

# Double trouble: impact of inappropriate use of asthma medication on the use of health care resources

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## Abstract

**Background:** There is considerable controversy about the regular use of short-acting  $\beta$ -agonists for the treatment of asthma. Although case-control studies have suggested that excessive use of these drugs may worsen asthma control and increase the risk of fatal or near-fatal asthma, the controversy remains unresolved because of the confounding that exists among disease control, disease severity and the use of short-acting  $\beta$ -agonists. Whatever the cause-and-effect relation between the use of short-acting  $\beta$ -agonists and disease severity, we hypothesized that their excessive use, in conjunction with underuse of inhaled corticosteroids, would be a marker for poorly controlled asthma and excessive use of health care resources.

**Methods:** To characterize the pattern of health services utilization among asthmatic patients taking various doses of inhaled  $\beta$ -agonists and corticosteroids in British Columbia, we linked the relevant health administrative databases. All patients between 5 and 50 years of age for whom a prescription for a short-acting  $\beta$ -agonist was filled in 1995 and whose prescription data were captured through the provincial drug plan were included in a retrospective analysis of prescriptions for asthma drugs, physician prescribing patterns and health services utilization. Patients' use of asthma medication was classified as appropriate (low doses of short-acting  $\beta$ -agonist and high doses of inhaled corticosteroid) or inappropriate (high doses of short-acting  $\beta$ -agonist and low doses of inhaled corticosteroid), and the 2 resulting groups were compared, by means of logistic, Poisson and gamma regression, for differences in prescribing patterns, physician visits and use of hospital resources.

**Results:** A total of 23 986 patients were identified as having filled a prescription for a short-acting  $\beta$ -agonist (for inhalation) in 1995. Of these, 3069 (12.8%) filled prescriptions for 9 or more canisters of  $\beta$ -agonist, and of this group of high-dose  $\beta$ -agonist users, 763 (24.9%) used no more than 100  $\mu\text{g}/\text{day}$  of inhaled beclomethasone. On average, those with inappropriate use of  $\beta$ -agonists visited significantly more physicians for their prescriptions (1.8 v. 1.4), and each of these physicians on average wrote significantly more prescriptions for asthma medications per patient than the physicians who prescribed to appropriate users (5.2 v. 2.5 prescriptions). Patients with inappropriate use were more likely to be admitted to hospital (adjusted relative risk [RR] 1.68, 95% confidence interval [CI] 1.25–2.26), were admitted to hospital more frequently (adjusted RR 1.81, 95% CI 1.41–2.32) and were more likely to require emergency admission (adjusted RR 1.93, 95% CI 1.35–2.77).

**Interpretation:** Despite the widespread distribution of guidelines for asthma pharmacotherapy, inappropriate use of asthma medications persists (specifically excessive use of inhaled short-acting  $\beta$ -agonists combined with underuse of inhaled corticosteroids). Not only are patients who use medication inappropriately at higher risk for fatal or near-fatal asthma attacks, but, as shown in this study, they use significantly more health care resources than patients with appropriate medication use.

## Research

## Recherche

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Concern over the regular use of inhaled short-acting  $\beta$ -agonists for the long-term management of asthma began in the 1960s, when the incidence of death from asthma increased after the introduction of a potent, nonselective  $\beta$ -agonist, isoprenaline-forte.<sup>1</sup> Although numerous subsequent studies<sup>2-8</sup> have resulted in significant controversy and continuing debate on this topic, it has become widely accepted that these agents should be used on an "as-needed" or "rescue" basis only. As a result, current guidelines<sup>9,10</sup> define appropriate asthma management as optimization of inhaled corticosteroid doses with or without add-on therapy, such that short-acting  $\beta$ -agonists are required fewer than 4 times weekly, on an as-needed basis only.

Some asthmatic patients may be using greater-than-recommended doses of short-acting  $\beta$ -agonists because of severe asthma that is refractory to treatment, but it has been our impression that excessive use of inhaled short-acting  $\beta$ -agonists without adequate doses of inhaled corticosteroids persists in British Columbia, despite the wide dissemination of the guidelines. We postulated that patients who used excessive doses of short-acting  $\beta$ -agonist as their mainstay of therapy (i.e., without sufficient concomitant inhaled corticosteroids) would probably require more health care services, an outcome that would suggest poor asthma control and potentially poorer quality of life and that would entail greater health care expenditures.

