Seizure-related hospital admissions, readmissions and costs: Comparisons with asthma and diabetes in South Australia

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ABSTRACT

Purpose: Seizures are listed as an Ambulatory Care Sensitive Condition (ACSC), where, in some cases, hospitalisation may be avoided with appropriate preventative and early management in primary care. We examined the frequencies, trends and financial costs of first and subsequent seizure-related hospital admissions in the adult and paediatric populations, with comparisons to bronchitis/asthma and diabetes admissions in South Australia between 2012 and 2014.
Methods: De-identified hospital separation data from five major public hospitals in metropolitan South Australia were analysed to determine the number of children and adults admitted for the following Australian Refined Diagnosis Related Groups: seizure related conditions; bronchitis/asthma; and diabetes. Additional data included length of hospital stay and type of admission. Demographic data were analysed to identify whether social determinants influence admission, and a macro costing approach was then applied to calculate the financial costs to the Health Care System.
Results: The rate of total seizure hospitalizations was 649 per 100,000; lower than bronchitis/asthma (751/100,000), yet higher than diabetes (500/100,000). The highest proportions of subsequent separations were recorded by children with seizures regardless of complexity (47% +CSCC; 17% −CSCC) compared with asthma (11% +CSCC; 14% −CSCC) or diabetes (14% +CSCC; 13% −CSCC), and by adults with seizures with catastrophic or severe complications/comorbidity (25%), compared with diabetes (22%) or asthma (14%). The mean cost per separation in both children and adults was highest for diabetes (AU $4438/$7656), followed by seizures (AU$2408/$5691) and asthma (AU$2084/$3295).
Conclusions: Following the lead of well-developed and resourced health promotion initiatives in asthma and diabetes, appropriate primary care, community education and seizure management services (including seizure clinics) should be targeted in an effort to reduce seizure related hospitalisations which may be avoidable, minimise costs to the health budget, and maximise health care quality.

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1. Background

Seizures are identified as an ambulatory care sensitive (ACS) condition, where, in some cases, hospitalisation can be avoided with appropriate preventative care and management of the condition [1–3]. It is acknowledged that not all hospitalisations for seizures are preventable, including first seizures, febrile convulsions, seizures occurring from other diagnoses/non-epilepsy related causes, and uncontrolled epilepsy [4], with up to 30–40% of recurring seizures resistant to current treatment options [5]. However, for others, patient education, counselling and seizure-management support targeting medication compliance and lifestyle management, have been suggested to reduce avoidable hospitalisations [6,7], with research indicating patients who achieve better management of their seizures and comorbidities are likely to significantly reduce their use of healthcare services [8].

Other ACS conditions, including asthma and diabetes, have demonstrated the impact well-funded education and supports can play in reducing avoidable hospitalisations. Studies suggest rates of hospital admissions can be reduced by improving health self-efficacy and health literacy amongst patients and carers [9–12], whilst increasing the regularity of physician check-ups and

producing patient action plans [12–15]. In another study, children with asthma or epilepsy who were trained to identify signs of a pending asthma attack or seizure, and who were given strategies for managing their illness, had significantly fewer physician visits (asthma), and fewer hospital visits (epilepsy) over the course of a year compared to controls [16].

As epilepsy presents very differently between children and adults, health care costs can also vary between the two age groups [17]. Paediatric epilepsy management is associated with higher numbers of hospital admissions and investigations, with subsequently higher direct costs [18]. In the United States, an estimated US$4.05bn was spent on potentially preventable paediatric hospital admissions in 2006, with asthma and epilepsy the first and fourth leading causes of hospitalisation [19].

Accurate Australian prevalence rates for epilepsy, asthma and diabetes are limited; however self-report data from the Australian Bureau of Statistics (ABS) National Health Survey (NHS) in 2014–2015 indicate 10.8% of Australians had asthma, 5.1% diabetes, and 1.5% epilepsy and other episodic and paroxysmal disorders (ABS, 2015) [20].

