Asthma-related productivity losses in Alberta, Canada

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Objectives: To estimate the number and cost of asthma-related productivity loss days due to absenteeism and presenteeism (at work but not fully functioning) in Alberta in 2005.

Methods: Using data from the 2005 Canadian Community Health Survey, this study focused on people of working age (18–64 years), who reported having an asthma diagnosis. Total asthma-related disability days, including in-bed days and activity-restricted days, were estimated by multiplying the difference in the means of total disability days between asthmatics and nonasthmatics adjusted for sociodemographic characteristics and other health conditions by a multiple linear regression, with the number of asthmatics in the population. Number of productivity loss days was a sum between the number of in-bed days (absenteeism) and the number of activity-restricted days multiplied by a reduction in functional level (presenteeism), adjusted for five working days per week. Other data from Alberta or Canadian published literature, such as a reduction in functional level of 20%–30%, a labor participation rate of 73%, and an average wage of $158 per day in 2005, were also used for analyses.

Results: The prevalence of asthma was estimated at 8.5% among approximately 2.1 million people of working age in Alberta in 2005. The difference in the means of total disability days between asthmatics and nonasthmatics was 0.487 (95% CI: 0.286–0.688) in a period of two weeks or 12.7 (7.5–17.9) in one year. With the reduction in functional level of 20%–30%, the number of asthma-related productivity loss days was estimated from 442 (259–624) to 533 (313–753) thousand, respectively. The corresponding cost was from $70 ($41–$99) to $84 ($49–$119) million. Of these, the presenteeism accounted for 42% to 52%.

Conclusions: The results suggest that an improvement in the controlling of asthma could have a significant economic impact in Alberta and that presenteeism plays an important role in asthma-related productivity losses and therefore employers should not only pay attention to absenteeism, but also to presenteeism to minimize productivity loss.

Keywords: productivity loss, absenteeism, presenteeism, asthma, Alberta

Introduction

Asthma is a chronic inflammatory disorder associated with airway hyper-responsiveness to stimulus that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. These episodes are usually associated with widespread, but variable, airflow obstruction within the lung that is often reversible either spontaneously or with treatment.[1,2]

In Canada, it is estimated that currently over three million people have asthma. According to Statistics Canada, 8.3% of the population aged 12 and older have been diagnosed at some time as having asthma.[3] About 500 adults die from asthma each year.[4] The economic burden of asthma is considerable both in terms of direct medical costs and indirect costs due to productivity losses. According to Health Canada,[5] an economic burden of over $4 billion can be attributed to asthma, bronchitis and emphysema in 1998. Of this, indirect costs accounted for 53%. The costs of hospitalization and drugs for asthma alone were $102 million and 301 million in 1998, respectively.[5]

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In another study,[6] Krahn and colleagues estimated that the annual cost of asthma in Canada was from $504 to $648 million in 1990. Of this, indirect costs accounted for 39%. In southern Ontario, asthma cost per patient per year was estimated at $2,550 in 2005 with indirect costs accounting for 50%.[7]

In Alberta, it was estimated that the direct cost of asthma from a societal perspective was more than $65 million in 2006.[8]

Although the indirect costs account for a large share of the total cost, there is no Alberta-based study on indirect costs of asthma. The indirect costs mainly refer to productivity losses due to absenteeism (absent from work) and presenteeism (at work but not fully functioning). Though it can be costlier than absenteeism, presenteeism is not always apparent.[9] This study aims to estimate the number and cost of asthma-related productivity loss days due to absenteeism and presenteeism in Alberta.

Methods

The 2005 Canadian Community Health Survey (CCHS) was a cross-sectional survey, done by Statistics Canada, to collect information related to health status, health care utilization and health determinants for the Canadian population. The 2005 CCHS targeted people aged 12 years and older who live in private dwellings in 125 health regions in all provinces and territories of Canada. Using a multistage stratified cluster design, the survey included 132,221 people representing a population of 27,126,165. The corresponding numbers for province of Alberta were 11,800 and 2,686,119, respectively. The CCHS is well-known and validated and details have been published elsewhere.[10]

Using Alberta's data from the 2005 CCHS, this study focused on people of working age (18–64 years) who reported having an asthma diagnosis. We used a societal perspective with a one-year time horizon.