We hypothesized that asthmatic patients between 5 and 50 years of age whose disease was managed inappropriately would be admitted to hospital more frequently for respiratory indications and would need more physician visits for these conditions than patients whose asthma was managed appropriately. Inappropriate medication use was defined as use of 9 or more canisters of salbutamol (200 puffs, 100  $\mu$ g/puff) (or an equivalent), combined with no more than 100  $\mu$ g/day of inhaled beclomethasone (or an equivalent), in a 1-year period. Appropriate medication use was defined as 4 or fewer canisters of salbutamol and at least 400  $\mu$ g/day of beclomethasone. These definitions limited our analysis to patients whose asthma could be considered controlled (on the basis of their limited use of short-acting  $\beta$ -agonists) and those whose asthma could be considered uncontrolled and who might therefore benefit from higher doses of inhaled corticosteroids. The analysis excluded patients who used excessive amounts of  $\beta$ -agonists in conjunction with high doses of inhaled corticosteroids; these patients might have had severe intractable asthma and might therefore have been at greater risk of adverse outcomes, independent of their use of  $\beta$ -agonists.

## Methods

We conducted a cross-sectional study of 1995 data on hospital admissions, physician visits and medications dispensed for individual patients by linking 3 British Columbia Ministry of Health administrative databases: Pharmacare, the Medical Services Plan and

Hospital Programs. All patients between 5 and 50 years of age for whom at least one prescription for a short-acting  $\beta$ -agonist was filled in 1995 and who were in the Pharmacare database were included in the study. Patients older than 50 years of age were excluded to limit the possibility that  $\beta$ -agonists were being taken for other chronic respiratory illnesses, such as chronic obstructive pulmonary disease and emphysema.

Pharmacare is the BC government's pharmaceutical reimbursement program. It provides comprehensive coverage for all senior citizens (plan A, patients 65 years of age and older), all people receiving social assistance (plan C) and families in the general population whose annual drug expenses total more than \$600 (the annual deductible) (plan E). Under plan E, once a family reaches the \$600 threshold, members become eligible for reimbursement of drug expenditures, and the complete drug profile of all family members (including drugs prescribed before the family reached the threshold level of expense) is added to the database. Because plan A covers only patients 65 years of age and over (i.e., outside our age criteria), only patients in plans C and E were included in this study.

The Medical Services Plan database contains the billing records of all physicians in the province and was used to ascertain the number of physician visits by each subject in the study.

The provincial Hospital Programs database captures data on all hospital admissions in the province, including urgency, primary diagnosis and length of stay.

Each short-acting  $\beta$ -agonist and inhaled corticosteroid formulation was uniquely identifiable in the Pharmacare database by its drug identification number, which facilitated standardization of doses. To control for differences in potency, strength and formulation, the total amount of each short-acting  $\beta$ -agonist and inhaled corticosteroid obtained by each patient was determined for the year, and these amounts were standardized in terms of number of 200-puff canisters of salbutamol (100  $\mu$ g per puff) or equivalent dose of beclomethasone dipropionate (micrograms per day) respectively. The multidose inhaler and dry powder formulations of each medication were assumed to be equivalent. All short-acting  $\beta$ -agonists (salbutamol, fenoterol and terbutaline) were considered equipotent, whereas budesonide 40  $\mu$ g and beclomethasone dipropionate 50  $\mu$ g were considered equivalent.

The 1995 asthma guidelines<sup>9,10</sup> defined asthma control as the use of no more than 3 puffs of short-acting  $\beta$ -agonist per week, which is equivalent to less than one 200-puff canister per year. Patients in this study were stratified into low and high drug use groups according to the standardized number of canisters of short-acting  $\beta$ -agonist obtained and the average standardized daily dose of inhaled corticosteroid. Low use of short-acting  $\beta$ -agonist was defined as the equivalent of no more than 4 canisters in 1 year, a level that allowed for use related to exercise-induced asthma and use of more than one canister concurrently. High use was defined as the equivalent of 9 or more canisters. Low use of inhaled corticosteroids was defined as an average daily dose equivalent to up to 100  $\mu$ g beclomethasone, and high use was defined as an average daily dose of at least 400  $\mu$ g. Next, each patient was classified into a subgroup on the basis of appropriate or inappropriate medication use, according to the combination of their use of  $\beta$ -agonist and inhaled corticosteroid. Patients with appropriate medication use were those with 4 or fewer canisters of short-acting  $\beta$ -agonist and at least 400  $\mu$ g/day of inhaled corticosteroid (low  $\beta$ -agonist and high corticosteroid use). Patients with inappropriate medication use were those with 9 or more canisters of short-acting  $\beta$ -agonist and no more than 100  $\mu$ g/day of in-

haled corticosteroid (high  $\beta$ -agonist and low corticosteroid use). For the purposes of this study, any patient who did not fall into 1 of these 2 subgroups was excluded from the analysis.

