioid-related deaths increased by almost 1500% [2].

Hospitalisations relating to opioid poisoning in Australia have also increased. From 2007–2008 to 2016–2017, the rate of hospitalisation for patients with a principal diagnosis of opioid toxicity increased by 25%, while hospitalisations in which opioid toxicity was implicated (but not the principal diagnosis) increased by 38% [3]. In 2018, there were ~150 hospitalisations, 14 emergency department presentations and 3 drug-related deaths involving opioid toxicity across Australia per day [3].

Publications summarising the characteristics of, and costs associated with, South Australian (SA) hospital presentations involving opioid toxicity are lacking. State-based data are essential as tertiary health services in Australia are predominantly state funded. Thus, in this article, we describe hospital presentations involving opioid toxicity in SA and the associated healthcare costs estimated to provide a basis to inform and evaluate the direction and impact of future potential risk mitigation strategies.

2 | METHODS

Admissions to all SA public hospitals ($n = 54$) from 1 June 2017 to 30 August 2020 were reviewed to identify those involving opioid toxicity. After consulting with the local hospital coding team, inclusion criteria were set to target admissions with (i) an International Classification of Diseases, 10th Edition (ICD-10) diagnostic code of T40.0–T40.4; and (ii) a condition onset flag coded as 'condition not noted as arising during the episode of admitted patient care' (thus excluding cases where opioid toxicity occurred during the hospital stay).

Data regarding patient demographics (sex, age on admission, country of birth, postcode) and the episode of hospitalisation (length of stay, admission site, primary diagnoses, time in intensive care unit [ICU], time ventilated, nature of separation, discharge referrals) were extracted for each admission. Outlying data points that were considered to result from inaccurate data entry (e.g., age documented as 129 years) were excluded. The Socio-Economic Indexes For Areas score of relative socio-economic (dis)advantage was determined using the patient's documented postcode [4].

Patient and admission data were summarised using descriptive statistics. Total admission cost estimates were calculated based upon the count of inpatient and ICU days using Independent Hospital Pricing Authority data [5].

In line with Chap. 2.3 of the National Statement on Ethical Conduct in Human Research, this project was deemed exempt from the Human Research Ethics Committee review as it formed the first phase of a quality improvement project (serving to guide implementation of a local take-home naloxone [THN] program). However, this article was reviewed and granted publication approval from the Central Adelaide Local Health Network Human Research Ethics Committee (Reference 17651).

3 | RESULTS

A total of 2046 admissions involving opioid toxicity were identified over the inquiry period. Female patients slightly predominated ($n = 1150$, 56.2%). The median age on admission was 44 years (interquartile range 27 years). Approximately 6% ($n = 118$) of cases involved children (<18 years). Notably, almost a fifth of these ($n = 21$) were 5 years old or younger. Most patients were Australian born ($n = 1622$, 79.3%) and the overall spread across countries of birth appeared to be reasonably representative of the broader SA population [6]. A summary of patient characteristics is presented in Table 1. Consistent with 22% of the SA population living outside the greater metropolitan region [7], around one-fifth of admissions ($n = 424$, 20.7%) were for patients living in non-metropolitan areas; most commonly in areas of greatest relative socio-economic disadvantage (Figure 1).

A summary of the characteristics of admissions involving opioid toxicity is presented in Table 2. Admission rates were reasonably consistent across all days of the week. Opioid toxicity was determined to be the primary diagnosis in just under half of all admissions ($n = 971$, 47.5%), most of which were attributed to unspecified opioids or synthetic narcotics ($n = 682$, 70.2%). The

TABLE 1 Summary of patient characteristics for admissions ($n = 2046$) involving opioid toxicity to public hospitals in South Australia between 1 July 2017 and 30 August 2020.

