

Which children are still dying from asthma? A Thirteen Year Review of Pediatric Asthma Deaths in British Columbia, Canada

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October 20, 2022

Abstract

Asthma deaths were rare in children but attention should be paid to those with a severe exacerbation (requiring systemic steroids, an ED visit or hospitalization) in the past year, more than three beta-agonist refills in a year and poor adherence to controller medication.

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To the Editor,

Pediatric deaths from asthma are rare, however a national inquiry into asthma deaths in the United Kingdom, including 28 children, found that 46% of deaths were avoidable¹.

We reviewed all pediatric asthma deaths from 2005 to 2018 in the province of British Columbia, Canada to understand if these patients had risk factors for asthma exacerbations.

METHODS

Patients with asthma as a cause of their death were identified from: 1) the Coroner's office if asthma was listed on the Coroner's report as an Immediate Cause of Death or as a Condition Contributing to Death (since 2007 all pediatric asthma deaths are reported to the Coroner's Service with a post-mortem examination done if the cause of death is not clear) or 2) the Discharge Abstract database at BC Children's Hospital if they had asthma listed as the most responsible or pre-admission diagnosis. BC Children's Hospital is the province's only tertiary care pediatric hospital and provides care for the critically ill children in the province.

Patients were included if they died between January 2005 and December 2018, were residents of British Columbia, and were aged 0-18 years at time of death. Data from coroner's records which includes records from primary care physicians and hospital charts were reviewed by a pediatric respirologist (CY) to confirm that asthma was the underlying cause of death and to obtain details of previous asthma care.

Administrative data on asthma-related hospitalizations, emergency room visits and dispensed prescription medication was obtained from de-identified national databases.

Informed consent was not obtained as the subjects were deceased however all clinical information was de-identified and is presented in aggregate. This study was approved by the UBC Research Ethics Board (H16-01655).

RESULTS

From January 2005 to December 2018, a total of ten deaths were identified from all sources. Upon further chart review, two deaths identified from the BCCH database that had asthma listed as a pre-admission comorbidity were not included as asthma was not the cause of death. The pediatric population at the midpoint of this time period was 938 628, leading to an estimated 0.07 deaths per 100 000 children per year. Deaths occurred in spring 38%, fall 25%, summer 22% and winter 13%.

There were an equal number of male and female children and the median age at death was 11 years of age (range 7-18 years). The most predominant ethnicity was Southeast and East Asian, followed by Caucasian and then First Nations.

All patients had at least one risk factor for severe asthma exacerbations (Table 1).

Asthma severity

Five children had a note regarding their asthma severity in medical records and it was classified as “mild”, “not severe” or “intermittent” in three and “severe” and “significant and poorly controlled” in two. Asthma severity as defined by the amount of daily asthma medication needed to maintain asthma control could not be assessed, as based on review of dispensed medications none of the patients had picked up enough controller medication in the last year for it to be used daily.

Medication usage and severe exacerbations

Half of the children were prescribed a daily controller medication and the other half were only prescribed controller medication with symptoms. Six patients had picked up a controller medication in the year before their death with adherence, defined as days of controller medication filled/365, ranging from 8% to 47% (median 33%) in those prescribed to be on a daily controller medication. All had picked up more than 2 SABA inhalers (range 800 to 2000 doses). Prescriptions for SABA were filled a median of 9 days prior to the day of death (range 4 to 60 days) with seven children filling the prescription within a month of their death including three children who reportedly had good control and during their terminal event were described as having sudden onset of death from asthma. 75% of patients had multiple providers prescribing short-acting beta agonists.

6 children had a severe exacerbation (hospitalization, ED visit, or course of systemic steroids) in the year before their death with only one having a lifetime history of an ICU admission.

Final event

All children in this series collapsed and had resuscitation outside of the hospital. Although these deaths occurred in the hospital, all children had evidence of severe anoxic brain injury or brain death shortly after arrival to hospital.

On history, the final event was described as having an acute onset of symptoms (within 3 hours) in half of the subjects and chronic onset (within days) in the other half.

Post mortem examinations in two patients showed findings consistent with asthma including mucous plugging of small bronchioles, eosinophilic inflammation, basement membrane thickening, smooth muscle hypertrophy and goblet cell metaplasia regardless of whether the attack was acute or chronic onset.

DISCUSSION

The number of pediatric deaths in this case series is similar to what has been reported in other Canadian studies² and is lower than the number of deaths per population in the United Kingdom¹ and the United States³. East/Southeast Asian ethnicities were over-represented as this ethnic group only accounts for 8% of the population in British Columbia. The predominance of deaths occurring in children aged 10 to 18 years old is the same as reported in a recent UK inquiry¹. All children had severe anoxic brain injury due to out of hospital arrests which identifies that in-hospital management of exacerbations is not contributing to asthma deaths.

Given the rarity of asthma deaths despite the high prevalence of asthma in children, it is important to note that all of the children in this case series had identifiable risk factors for asthma death most commonly: poor adherence to controller medication, overuse of short-acting beta agonists, and a recent exacerbation. Although previous studies identified that use of more than 12 inhalers of reliever in a year increased the risk of death⁵, a recent study found that this threshold is much lower with the use of more than 3 inhalers associated with an increased risk of death⁶, which was seen in this series with all children filling more than 3 inhalers but none filling more than 12. A limitation of prescription refill data is that it is not known if short-acting-beta-agonists were used or if they were filled to have additional rescue inhalers on hand. However, refills of rescue inhalers can act as an objective surrogate for asthma control given it is known that patients often overestimate their asthma control when asked⁷.

Asthma deaths were rare in children but attention should be paid to those with a severe exacerbation (requiring systemic steroids, an ED visit or hospitalization) in the past year, more than three beta-agonist refills in a year and poor adherence to controller medication.

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Word count 1335

Funding Statement: Financial support was provided in part by the Therapeutic Evaluation Unit of the BC Provincial Health Services Authority

Competing interests: None of the authors have competing interests for the content of this paper

Word count (excluding abstract): 995

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Table 1 Risk factors.docx available at <https://authorea.com/users/516088/articles/591151-which-children-are-still-dying-from-asthma-a-thirteen-year-review-of-pediatric-asthma-deaths-in-british-columbia-canada>