Total asthma-related disability days were estimated by multiplying the difference in the means of total disability days between asthmatics and nonasthmatics with the number of asthmatics in the population. A multiple linear regression was used to adjust the difference for sociodemographic characteristics and other health conditions of the people as shown in Table 1. These covariates were chosen based on the potential associations between them and disability days, and asthma; and on the availability in the dataset. The number of asthmatics in the population was estimated by multiplying the asthma prevalence among people of working age in the survey sample with the number of people of working age (the population size) estimated by using the weight of the sample. Because in CCHS data, the total disability days were for a two-week period, the one-year results were estimated by multiplying the two-weeks with 365/14.

The total disability days included the in-bed days (patients had to stay in bed) and the activity-restricted days. The proportions of these among the total disability days were based on the information about whether or not the respondents had the in-bed days or the activity-restricted days in the CCHS dataset. We assumed that on the in-bed days patients could not go to work, and on the activity-restricted days patients could work with a reduction in functional level.

Accordingly, the number of productivity loss days was a sum between the number of in-bed days (absenteeism) and the number of activity-restricted days multiplied by a reduction in functional level (presenteeism), adjusted for five working days per week, and for labor participation rate, which was 73% in Alberta in 2005.[11]

Regarding the reduction in functional level during restricted days of asthma patients, some previous Canadian studies used an arbitrary weight. For example, Krahn and colleagues[6] used a weight of 0.5. However, by surveying 892 adult asthma outpatients in southern Ontario, Ungar and colleagues[12] suggested that a weight from 0.2 to 0.3 would more accurately reflect restricted productivity loss days of asthma patients. Accordingly, these reductions in functional level were used for our analyses.

Using the human capital approach,[13,14] cost of productivity losses were estimated by multiplying the number of productivity loss days with the average wage per day in Alberta, which was $158 in 2005.[11]

In summary, absenteeism was in-bed days and presenteeism was restricted days multiplied by reduction in functional level (20%–30%). The number of productivity loss days was found by adding absenteeism and presenteeism data and multiplying by five working days per week (5/7) and by labor participation rate (73%). Therefore, the cost of productivity loss days was number of productivity loss days multiplied by average wage ($158).

A sensitivity analysis was performed for lower and upper boundaries of 95% confidence interval (CI) of the difference in means of total disability days between asthmatics and nonasthmatics, and for lower and upper boundaries of the reduction in functional level.

Any productivity losses from job change or premature death were excluded from this study. Stata 9.2 (Stata Corp., College Station, TX) was used for data analyses.

Table 1 List of variables studied

Name	Explanation	% of asthmatics (N = 723)	% of nonasthmatics (N = 7795)
Outcome variable			
Disability day	Total two-week disability days		
Main studied variable			
Asthma	Self-reported having an asthma diagnosis	100.0	0.0
Other health conditions			
Allergy	Self-reported having an allergy diagnosis	66.8	28.0
Smoke	Self-reported having smoked 100 or more cigarettes	53.0	53.5
Injury	Self-reported having at least one injury last year	30.2	23.5
Hospitalization	Self-reported having at least one hospitalization last year	11.9	8.4
Poor health	Self-perceived health as poor	5.1	2.1
Other, chronic	Self-reported having at least another chronic condition (other than allergy)	21.4	36.5
Sociodemographic characteristics			
Male	Sex	38.6	48.8
Age group 1	18–19 years old	6.2	4.4
Age group 2	20–24 years old	12.9	9.9
Age group 3	25–29 years old	13.7	12.2
Age group 4	30–34 years old	12.5	11.9
Age group 5	35–39 years old	11.3	11.3
Age group 6	40–44 years old	7.9	12.0
Age group 7	45–49 years old	8.9	10.0
Age group 8	50–54 years old	9.7	10.8
Age group 9	55–59 years old	8.9	9.6
Age group 10	60–64 years old (used as the reference in the model)	8.2	8.0
Married	Marital status	41.9	50.0
Job	Had a job last week	78.7	79.2
Poor	Household income is less than $15,000	6.1	5.1

Results

In total, there were 11,800 people aged 12 and older in the survey. Of this sample, 8,522 people were from 18 to 64 years old. Excluding three people who answered "don't know" and one person who answered "not stated" for the question of asthma, we included 8.518 people. The prevalence of asthma among these people was estimated at 8.5%. The sample was representative for a population size of 2,087,659.