For the purposes of this study, prescribing physicians were doctors who prescribed any asthma medication to any of the patients in the study. The number of visits to each prescribing physician by each patient was determined from the Pharmacare database by means of a unique physician identifier that is recorded for each filled prescription of any asthma medication. In addition, the total number of physicians seen by each patient during the year, regardless of whether the patient received a prescription for an asthma medication from that physician (referred to here as "all physicians"), was determined from the claims database of the Medical Services Plan.

The occurrence and frequency of respiratory-related hospital admissions were determined from the Hospital Programs database on the basis of admissions specifying ICD-9 code 08 (diseases of the respiratory system, clinical modification of International Classification of Diseases, 9th revision<sup>11</sup>). Only admissions for which the primary reason was a respiratory-related condition were included. The number of patients admitted to hospital, the number of admissions among those who were admitted at least once and the number of admitted patients who required urgent admission (i.e., who were admitted after assessment in the emergency department) were determined.

The primary comparison of interest was between appropriate and inappropriate use of asthma medication. Student *t*-tests and  $\chi^2$  tests were applied to evaluate baseline differences between the 2 study groups. Multivariate analyses were then conducted to assess whether appropriate use was an independent predictor of health resource utilization, with adjustment for the effect of age (in years), sex and social status (health plan type). Unadjusted and adjusted relative risks due to inappropriate use for the various outcome variables, along with 95% confidence intervals, were computed using appropriate models.

Logistic regression was used to estimate the relative risks (RRs) of admission to hospital and of urgent admission. The Poisson regression was applied to model the frequencies of admission and of urgent admission. The Poisson regression model was also used to evaluate the pattern of physician visits (the number of unique physicians in the "prescribing physicians" and "all physicians" categories). Gamma regression models (generalized linear models with gamma-distributed outcomes and logarithmic link functions) were developed to estimate the RR values for the mean number of prescriptions per prescribing physician and the mean number of visits per physician.

For each model, the RR was computed as  $\exp\beta$ , where  $\beta$  was the coefficient in the regression model. For the Poisson and gamma regression models, the RR is the ratio of the mean outcome for inappropriate users to that for appropriate users. For the logistic regression models (modelling the risk of admission to hospital or emergency admission), the RR is the odds ratio for inappropriate users compared with appropriate users.

## Results

A total of 23 986 patients between 5 and 50 years of age filled at least one prescription for a short-acting  $\beta$ -agonist in 1995: 16 881 through plan C and 6959 through plan E (146 patients were covered by other plans and were excluded from the analysis). The overall prevalence of  $\beta$ -agonist use by all patients covered by plans C and E was 8.1%.

Table 1 shows the patterns of use of short-acting  $\beta$ -agonists and inhaled corticosteroids for all patients in the study group. More than half of the patients (12 727 [53.1%]) used low doses of both  $\beta$ -agonist and inhaled corticosteroid, but 3069 patients (12.8%) obtained 9 or more canisters of short-acting  $\beta$ -agonist or an average of 500  $\mu\text{g}$  (5 puffs) of salbutamol per day (high use). Of patients with high use of short-acting  $\beta$ -agonists, 1292 (42.1%) used the equivalent of up to 400  $\mu\text{g}/\text{day}$  of inhaled corticosteroids (low use), whereas only 1159 (37.8%) used the equivalent of more than 800  $\mu\text{g}/\text{day}$ . A total of 4671 patients (19.5%) met the criteria for appropriate use of asthma medications: low use of short-acting  $\beta$ -agonists (4 or fewer canisters) and high use of inhaled corticosteroids (at least 400  $\mu\text{g}/\text{day}$ ). Conversely, 763 (24.9%) of the 3069 patients who obtained 9 or more canisters of short-acting  $\beta$ -agonist used the equivalent of 100  $\mu\text{g}/\text{day}$  of inhaled corticosteroids or less (inappropriate use); this group accounted for 3.2% of the whole study population. In fact, 735 (96.3%) of those with inappropriate use did not receive any inhaled corticosteroids.

