

# MOVING THE DIAL

ON THE DIAGNOSIS AND TREATMENT OF ASTHMA

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*Proud supporter:*

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B R E A T H E  
the lung association

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# ABOUT

**The Lung Association** is a not-for-profit organization dedicated to helping all Canadians breathe. Our community of donors, patients, researchers, volunteers and professional staff work to ensure Canadians have the healthy lungs, bodies and clean air necessary to breathe. A healthy breath fuels the body and mind. It's something we should not take for granted.

We help Canadians breathe by:

## **PROMOTING HEALTHY BREATHING**

We promote healthy breathing by fighting for policies that protect our air and educate Canadians about what they can do to promote their own lung health.

## **SUPPORTING THOSE WITH LUNG DISEASE**

We support and advocate for those living with conditions that affect the lungs and the ability to breathe, and fight to challenge the stigma and ignorance that can be associated with lung disease.

## **FINDING FUTURE SOLUTIONS**

Through education and research, we work to turn knowledge into action and find cures to diseases that will deliver a future of better breathing for all.

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We would like to thank the members of our advisory committee for their time and expertise:

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# EXECUTIVE SUMMARY

***Moving the Dial on Diagnosis and Treatment of Asthma*** examines the barriers and challenges a patient faces throughout their journey with asthma. Along the way, many gaps and challenges can arise regarding how and when they are diagnosed and treated. This study will help The Lung Association and others shape an environment that will better support more effective and timely diagnosis and treatment and provide a strong base for education, awareness and advocacy efforts.

To improve the lives of the millions of Canadians with asthma, it is imperative to increase access to diagnosis, treatment, support and education along each step of their journey. This starts when their first symptoms appear, for example, with access to a family physician to investigate and make a proper diagnosis. Spirometry testing—considered the gold standard in diagnosis by the Canadian Thoracic Society—enables accurate diagnosis, which is necessary for appropriate treatment. The access and availability of treatments, including respiratory biologics, all influence whether patients will be able to live full, active lives. Education—of patients and healthcare providers—regarding appropriate use of medications and devices, as well as patient management tools such as asthma action plans, will ensure Canadians with asthma are

equipped to manage their disease and decrease healthcare costs and pressures.

The path to this ideal picture involves increasing access to accredited, high quality spirometry testing, including education for test providers and those interpreting the results, as well as regulations for testing sites. Better education is also needed to help patients and physicians understand asthma control. Patients need to know how to control their asthma, including understanding the type of asthma they have and ensuring they are on the right management plan.

The use of asthma action plans has been shown to result in behaviours that improve asthma control and increase patient self-advocacy. Educating healthcare providers and patients about the benefits of an asthma action plan and how to use this tool could help improve asthma control and patient quality of life, save healthcare costs and lead to patients feeling more empowered in managing their disease.

These facets can lead to correct treatment for all people living with asthma. Asthma is not the same for all patients and one type of treatment does not fit all. Proper diagnosis, followed by education of patients and healthcare providers will lead to individualized, effective treatment.

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# INTRODUCTION

Asthma is a chronic inflammatory disease that can make it hard to breathe. It affects 2,428,600 Canadians age 12 and over<sup>1</sup> and about 850,000 children under age 14.<sup>2</sup> Asthma causes airways (breathing passages) to become very sensitive. Airways can become tight or swollen and filled with mucus, all of which make it difficult for air to pass through. Asthma symptoms and attacks can be triggered by factors such as exercise, exposure to allergens or irritants, changes in the weather or viral respiratory infections. Symptoms include wheezing, shortness of breath, coughing and tightness in the chest. The airways can become obstructed to the point where it is impossible to breathe.

While there is no cure for asthma, with proper treatment and control, people with asthma can lead normal, active lives. Lack of access to diagnostic tests, treatments and patient support, as well as patients' lack of understanding of the disease or failure to take medications as prescribed, create barriers to the diagnosis and management

that can ensure patients are living with the best quality of life.

These issues only promise to grow more urgent. It is estimated that by 2030, the number of Canadians with asthma will climb to 3.9 million and direct and indirect costs will reach \$4 billion per year.<sup>3</sup> *Moving the Dial on Diagnosis and Treatment of Asthma* aims to help remove barriers and improve access to diagnosis and treatment. It is imperative to address these challenges and identify opportunities for improved education and awareness, as well as policy change.

This report includes a snapshot outlining important indicators regarding the diagnosis and treatment of asthma and identifies where gaps and challenges exist. It also shares experiences and insights from asthma specialists and people living with asthma, providing policy recommendations to help reduce the physical, social and financial impact of asthma.

# THE DIAGNOSIS AND TREATMENT OF ASTHMA ACROSS CANADA —A SNAPSHOT

The goal of this snapshot is to reveal the strengths and gaps in asthma diagnosis and management, highlighting areas that need more attention and action, and prompting discussion and policy changes to better serve Canadians with asthma.

The information for this snapshot was compiled through research into databases, reports and scientific studies, as well as consultation with asthma specialists, patients and provincial and regional health organizations. It also includes data collected in our 2018 Asthma Survey, which was conducted by Leger from Oct. 15 to Nov. 2, 2018.