Patient characteristics	*n* (%)
Sex	
Female	1150 (56.2)
Male	896 (43.8)
Age bracket, years	
0–9	22 (1.1)
10–19	162 (7.9)
20–29	328 (16.0)
30–39	332 (16.2)
40–49	416 (20.3)
50–59	365 (17.8)
60–69	214 (10.5)
70–79	112 (5.5)
80–89	70 (3.4)
90–99	24 (1.2)
Country of birth	
Australia	1622 (79.3)
England	83 (4.1)
Germany	17 (0.8)
Iran	11 (0.5)
Italy	13 (0.6)
New Zealand	26 (1.3)
Scotland	14 (0.7)
United Kingdom, Channel Islands, and Isle of Man	46 (2.2)
Not stated or inadequately described	110 (5.4)
Other	104 (5.1)

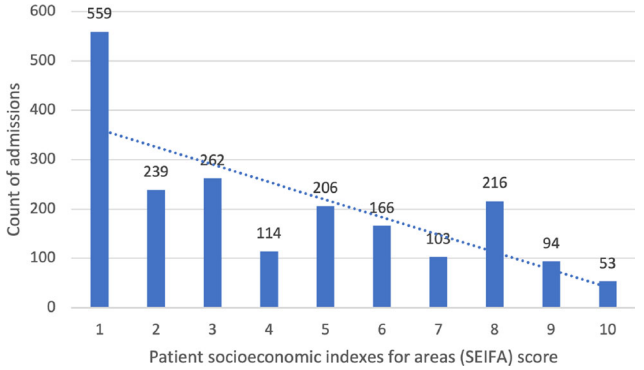

FIGURE 1 Number of admissions involving opioid toxicity by Socio-Economic Indexes For Areas (SEIFA) scores associated with patients' home postcodes. SEIFA scores summarise the socio-economic characteristics of small geographical regions, providing a mechanism to consider the differences in socio-economic factors between. The scores correspond to whether the geographical area is relatively advantaged or disadvantaged, with a lower index score indicating that an area has more disadvantage relative to areas with a higher score [4].

majority ($n = 1373$, 67.1%) of patients were not referred to further services beyond their acute admission.

Over half ($n = 1091$, 53.3%) of all admissions involving opioid toxicity required a hospital stay of ≥24 hours (h), with a substantial proportion ($n = 379$, 18.5%) requiring ≥5 days. Nearly, a quarter ($n = 452$, 22.1%) required an ICU admission, resulting in a combined total of 21,255 h of intensive care. Of those admitted to the ICU, over half ($n = 230$, 50.9%) had a primary diagnosis of opioid toxicity. Almost 10% of patients ($n = 199$) required mechanical ventilation. In total, 8035 h of ventilation were provided across all admissions.

The financial cost associated with admissions involving opioid toxicity was estimated using several sources. In total 135,468.6 h (5644.525 days) of non-ICU hospital care were provided. Given the National Hospital Cost Data Collection Report indicated that the average daily cost of a SA-based acute inpatient admission during the 2019–2020 financial year was 2439 AUD [8], this represented a total cost of 13,766,996.50 AUD. In total 21,255 h (885.625 days) of ICU care were provided. Given the 2019 Independent Hospital Pricing Authority cited an average ICU bed day cost of 5040 AUD [9], this represented an ICU cost for this sample of 4,463,550 AUD. The combined total cost for acute inpatient and ICU admissions over this 39-month period was therefore 18,230,546.50 AUD–5,609,398.92 AUD per annum.

4 | DISCUSSION

This article summarises the demographic and admission characteristics of >2000 admissions involving opioid toxicity in SA over a 39-month period. Admissions involving opioid toxicity were estimated to cost the SA health system ~5.6 million AUD per annum. Given past opioid toxicity is a known risk factor for subsequent opioid-related harm [10], these findings can be used alongside concurrent reports [11] to inform design and implementation of risk mitigation strategies to improve population health and optimise health system sustainability. These data also provide a baseline to evaluate the effectiveness of initiatives to reduce opioid-related harm.