The characteristics of the 2 groups of patients are compared in Table 2. The proportion of females was higher in the appropriate-use group ( $p = 0.004$ ), and patients in this group were younger ( $p < 0.001$ ) and more likely to be covered by plan C ( $p = 0.001$ ).

Table 3 compares the 2 groups in terms of hospital ad-

**Table 1: Use of short-acting  $\beta$ -agonists and inhaled corticosteroids in 1995 by British Columbia patients 5–50 years of age**

Use of $\beta$ -agonist, no. of canisters/yr	Use of inhaled corticosteroid, $\mu\text{g}/\text{d}$ ; no. (and %*) of patients					Total
	$\leq 100$	101–200	201–399	400–800	$> 800$	
$\leq 4$	11 919 (49.7)	1430 (6.0)	671 (2.8)	3033 (12.6)	1638 (6.8)	18 691 (77.9)
5–8	808 (3.4)	205 (0.9)	176 (0.7)	406 (1.7)	631 (2.6)	2226 (9.3)
9–12	345 (1.4)	90 (0.4)	88 (0.4)	206 (0.8)	442 (1.8)	1171 (4.9)
13–20	248 (1.0)	89 (0.4)	89 (0.4)	207 (0.9)	380 (1.6)	1013 (4.2)
$> 20$	170 (0.7)	82 (0.3)	91 (0.4)	205 (0.8)	337 (1.4)	885 (3.7)
Total	13 490 (56.2)	1896 (7.9)	1115 (4.6)	4057 (16.9)	3428 (14.3)	23 986 (100.0)

\*Percentages are calculated with reference to the total number of patients in the study (23 986).

missions, emergency admissions, physician visits and prescriptions. A greater proportion of those with inappropriate medication use were admitted to hospital ( $p = 0.002$ ) and were admitted on an urgent basis ( $p = 0.001$ ) at least once during the year, and these patients were admitted ( $p = 0.006$ ) or admitted on an urgent basis ( $p = 0.005$ ) more frequently. The mean number of unique prescribing physicians seen per patient was significantly higher in the inappropriate-use group, as was the mean number of prescriptions per prescribing physician and the mean number of prescriptions per patient ( $p < 0.001$  for all comparisons). Although patients with appropriate and inappropriate use visited the same number of physicians overall (including physicians who did not prescribe asthma medication) ( $p = 0.16$ ), those with appropriate medication use had significantly fewer visits per physician in this category

( $p < 0.001$ ) and significantly fewer visits overall ( $p = 0.015$ ).

Table 4 lists the RRs and corresponding 95% CIs for admissions to hospital and physician visits, as determined by the logistic, Poisson and gamma regression analyses. In particular, patients with inappropriate medication use were more likely to be admitted to hospital (adjusted RR 1.68, 95% CI 1.25–2.26) and to be admitted urgently through the emergency department because of a respiratory disease (adjusted RR 1.93, 95% CI 1.35–2.77). Those with inappropriate use who were admitted to hospital were admitted more frequently (adjusted RR 1.81, 95% CI 1.41–2.32) and had more urgent admissions because of respiratory diseases (adjusted RR 2.07, 95% CI 1.52–2.83) than those with appropriate use. Our analysis showed that those with inappropriate medication use had more prescribing physicians (adjusted RR 1.33, 95% CI 1.26–1.41), received more pre-

**Table 2: Characteristics of study patients**

Characteristic	Patient group; mean (and SD)*		p value
	Appropriate use (n = 4671)	Inappropriate use (n = 763)	
Sex, no. (and %) female	2821 (60.4)	419 (54.9)	0.004
Age, yr	25.3 (13.7)	32.8 (11.2)	<0.001
Pharmicare plan C (receiving social assistance), no. (and %)	3391 (72.6)	468 (61.3)	0.001
Use of short-acting $\beta$ -agonists, no. of canisters/yr	1.9 (1.0)	16.9 (10.2)	<0.001
Use of inhaled corticosteroids, $\mu\text{g}/\text{d}$	16.6 (479.8)	2.7 (12.1)	<0.001

\*Except where indicated otherwise.