Effects of asthma on the total disability days

Table 2 shows a multiple linear regression model examining influences of demographic characteristics and health conditions on the total two-week disability days of people. Controlling for other factors, the model showed that asthma significantly increased the disability days ($P < 0.001$). The difference in the means of two-week disability days between asthmatics and nonasthmatics was 0.487 (95% CI 0.286–0.688).

The other results shown by the model were also explainable and expected. For example, people with allergy, other chronic conditions, injury, poor health, hospitalization, and smoke had more disability days. Regarding sociodemographics, male, married, having a job last week, and people aged 60–64 years old had less while the poor had more disability days than otherwise. All the differences were statistically significant.

Table 2 Multiple linear regression of the two-week disability days

Variables	Coefficient	P value	95% Confidence interval	
Asthma	0.487	0.000	0.286	0.688
Allergy	0.446	0.000	0.309	0.583
Smoke	0.176	0.002	0.065	0.287
Injury	0.791	0.000	0.663	0.919
Hospitalization	1.184	0.000	0.989	1.379
Poor health	3.360	0.000	2.992	3.729
Other, chronic	0.380	0.000	0.244	0.517
Male	–0.254	0.000	–0.365	–0.143
Age group 1	0.566	0.001	0.235	0.897
Age group 2	0.378	0.006	0.110	0.645
Age group 3	0.233	0.071	–0.020	0.485
Age group 4	0.362	0.005	0.110	0.613
Age group 5	0.326	0.012	0.072	0.579
Age group 6	0.378	0.003	0.126	0.630
Age group 7	0.483	0.000	0.223	0.743
Age group 8	0.533	0.000	0.278	0.787
Age group 9	0.439	0.001	0.180	0.698
Married	–0.170	0.005	–0.289	–0.050
Job	–0.305	0.000	–0.447	–0.163
Poor	0.428	0.001	0.176	0.681
Constant	0.197	0.138	–0.064	0.457

Notes: N = 8518; R-squared = 0.115; P = 0.000.

Asthma-related disability days

We considered the difference in the means of total disability days between asthmatics and nonasthmatics as asthma-related disability days. By multiplying the two-week results with 365/14, asthma-related disability days per patient per year were estimated at 12.7 (7.5–17.9) (Table 3).

Table 3 also showed that the total asthma-related disability days and total asthma-related disability working days among Alberta's labor force were about 1.6 million and 1.2 million in 2005, respectively. Of these, the in-bed days accounted for 22% and the restricted days accounted for 78%.

Asthma-related productivity losses for Alberta

Table 4 shows the number and costs of asthma-related productivity loss days by lower and upper boundaries of the total asthma-related disability working days; as well as by lower and upper boundaries of the reduction in functional level, in Alberta in 2005. With the reduction in functional level of 20%–30%, number of asthma-related productivity loss days was estimated at from 442 (259–624) to 533 (313–753) thousand, respectively. The corresponding cost was from $70 ($41–$99) to $84 ($49–$119) million. Of these, the presenteeism accounted for 42%–52%.

Discussion

The indirect cost due to asthma-related productivity losses in Alberta was from $70 to $84 million in 2005. In combination with the direct cost (~$65 million),[8] asthma costs Alberta's economy from 135 to 149 million a year in terms of both direct and indirect cost. Of this, the indirect cost accounts for 52%–56%. This is comparable to results from other studies, such as a study by Ungar[7] in southern Ontario in 1995 where the indirect costs of asthma estimated to account for 50% of the total, or the *Economic Burden of Illness in Canada 1998* by Health Canada,[5] where the indirect costs of asthma, bronchitis and emphysema were estimated to account for 53% of the total costs of these three diseases. Also in this report, indirect costs due to asthma morbidity were $679 million in 1998 or $835 million in 2005 (based on a discount rate of 3%). It is reasonable to expect Alberta's cost to be around one tenth of the national figure and thereby comparable to our estimates.

