

Is asthma associated with increased risk of injury?

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Running head: Asthma and injury risk

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ABSTRACT

Background: Asthmatic patients are at higher risk of fracture and bruising due to the systemic side effects of corticosteroid medication. However, the link between asthma and injury leading to these adverse outcomes remains unclear.

Objective: This study investigated asthma and cause- and type-specific injury at the population level.

Methods: Using data from the 2001 and 2004 Australian National Health Surveys (n = 52,768), the prevalence and risk of experiencing specific causes and types of injury in the past four weeks were assessed by logistic and Poisson regression analyses.

Results: A history of asthma was associated with a higher prevalence of injury for both adults and children, as well as increased risk of incurring various causes and types of injury, after accounting for the effects of confounding factors.

Conclusions: The associations cannot be explained by the physiological systemic side effects of medication alone. Further research is needed to understand the underlying relationship so that an appropriate injury prevention strategy can be developed for asthma sufferers.

Keywords: bruising, fracture, injury risk, injury prevention, population study

INTRODUCTION

Asthma is a major public health problem affecting children and adults in both industrialised nations and developing countries (1-3). The prevalence of asthma appears to have increased steadily over the past decades. Although the observed trend may be partly due to improvements in education, awareness, screening and diagnosis, the increase is thought to reflect a real rise in the prevalence of environmental risk factors (1-2). Asthmatic patients are known to have a higher risk of fracture and bruising because of the systemic side effects of the corticosteroid medication (4-5). On the other hand, fracture and bruising are outcomes of injury events. Asthmatic children may have a high risk of injury potentially, since the presence of chronic conditions may affect their motor control and impair their mental processing. To the best of our knowledge, there is no established evidence on the relationship between asthma and risk of injury for the adult population. It is unclear whether asthma can increase the likelihood of an injury event in mature adults. Therefore, the present study aimed to ascertain the association between asthma and the risk of injury at the population level, using data from the 2001 and 2004 Australian National Health (ANH) surveys.

METHODS

Details of the ANH survey sampling strategy and data collection methods have been described elsewhere (6). Briefly, both ANH surveys were nationally focussed and conducted by the Australian Bureau of Statistics (ABS). The surveys covered urban and rural areas across all States and Territories of Australia and across all age groups. For children aged 0 to 17 years, an adult was interviewed on behalf of the child in the 2001 ANH survey, but for the 2004 survey, children aged 15 to 17 years were interviewed in person whenever possible with a parent or guardian's consent.

The ANH surveys collected information on the health status of the population, use of health services and other actions people had recently taken for their health, health-related aspects of lifestyle and risk factors, as well as demographic characteristics. Information was obtained through face-to-face interviews by trained ABS interviewers. In this study, data from the 2001 and 2004 ANH surveys were combined and analysed together.

The asthma histories were self-reported, and participants were asked whether they had ever been told by a doctor or health professional that they have asthma. Participants with positive responses were further asked whether their asthma was current, i.e. they had experienced symptoms within the last four weeks. According to the ANH survey definition, a recent injury was defined as an injury event that occurred in the past four weeks for which any of the following actions had been taken: consulted a health professional; sought medical advice; received medical treatment; reduced usual activities; other treatment for injury such as taking medications, using a bandage, band aid, heat or ice pack. Participants were further asked for the details of each injury event. No restriction was imposed on the total number of detailed events that could be reported in the 2004 ANH survey, whereas the 2001 ANH survey was limited to the three most recent events for which details were collected. The ABS classified injury events into the following causal categories: vehicle accident; low/high fall; attack by another person; bite or sting; hitting something or being hit by something; swallowing poisons; and others (e.g. near drowning, exposure to fire/chemicals/heat, loud sounds, electric shocks). The outcome of an injury event was recorded against the following classifications: fractures; dislocations, sprains, strains, torn muscles/ligaments; open wound; bruising; burns and scalds; poisoning; and others.

Details of demographic characteristics of the sample have been previously reported (7-8). Logistic regression was conducted to investigate the association between asthma status (without asthma; previous; current) and prevalence of injury in the four-week period. Poisson regression analyses were then undertaken to ascertain the association between asthma status and the rate of: (i) causes of injury and (ii) types of injury, in the four-week period prior to the survey. Analysis was performed separately for children and adolescents (0-17 years) and adults (≥ 18 years). For adults, adjustment for potential confounding effects was made with respect to age, gender, remoteness of the dwellings (major cities; inner regional area; other areas as defined by ABS), household income (five quintile groups), marital status (married or de facto relationship; not married), language spoken at home (English; others), education (no post-school qualification; post-school qualification but level not stated; vocational qualification; undergraduate diploma; bachelor degree or above), alcohol consumption level (as defined by the National Health and Medical Research Council 2000 guideline), smoking status (smoke daily; current smoker but not smoke daily; ex-regular smoker; never smoker), and survey year (2001; 2004). For children and adolescents, the regression models were adjusted for age, gender, remoteness of the dwellings, household income and survey year.