**Table 3: Use of health care resources by groups with appropriate and inappropriate use of asthma medications**

Use of health care resources	Patient group; mean (and SD)*		p value
	Appropriate use (n = 4671)	Inappropriate use (n = 763)	
<b>Hospital resources</b>			
Hospital admissions			
No. (and %) of patients admitted at least once	257 (5.5)	64 (8.4)	0.002
No. of admissions per patient	0.07 (0.34)	0.11 (0.42)	0.006
Urgent admissions			
No. (and %) of patients with at least one urgent admission	154 (3.3)	44 (5.8)	0.001
No. of urgent admissions per patient	0.04 (0.26)	0.08 (0.33)	0.005
<b>Prescribing physicians†</b>			
No. of "prescribing physicians" seen per patient	1.4 (0.7)	1.8 (1.4)	<0.001
No. of prescriptions‡ per physician	2.5 (1.5)	5.2 (4.2)	<0.001
No. of prescriptions per patient	3.3 (1.9)	7.5 (4.9)	<0.001
<b>All physicians§</b>			
No. of physicians seen per patient	5.1 (4.2)	4.8 (4.3)	0.16
No. of visits per physician	3.2 (3.0)	3.9 (3.8)	<0.001
No. of visits to all physicians per patient	14.9 (15.9)	16.7 (19.3)	0.015

\*Except where indicated otherwise.

†A prescribing physician was any physician who prescribed asthma medication for a member of the study group.

‡For any asthma medication.

§All physicians seen by all patients in the study group, whether or not they prescribed asthma medication.

scriptions per prescribing physician (adjusted RR 1.99, 95% CI 1.91–2.07) and had more prescriptions per patient (adjusted RR 2.34, 95% CI 2.26–2.41).

The pattern of visits to all physicians (including those who did not prescribe asthma medication) was similar between the 2 study groups, except that patients with inappropriate medication use each visited slightly fewer physicians (adjusted RR 0.94, 95% CI 0.91–0.98). However, these patients had more visits per physician for all physicians (adjusted RR 1.06, 95% CI 1.01–1.12) and more visits per patient to all physicians (adjusted RR 1.13, 95% CI 1.07–1.22).

There was little difference between the unadjusted and adjusted RR estimates, which indicates that age, sex and social status did not confound the effect of appropriateness of drug use on the various measures of health resource utilization.

### Interpretation

We found that inappropriately treated asthmatic patients were more likely than appropriately treated patients to receive more prescriptions, more likely to visit more prescribing physicians and more likely to be admitted to hospital, and were admitted to hospital more often. Thus, inappropriately treated patients appear to have poorer outcomes, independent of disease severity or control.

If an attempt was made to evaluate drug use among all

patients receiving prescriptions for short-acting  $\beta$ -agonists, appropriate and inappropriate use could only be identified by combining drug use data with clinical and physiologic markers of disease severity and control. In the absence of clinical assessments, we felt that it was reasonable to limit our analysis to patients whose appropriateness of management could be determined from drug use data alone. It can be argued that any patient using 9 or more canisters of short-acting  $\beta$ -agonist per year and 100  $\mu$ g or less of inhaled corticosteroids per day is receiving inappropriate management, independent of disease severity, given that this usage level of short-acting  $\beta$ -agonist significantly exceeds the asthma management guidelines (which specify about 1 canister per year).<sup>9,10,12</sup> Conversely, patients using 4 or fewer canisters of short-acting  $\beta$ -agonist and at least 400  $\mu$ g of inhaled corticosteroids per day are receiving appropriate management. This cut-off of 4 canisters for appropriate use is conservative, and allows for patients who have multiple canisters for convenience and those who use more than the recommended doses of short-acting  $\beta$ -agonist for exercise-induced asthma (whose use should not be considered excessive).