Areas of greatest socio-economic disadvantage were markedly over-represented across opioid toxicity-related admissions. The link between lower socio-economic status and increased risk of opioid-related harms has been

TABLE 2 Summary of characteristics for public hospital admissions ($n = 2046$) involving opioid toxicity in South Australian between 1 July 2017 and 30 August 2020.

Admission characteristics	*n* (%)
Day of the week admission occurred	
Monday	289 (14.1)
Tuesday	321 (15.7)
Wednesday	272 (13.3)
Thursday	282 (13.8)
Friday	275 (13.4)
Saturday	331 (16.2)
Sunday	276 (13.5)
Principal diagnosis	
T40.1: Heroin	225 (11.0)
T40.2: Other opioids	463 (22.6)
T40.3: Methadone	64 (3.1)
T40.4: Other synthetic narcotics	219 (10.7)
Total number of opioid-related principal diagnoses	971 (47.5)
Overall length of stay, hours	
<24	955 (46.7)
24–47	339 (16.6)
48–71	164 (8.0)
72–95	131 (6.4)
96–119	78 (3.8)
120+	379 (18.5)
Hours on ventilator	
0	1847 (90.3)
1–12	62 (3.0)
13–24	67 (3.3)
25–48	33 (1.6)
49–72	15 (0.7)
73–120	10 (0.5)
>120	12 (0.6)
Referral outcome on discharge	
At home services	20 (1.0)
Mental health service (community + private)	127 (6.2)
Residential mental health service	9 (0.4)
Referral to other services/practitioners[a]	391 (19.1)
Not referred	1373 (67.1)
Primary diagnoses of patients admitted to ICU	
Other opioids	117 (25.9)
Heroin	68 (15.0)
Benzodiazepines	46 (10.2)
Paracetamol	35 (7.7)
Antidepressants	33 (7.3)
Other synthetic narcotics	25 (5.5)
Antiepileptics	21 (4.6)
Methadone	20 (4.4)
Antipsychotics and neuroleptics	16 (3.5)
Psychostimulants	10 (2.2)

Abbreviation: ICU, intensive care unit.

[a]Includes referral to drug and alcohol inpatient services, not presented separately to protect privacy due to small count.

documented previously [12]. Equitable distribution of, and access to, risk mitigation and health promotion approaches are required to optimise safe medication use in these communities.

Just over 1% of hospital admissions involving opioid toxicity involved children aged ≤10 years. The most likely cause was accidental poisoning after accessing a caregiver's opioid medication. This link has been previously established, with children of mothers prescribed opioids shown to be at greater risk of accidental opioid overdose compared with controls [13]. Given these findings, and as opioids are the leading cause of poisoning deaths in Australian children [14], it is critical health professionals provide parental/carer education about dangers of opioid exposure in children, safe medication storage, and appropriate disposal approaches to minimise risk.

Opioid-related morbidity and mortality are known to be costly to the Australian public health system. Costs calculated in this evaluation did not consider potential ambulance or emergency department services associated with admissions. During the 2019–2020 financial year, each patient presentation to an SA-based emergency department that resulted in admission was estimated to cost 1086 AUD [8]. If applied to this dataset, this would equate to an additional 2,221,956 AUD on top of the 5.6 million AUD annual cost identified.

The Australian government launched a pilot providing free access to THN in three Australian states in 2019 [15]. SA public hospital participation in the pilot was limited, thus this sample largely represents a pre-THN program baseline. Evaluation of the THN pilot program from December 2019 to June 2021 found it saved an estimated three lives per day [15]. Guidelines recommend provision of THN to all at-risk patients [16], which would encompass all patients in this dataset. A recent study determined expansion of the THN program to include 90% of patients prescribed oral morphine equivalent daily doses of >50 mg

would save over 650 lives between 2020 and 2030, saving 43,600 AUD per life [17]. Staff education on provision of THN is required to achieve this, as staff attitudes and awareness are barriers to hospital-initiated supply [18]. To enhance THN access in remote and disadvantaged communities, increased funding for awareness campaigns highlighting THN availability, flexible distribution strategies tailored to local services (including distribution by non-traditional suppliers), and initiatives to encourage proactive supply by local health professionals (such as audit and feedback [19]) are recommended.