The productivity loss days per person per year, which averaged from five to six corresponding to the reduction in functional level of 20%–30% in this study, are lower than the annual productivity loss days per person in Ungar and colleagues' study,[12] which were 11–12 for employees. This difference is to some extent because Ungar and colleagues included travel time, and waiting and treatment time in their calculation.[12]

Table 3 Total asthma-related disability working days of labor force in Alberta, 2005

	Total disability days per subject		Of the labor force in one year	
	Two-week (I)	One-year (II)	Total disability days (III)	Total disability working days (IV)
Mean	0.487	12.7	1,644,732	1,174,809
Lower*	0.286	7.5	965,900	689,929
Upper*	0.688	17.9	2,323,564	1,659,688

Notes: *Corresponding to the lower and upper bounds of 95% CI of the mean; II = I * (365/14); III = II * 2,087,659 * 8.5% * 73%; IV = III * (5/7).

Table 4 Number and costs of asthma-related productivity loss days in Alberta, 2005

	Absenteeism		**Presenteeism****		**Productivity loss days****		**Cost****	
	In-bed days***	Restricted days***	Lower	Upper	Lower	Upper	Lower	Upper
	I	II	III	IV	V	VI	VII	VIII
Mean	258,458	916,351	183,270	274,905	441,728	533,363	$69,793,027	$84,271,368
Lower*	151,784	538,144	107,629	161,443	259,413	313,228	$40,987,281	$49,489,961
Upper*	365,131	1,294,557	258,911	388,367	624,043	753,499	$98,598,773	$119,052,774

Notes: *Corresponding to the lower and upper bounds of 95% CI of the mean; **Corresponding to the lower and upper bounds of the reduction in functional level; *** The in-bed days = 22% and restricted days = 78% of the total disability working days; III = II * 20%; IV = II * 30%; V = I + III; VI = I + IV; VII = V * 158; VIII = VI * 158.

Regarding the role of presenteeism in the productivity losses, our results showed that the presenteeism accounted for 42%–52% of the total. This is significant but still lower than in the Lamb and colleagues study,[15] where the presenteeism accounted for 68%. The difference is probably because Lamb and colleagues used a different reduction in functional level. The reduction in functional level (20%–30%) used in our study is suggested by Ungar and colleagues who developed a method to measure restricted days and to quantify total productivity loss days in adult asthma patients published in the *Journal of Health Economics* in 2000.[12] If we calculate productivity loss days due to presenteeism per person per year, it will be about 2–3 days in the present study. This is comparable to allergy-related productivity loss days due to presenteeism per person per year reported by Stevens in a Chicago-based BankOne survey.[16]

A limitation in this study is that the two-week disability days were generalized to one year. One may argue that there is a bias due to seasonal effects. However, the 2005 CCHS was designed to control for seasonal effects by allocating the data collection equally throughout 12 months of the surveyed year, and by applying an adjustment in the weighting to ensure that the portion of the sample interviewed each season represented 25% of the total population.[10] Therefore, we believe that the seasonal effect is minimal. Furthermore, a two-week recall period used for disability days would be less recall-biased in comparison with a longer one (such as one year). Another limitation is that asthmatic mortality is not included in the analysis. This may result in an underestimation of the total indirect costs. However, the indirect costs incurred by premature deaths of asthma are small since the asthmatic mortality rate is low in Alberta. In 2005, there were only 16 cases of death, equivalent to the rate of 0.5 per 100,000 people.[8]

In conclusion, the number of asthma-related productivity loss days in Alberta in 2005 was from 442 (259–624) to 533 (313–753) thousand. The corresponding cost was from $70 ($41–$99) to $84 ($49–$119) million. Of these, presenteeism accounted for 42%–52%. These results suggest that an improvement in controlling asthma could have a significant economic impact in Alberta, and that presenteeism plays an important role in asthma-related productivity losses. Therefore employers should not only pay attention to absenteeism, but also to presenteeism to minimize productivity loss.

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Disclosure

The authors report no conflicts of interest in this work.

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