The drug usage pattern that we have identified reveals that asthma mismanagement persists, despite guidelines advocating the optimization of inhaled corticosteroid use so as to limit use of short-acting  $\beta$ -agonist to “rescue” situations only.<sup>9,10</sup> This analysis illustrates a subset of patients

**Table 4: Relative risks (RR) and 95% confidence intervals (CI) for use of health care resources by groups with appropriate and inappropriate use of asthma medications\***

Use of health care resources	Unadjusted RR (and 95% CI)	Adjusted† RR (and 95% CI)
<b>Hospital resources</b>		
Admission to hospital‡	1.56 (1.17–2.07)	1.68 (1.25–2.26)
Frequency of admission to hospital§	1.70 (1.34–2.16)	1.81 (1.41–2.32)
Urgent admission‡	1.81 (1.28–2.55)	1.93 (1.35–2.77)
Frequency of urgent admission§	1.95 (1.45–2.63)	2.07 (1.52–2.83)
<b>Physician resources</b>		
<i>Prescribing physicians</i>		
No. of prescribing physicians seen§	1.29 (1.21–1.36)	1.33 (1.26–1.41)
No. of prescriptions per prescribing physician¶	2.06 (1.98–2.15)	1.99 (1.91–2.07)
No. of prescriptions per patient§	2.28 (2.21–2.35)	2.34 (2.26–2.41)
<i>All physicians</i>		
No. of physicians visited§	1.95 (0.92–0.99)	0.94 (0.91–0.98)
No. of visits per physician¶	1.20 (1.14–1.26)	1.06 (1.01–1.12)
No. of visits per patient§	1.12 (1.05–1.20)	1.13 (1.07–1.22)

\*For values of RR greater than 1.0, the risk was greater among those with inappropriate medication use, whereas for values of RR less than 1.0, the risk was greater among those with appropriate medication use. For example, the risk of admission to hospital was 1.56 times greater (unadjusted) among those with inappropriate medication use than among those with appropriate use, and the frequency of admission to hospital was 1.70 times greater among those with inappropriate use than among those with appropriate use. For use of physician resources, the number of prescribing physicians seen by those with inappropriate medication use was 1.29 greater than the number seen by those with appropriate medication use.

†Adjusted for age, sex and Pharmacare plan.

‡Logistic regression.

§Poisson regression.

¶Gamma regression.

taking excessive amounts of short-acting  $\beta$ -agonist in conjunction with inappropriately low amounts of inhaled corticosteroids, who would probably benefit from an increase in inhaled corticosteroid dose. Such a change in drug use might result in lower use of  $\beta$ -agonist, fewer physician visits and fewer admissions to hospital.

It is impossible to determine from this analysis whether the high use of health care resources by those with inappropriate use of asthma medication is related specifically to excessive  $\beta$ -agonist use. An alternative reason might be that excessive  $\beta$ -agonist use is a marker of poor asthma management and that underuse of inhaled corticosteroids is responsible for the poorer outcomes. It can be concluded, however, that these patients experienced greater asthma-related morbidity and generated higher health care costs. Furthermore, because urgent admission is defined as "a need for immediate assessment due to life-threatening conditions," mortality rate may also be higher in this group.

Our study design did not allow us to determine which patient or physician factors were responsible for excessive use of  $\beta$ -agonists and inadequate use of inhaled corticosteroids. Individual patients may need to use large amounts of  $\beta$ -agonist because of poor compliance with inhaled corticosteroid medication (which most clinicians would agree is common among asthmatic patients), "addiction" to other side effects of the  $\beta$ -agonists (such as stimulation and hallucinations), genotypic predisposition to  $\beta$ -receptor down-regulation,<sup>13</sup> asthma that is unresponsive to steroids or asthma that is refractory to any treatment. Physician factors favouring excessive  $\beta$ -agonist use might include lack of awareness of recent asthma therapy guidelines or a practice with a high proportion of patients with severe asthma or of transient patients.

Despite our inability to say why some patients have high use of  $\beta$ -agonists, our results do show that patients who receive excessive doses of short-acting  $\beta$ -agonist with sub-optimal doses of inhaled corticosteroid use more health care services. Although we were not surprised that patients with inappropriate use received more prescriptions per prescribing physician, the finding that they received prescriptions from a greater number of unique physicians was unexpected. This may indicate deliberate solicitation of prescriptions from multiple physicians, or it may reflect a lack of continuity of care, which may partially explain the poorer outcomes in this group.

Both the number of unique physicians seen (including physicians not prescribing asthma medication) and the number of physician visits by this group of individuals were higher than among patients with appropriate medication use. These findings may reflect bias in the study population, which included only plan C and plan E Pharmacare beneficiaries. Plan C covers patients receiving social assistance, who represent the lower socioeconomic strata and the unemployed, among whom greater health services utilization has already been demonstrated.<sup>14-19</sup> People in plan E are those who individually or as a family exceeded the

\$600 deductible for the year and may therefore overrepresent patients using more drugs, patients with comorbid conditions or families with sick members.