RESULTS

The total sample sizes for children and adults available from the surveys were 15349 and 37419, respectively. Overall, the prevalence of self-reported asthma was higher among children (current 12.5%, previous 10.5%) than adults (current 10.7%, previous 8.9%). Table 1 presents the results of the logistic regression analyses for the two groups. The prevalence of being injured in the four weeks prior to the survey was higher among participants with a history of asthma, regardless of whether the symptoms occurred in the last four weeks or not.

As shown in Table 2, the adjusted rates of experiencing specific causes of injury were significantly higher among participants with current asthma compared to others without a history of asthma for all causes except vehicle accidents. Adults with a history of asthma but without symptoms in the last four weeks had significantly increased risk of injuries resulting from hitting/being hit by something and being attacked by another person. Similarly, children and adolescents with a history of asthma but no symptoms in the last four weeks had significantly higher risk of injuries resulting from falls and bites/stings, when compared to those without a history of asthma.

Poisson regression results concerning types of injury are presented in Table 3. The risk of fracture was significantly higher among adults with asthma regardless of whether they had symptoms in the last four weeks, but there was no apparent difference in the observed fracture rates among children and adolescents. The risk of dislocations, sprains, strains and torn muscles/ ligaments and the risk of poisoning were only significantly higher among adults with symptoms in the last four weeks. The risk of bruising was significantly higher among participants with asthmatic symptoms in the last four weeks compared to their counterparts without a history of asthma.

DISCUSSION

In this study, Australians with a history of asthma had an increased prevalence of injury over a four-week period. Moreover, a history of asthma was also associated with increased risk of injury due to difference causes. There has been limited evidence on the relationship between asthma and injury in the literature and the available results were only concerned with children (9-12). For the adult population, past research has focused on the use of corticosteroid in relation to the risk of fracture and bruising among asthma patients (5, 13). The present

investigation represents the first study to assess the likelihood of experiencing specific causes and types of injury. The particular types of injury observed to be significantly related to asthma may be partly explained by the physiological side-effects of corticosteroid, such as the risk of fracture, bruising, and open wound (possibly related to skin thinning). However, the potential physiological side-effects of corticosteroids cannot readily explain the significantly higher risk among asthmatics of experiencing certain causes of injury such as being attacked by another person, falling or being bitten or stung. The mechanisms underlying such associations are not clear. It is plausible that asthmatic conditions and the medications used to treat asthma (including corticosteroids) may impair the mental function of patients and alter their responses to hazard. Corticosteroids, for example, have been found to increase the risk of mania (14-15), while mania is associated with risky behaviours which can lead to injuries (16-17). Alternatively, asthmatic patients may have a reduced level of physical activity compared to participants without asthma. Therefore, well-controlled asthmatics are likely to have more potential for injury during physical activity.

The data used in the present study were collected via the 2001 and 2004 ANH surveys. The large sample obtained was considered representative of the general Australian population. The large sample sizes also enabled separate analyses of adults and children with high statistical power. Our new finding suggested associations between a history of asthma and risk of different types and causes of injuries. Another strength was that potential confounding variables, such as demographic characteristics and lifestyle factors, were controlled for in the multivariate regression analyses. It should be noted that injuries of young children are typically driven by parent behaviour rather than child behaviour. In Australia, the youngest age of schooling is four to five years (when most children will spend a large amount of time away from their parents). A series of sensitivity analyses was performed by removing the 0-4

year old group. The results for children aged 5-17 years, presented as supplementary tables A1 to A3, indicate similar findings to our original analysis.

Several limitations should be taken in account. Asthma status was not clinically diagnosed and reported by a medical practitioner. Therefore, the observed prevalence of the condition might be prone to under-reporting. It is also possible, though less likely, that some participants might have incorrectly claimed to have asthma. Recall bias also posed as a limitation of the self-report method and might have affected the accuracy of asthma history, especially among older respondents for whom remembering past diagnoses over longer periods of time could be problematic. Nevertheless, we expect recall bias to be minimal for participants who experienced symptoms in the last four weeks. Patients with asthma tend to seek medical treatment after an injury event, but this is unlikely to explain why participants with a previous history of asthma were also found to have an increased risk of injury. In this study, the association between asthmatic medication intake and injury outcome could not be accessed directly. Finally, the study design was retrospective. Large scale longitudinal studies in Australia and other countries are recommended to confirm the observed findings.

CONCLUSION

Australian adults and children with a history of asthma were found to exhibit an increased risk of injury of various causes and types. The observations cannot be explained by the physiological systemic side effects of asthma medication alone. Further research is required to understand the unknown causes of the relationship between asthma and injury, so that appropriate injury prevention strategies can be developed for asthmatic patients.

DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Table 1. Asthma status and prevalence of injury in the past four weeks for adults (n = 37419) and children (n = 15349)

asthma status	injury in past 4 weeks	no injury in past 4 weeks	adjusted* odds ratio	95% confidence interval
≥18 years				
without asthma history	3906	26184	1.00	
current	719	3297	1.33	(1.21, 1.47)
previous	580	2733	1.18	(1.07, 1.31)
0-17 years				
without asthma history	2299	9516	1.00	
current	478	1445	1.39	(1.23, 1.58)
previous	405	1206	1.42	(1.25, 1.62)

* from multivariate logistic regression analyses

Table 2. Asthma status and risk of experiencing specific causes of injury in the past four weeks for adults (n = 37419) and children (n = 15349)

asthma status	number of injury events	number of participants	adjusted*	
			incidence rate ratios	95% confidence interval
≥18 years				
Vehicle accident				
without asthma history	68	30090	1.00	
current	10	4016	0.75	(0.32, 1.76)
previous	14	3313	1.60	(0.86, 2.97)
Low/high fall				
without asthma history	728	30090	1.00	
current	144	4016	1.31	(1.07, 1.60)
previous	102	3313	1.13	(0.89, 1.42)
Hitting something or being hit by something				
without asthma history	697	30090	1.00	
current	147	4016	1.45	(1.19, 1.77)
previous	116	3313	1.29	(1.04, 1.60)
Attack by another person				
without asthma history	53	30090	1.00	
current	23	4016	2.17	(1.23, 3.83)
previous	16	3313	1.90	(1.03, 3.49)
Bite or sting				
without asthma history	461	30090	1.00	

current	96	4016	1.41	(1.11, 1.78)
previous	75	3313	1.30	(0.99, 1.70)

Others

without asthma history	2059	30090	1.00	
current	352	4016	1.19	(1.05, 1.35)
previous	302	3313	1.05	(0.92, 1.21)

0-17 years

Low/high fall

without asthma history	1238	11815	1.00	
current	243	1923	1.26	(1.08, 1.46)
previous	214	1611	1.40	(1.19, 1.64)

Hitting something or being hit by something

without asthma history	392	11815	1.00	
current	104	1923	1.62	(1.28, 2.04)
previous	74	1611	1.23	(0.93, 1.61)

Attack by another person

without asthma history	70	11815	1.00	
current	22	1923	1.88	(1.13, 3.14)
previous	11	1611	0.98	(0.48, 1.99)

Bite or sting

without asthma history	346	11815	1.00	
current	76	1923	1.48	(1.13, 1.93)
previous	65	1611	1.62	(1.22, 2.14)

Others

without asthma history	502	11815	1.00	
current	115	1923	1.42	(1.14, 1.77)
previous	101	1611	1.41	(1.12, 1.77)

* from multivariate Poisson regression analyses

Table 3. Asthma status and risk of experiencing specific types of injury in the past four weeks for adults (n = 37419) and children (n = 15349)

asthma status	≥18 years		0-17 years	
	Adjusted* incidence rate ratios	95% confidence interval	Adjusted* incidence rate ratios	95% confidence interval
fracture				
without asthma history	1.00		1.00	
current	1.77	(1.13, 2.79)	0.57	(0.26, 1.24)
previous	1.87	(1.16, 3.03)	1.11	(0.59, 2.07)
dislocations, sprains, strains, torn muscles/ligaments				
without asthma history	1.00		1.00	
current	1.31	(1.07, 1.61)	1.34	(0.98, 1.83)
previous	1.12	(0.89, 1.41)	1.31	(0.96, 1.80)
open wound				
without asthma history	1.00		1.00	
current	1.15	(1.01, 1.32)	1.18	(0.99, 1.39)
previous	1.11	(0.97, 1.29)	1.40	(1.18, 1.65)
bruising				
without asthma history	1.00		1.00	
current	1.22	(1.02, 1.47)	1.58	(1.34, 1.86)
previous	1.15	(0.94, 1.41)	1.15	(0.94, 1.40)
burns and scalds				
without asthma history	1.00		1.00	

current	1.35	(0.99, 1.81)	0.95	(0.52, 1.76)
previous	1.02	(0.72, 1.45)	1.23	(0.70, 2.16)
poisoning				
without asthma history	1.00		1.00	
current	2.84	(1.84, 4.39)	1.47	(0.80, 2.73)
previous	1.07	(0.53, 2.15)	0.83	(0.35, 1.95)
others				
without asthma history	1.00		1.00	
current	1.44	(1.13, 1.84)	1.38	(1.03, 1.85)
previous	1.25	(0.94, 1.65)	1.55	(1.15, 2.11)

* from multivariate Poisson regression analyses