Real-time prescription monitoring became mandatory in SA from April 2022 [20]. Diligent use of this tool could assist health professionals in identifying high-risk prescription opioid use. Evaluating hospital admissions involving prescription opioid toxicity in the future could provide one avenue to assess the impact of real-time prescription monitoring in SA.

A history of opioid toxicity is a major risk factor for future toxicity [10], yet for most patients no referral to further services was documented. Referral to drug and alcohol services to manage dependence or to pain management services for review of pain-related opioid regimens may reduce future risk. We believe several factors may contribute to low referral rates, which could be further explored to improve continuity of care. Across the hospitals in this study, availability of consultant liaison addiction medicine clinicians is low. Inpatient teams may also overlook misuse of prescription opioids and the potential benefits of addiction medicine consultations. For short inpatient stays, requirements associated with ongoing care are often deferred to the GP. Finally, risks and significance of the toxicity episode may not be accepted by the patients during hospitalisation, which could limit willingness to engage with post-discharge follow-up.

These results should be considered in the context of several recognised limitations. First, the analysis did not include non-admitted presentations to, or treatment provided in, emergency departments. Many opioid toxicity-related events may therefore not have been captured, resulting in an underestimation of the impact of these admissions and the potential impact of future risk mitigation strategies. The decision to exclude non-admitted presentations also has potential to bias data, although the most severe non-fatal presentations were likely to have been captured. Furthermore, the analysis did not include data from private hospitals. Additionally, as patient data was de-identified, we were unable to identify re-presentations for the same patient within the data set, meaning there is the potential for multiple re-presentations which may have skewed the analysis of patient demographic trends.

It should be noted that patients included in this analysis often presented with concurrent diagnoses that may have impacted the extent and duration of hospitalisation, thus contributing to costs. While selection of appropriate codes to identify relevant admissions in this report was informed by the local coding team, coding can involve subjective decision-making resulting in a degree of inter-coder variability. Despite being the most pragmatic identification strategy, issues relating to reliance on ICD-10 coding to infer drug overdose have been described previously [21] and results should be interpreted with this in mind. Expanding to include further ICD-10 codes (e.g., T40.6) may have identified additional admissions, and, although not feasible in this work, use of a manual screening to confirm relevance could increase confidence in findings [22]. Future projects investigating patterns of opioid toxicity-related emergency presentations and deaths prior to admission would also be of use in further characterising opioid toxicity-related trends in SA.

5 | CONCLUSIONS

Australia is facing an increasing healthcare burden from rising rates of opioid toxicity-related morbidity and mortality. Our results suggest that certain patient groups are more vulnerable to opioid toxicity events than others, and that future risk mitigation strategies can be tailored to target these at-risk populations. Specific recommendations include the broad implementation of the state-wide THN program, conscientious use of real-time prescription monitoring, improved discharge referral to further healthcare services, and parental/guardian education around safe storage and disposal of opioids.

AUTHOR CONTRIBUTIONS

Each author certifies that their contribution to this work meets the standards of the International Committee of Medical Journal Editors.

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This research did not receive any specific funding.

CONFLICT OF INTEREST STATEMENT

Jacinta L. Johnson has received consultancy funds from the Pharmaceutical Society of Australia, the Pharmacy Guild of Australia and Mundipharma Pty Ltd for development and delivery of educational materials for pharmacists relating to take-home naloxone. All other authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support this study will be shared upon reasonable request to the corresponding author.

ETHICS STATEMENT

In line with Chap. 2.3 of the National Statement on Ethical Conduct in Human Research, this project was deemed exempt from the Human Research Ethics Committee review as it formed the first phase of a quality improvement project (serving to guide implementation of a local take-home naloxone program). This article was reviewed and granted publication approval from the Central Adelaide Local Health Network Human Research Ethics Committee (Reference 17651).

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