On the basis of estimates of the 1995 BC population for this age group and an asthma prevalence of approximately 5%, we estimate that this sample represents approximately 20% of asthmatic patients in BC. The generalizability of our results is thus limited, yet our study illustrates the prevalence of inappropriate management and related outcomes in this population. The fact that 70.4% of our study population was of lower socioeconomic status indicates that further research is needed to investigate the possibility of a causal relation between income and asthma management.

For our analysis, we tracked hospital admission for any respiratory illness. Therefore, some of the admissions may have been for indications other than asthma, such as pneumonia, chronic obstructive pulmonary disease, chronic bronchitis or emphysema, since patients with any of these conditions may use short-acting  $\beta$ -agonists. However, we believe that contamination of the data by nonasthmatic patients was probably minor, given the relatively low prevalence of these disorders relative to the prevalence of asthma in the study age group.

The implications of the drug use patterns exemplified by this study are significant. Despite increasing evidence of excessive use of short-acting  $\beta$ -agonist as either a marker for or a cause of adverse outcomes, such excessive use remains prevalent. Inappropriately managed patients use more health care services, which suggests greater asthma-related morbidity and greater health care costs. We propose that the strategy employed in this study may be useful for identifying patients with excessive  $\beta$ -agonist use who might benefit most from an asthma education program, with the ultimate goal of improving asthma management and reducing utilization of health care services.

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*Contributors:* Dr. Anis was the principal investigator. Drs. Anis, Fitzgerald, Bai and Paré developed the hypothesis and the study design. Dr. Spinelli and Ms. Wang developed the statistical methodology and performed the statistical analyses.

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## How you can get involved in the CMA!

The CMA is committed to providing leadership for physicians and promoting the highest standard of health and health care for Canadians. To strengthen the Association and be truly representative of all Canadian physicians, the CMA needs to hear from members interested in serving in elected positions and on appointed committees and advisory groups.

The CMA structure comprises both governing bodies and advisory bodies either elected by General Council or appointed by the CMA Board of Directors. The Board of Directors - elected by General Council - has divisional, affiliate, resident and student representation, is responsible for the overall operation of the CMA and reports to General Council on issues of governance. CMA councils and committees advise the Board of Directors and make recommendations on specific issues of concern to physicians and the public. Four core councils and committees consist of either divisional or regional representation while other statutory and special committees, expert working and project advisory groups comprise individuals with interest and expertise in subject-specific fields. Positions on one or more of these committees may become available in the coming year.

For further information on how you can get involved, please contact:

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By getting involved, you will have an opportunity to make a difference.

We hope to hear from you.

## Comment vous pouvez participer à l'AMC!

L'AMC est vouée à jouer un rôle de chef de file auprès des médecins et à promouvoir les normes les plus élevées de santé et de soins de santé pour les Canadiens. Afin de renforcer l'Association et pour qu'elle représente véritablement tous les médecins du Canada, l'AMC a besoin de membres intéressés à occuper des charges élues et à siéger à des comités et des groupes consultatifs.

La structure de l'AMC est composée d'organes de régie élus par le Conseil général et d'entités consultatives nommées par le Conseil d'administration. Le CA, dont les membres sont élus par le Conseil général, réunit des représentants des divisions, des sociétés affiliées, des résidents et des étudiants en médecine et est chargé de l'administration générale de l'AMC. Il rend compte de questions de régie au Conseil général. Les conseils et les comités de l'AMC jouent le rôle de conseillers auprès du Conseil d'administration et présentent des recommandations au sujet de questions particulières qui intéressent les médecins et la population. Quatre conseils et comités principaux sont constitués de représentants des divisions et des régions, tandis que les autres comités statutaires et spéciaux, les groupes d'experts et les groupes consultatifs de projets réunissent des personnes qui s'intéressent à des sujets précis et possèdent des compétences spécialisées. Des postes pourront devenir vacants dans un ou plusieurs de ces comités en cours d'année.

Pour en savoir davantage sur les modalités de participation, veuillez communiquer avec

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Votre participation peut faire la différence.

Nous espérons avoir de vos nouvelles!