Although other studies have examined seizure-related hospital admission rates in Australia for the period 1998–2004 by demography including socio-economic status (SES) and indigenous vs. non-indigenous groups [21], none have looked at children separately to adults and performed financial costings. This study determined: the rate and frequencies of first and subsequent hospital admissions coded for seizures, bronchitis/asthma, and diabetes in children and adults; the socio-demographic factors associated with admission and readmission; and the financial costs of hospitalisations.

2. Methods

2.1. Setting and data sources

De-identified hospital separation data from May 2012 to May 2014 were obtained from the Medical Records departments of five major South Australian public hospitals: the Women's and Children's Hospital; Flinders Medical Centre; Lyell McEwan Hospital; Queen Elizabeth Hospital; and the Royal Adelaide Hospital. These sites were selected as they are the major public paediatric or adult emergency hospital facilities in metropolitan South Australia.

South Australia has a population of just over 1,700,000, with estimates indicating this will increase to over 1.9 million by 2026 [22]. In 2014, 1,276,700 (75%) of South Australians lived in urban areas, with resident Aboriginal and Torres Strait Islander population estimated to be 39 773 [22].

Hospital separation data were sent to the investigators as an excel file. The term 'separation' refers to the formal process where a hospital records the completion of an episode of treatment and/ or care for an admitted patient [23]. Data files included separations with selected AR-DRG codes presented in Table 1. AR-DRGs are an Australian casemix classification system used to inform hospital funding allocations. Patients admitted to hospital are categorised into groups with analogous clinical conditions requiring similar hospital services [24]. The average cost per casemix-adjusted separation is a means of calculating the average cost of treating a range of different diagnoses after controlling for differences in complexity of care for an episode of care [25]. Additional information collected included: type of admission (inpatient or emergency); length of hospital stay (days); number of readmissions (determined by individual hospital patient ID numbers); care provided (surgical, medical); care type (acute, maintenance, other admitted patient care); and demographic data (age, gender, postcode, indigenous status, country of birth, ethnicity). The term 'separation' refers to the formal process where a hospital records the completion of an episode of treatment and/or care for an admitted patient [23].

2.2. Data analysis

All analyses were conducted using SPSS (version 23). Descriptive statistics were used to compare number of hospitalizations for children and adults. We compared admissions by AR-DRG code and category (i.e. seizure, bronchitis/asthma, diabetes) as well as readmissions of patients in the dataset. Febrile convulsions are classified using a separate AR-DRG code, and were not included in the analysis. Differences between sociodemographic and socioeconomic variables for children and adults were also examined between the AR-DRG codes using Chi-Square and independent samples T-tests or Analysis of Variance (ANOVA) as appropriate. Socio-economic status was based on postcode Socio-Economic Index for Area (SEIFA), with lower decile values indicating higher disadvantage. This Index was developed by the Australian Bureau of Statistics and ranks areas in Australia according to relative advantage and disadvantage, based on the five yearly Census [26] and we also compared differences based on country of birth, indigenous status, age and gender. Differences in mean length of stay between AR-DRG codes were examined using Analysis of Covariance (ANCOVA) controlling for sociodemographic variables as co-variates.

2.3. Hospital costings

A macro-costing approach was used to estimate hospitalisation costs according to type and length of admission. Inpatient costs

Table 1
Coding of seizures, bronchitis/asthma & diabetes.

Diagnosis group	AR-DRG Code	Description	Average cost per AR-DRG (AUS$)	Average length of stay (days)	Average cost per inpatient bed-day
Seizures	B76A	Seizures with catastrophic or severe complication/ comorbidity (+CSCC)	$9199	6	$1530
	B76B	Seizures without catastrophic or severe complication/ comorbidity (-CSCC)	$3272	2	$1647
Bronchitis & Asthma	E69A	Bronchitis and asthma with catastrophic or complication/ comorbidity (+CSCC)	$5519	4	$1464
	E69B	Bronchitis and asthma without catastrophic of complication/ comorbidity (-CSCC)	$2706	2	$1573
Diabetes	K60A	Diabetes with catastrophic or severe complication/ comorbidity (+CSCC)	$10,788	7	$1460
	K60B	Diabetes without catastrophic or severe complication/ comorbidity (-CSCC)	$4810	3	$1531