## **Number of people with asthma in Canada, age 12 and over (2017)**

2,428,600 people (7.8% of population)<sup>4</sup>

## **Number of children under age 14 with asthma in Canada**

About 850,000 children under age 14 have asthma in Canada<sup>5</sup>

## **Access to healthcare professionals**

### **Access to a family physician**

In 2016, there were 42,522 family physicians in Canada. The number of family physicians per 100,000 population was 116.<sup>6</sup> Yukon has the highest physician to 100,000 population ratio at 180. Nunavut has 19. Among provinces, British Columbia has 130, while Prince Edward Island has 102. But numbers don't tell the whole story. Geographic distribution also affects access to a family physician. In some provinces, patients must travel many kilometres to reach a doctor.

Since our 2018 Asthma Survey showed that a family physician is the one who usually diagnoses respondents with asthma (66 per cent) and family physicians are also the first step toward seeing a needed specialist, it is especially important that Canadians have access to a family care physician. Beyond diagnosis, a 2011 Survey on Living with Chronic Diseases in Canada, found that for 83.8 per cent of asthma patients, a family physician or general practitioner was most responsible for their care.<sup>7</sup>

### **Access to clinical immunology/allergy physicians (adult)**

There are 128 clinical immunology/allergy physicians in Canada.<sup>8</sup> The difference in the number of clinical immunology/allergy physicians varies widely. For example, Ontario has 47, while a few provinces have one. Prince Edward Island has none.

### **Access to clinical immunology/allergy and respirology physicians (pediatric)**

Canada has 94 pediatric clinical immunology/allergy physicians.<sup>9</sup>

Ontario has 35 pediatric clinical immunology/allergy physicians and Quebec has 25, while most provinces have fewer than 10.

### **Number of adult respirologists per 100,000 people in Canada**

Canada has two adult respirologists per 100,000 people, with 699 in total. Ontario has 249, while Alberta has 91 and Newfoundland and Labrador has four.<sup>10</sup> According to 2017 Canadian Medical Association data, Quebec has three respirology physicians (adult and pediatric) per 100,000 population, while Nova Scotia has 0.9.<sup>11</sup> But beyond per capita numbers, is geographic distribution. For example, in Manitoba, all 12 adult respirologists practise in the Winnipeg Regional Health Authority. For someone in Thompson, Manitoba, that is more than 760 kilometres away.

### **Number of pediatric respirologists in Canada**

74 pediatric respirologists in Canada<sup>12</sup>

### **Number of respirologists per 10,000 people with asthma in Canada**

There are 2.36 adult and pediatric respirologists for every 10,000 people with asthma (calculation based on the number of people in Canada with asthma and the reported numbers of pediatric and adult respirologists).

An adequate amount of respirologists practising in Canada would decrease wait times for patients in need. In many communities, patients do not have any access to a respirologist or would have to travel a great distance to see one. Respirologists are also more likely to diagnose asthma using spirometry testing, which is the gold standard for diagnosis (opposed to a clinical diagnosis alone).



## Diagnosis

### **Spirometry**

The availability of centres offering spirometry varies among provinces and even among health regions within each province. For example, in Quebec, the Outaouais region has 1.27 labs per 100,000 population, while the Nord-du-Québec region has 21 per 100,000 population. Generally, many regions throughout Canada have between three and seven labs per 100,000 population while some only have one or two. Access to centres providing spirometry testing is extremely important, as this is the best diagnostic tool for asthma.

### **Average wait time for spirometry**

The average wait time for spirometry testing in Canada is 4.15 weeks. This is the wait for non-urgent tests, based on the lower end of the average wait reported by health regions (for example, if a region reported two to four weeks, this calculation used the two-week figure). When looking at the high end of the reported average wait times, the average is 9.21 weeks.

According to our 2018 Asthma Survey, of people with asthma who had spirometry testing, 37 per cent waited less than one month, 24 per cent waited one to less than three months, 12 per cent waited three to less than six months, six per cent waited six months to less than a year and four per cent waited a year or longer. Regionally, residents in the Atlantic provinces (47 per cent) were least likely to get this test in under three months (vs. 65 per cent in the West, 62 per cent in Ontario and 59 per cent in Quebec).

### **Percentage of patients with an asthma diagnosis who had spirometry**

According to our 2018 Asthma Survey, 67 per cent of respondents with asthma reported having had spirometry. A 2016 Lung Association Asthma Study found that 75 per cent of general practitioners treating asthma patients got spirometry test results for patients aged six and over.<sup>13</sup> A 2012 study found that 42.7 per cent of the 465,866 Ontarians newly diagnosed with asthma received pulmonary function testing between one year prior and 2.5 years following the time of diagnosis.<sup>14</sup>

An asthma diagnosis is often made based on symptoms and history and asthma medications are often initiated on that basis, without spirometry. However, physical exam findings and symptoms, such as coughing or wheezing, can be caused by other conditions. A false clinical diagnosis of asthma may delay diagnosis of the actual underlying condition, which may include serious conditions. Patients with a false diagnosis of asthma who are started on asthma medications are unnecessarily exposed to the side effects and the costs of these medications. Failure to diagnose asthma can lead to unnecessary prescriptions of antibiotics and continued asthma symptoms and danger of a severe attack.



## Quality of interpretation: Spirometry

### Who is allowed to perform and interpret spirometry tests?

There is wide variability in regulations regarding who can perform spirometry. For example, Alberta has comprehensive guidelines concerning who can perform spirometry, including their training and experience, depending on the level of lab. Other provinces, such as New Brunswick and Manitoba, have no regulations surrounding who performs spirometry, though organizations may have their own regulations. For example, the Winnipeg Regional Health Authority uses only professionals who have completed approved training, including respiratory therapists, nurses and pharmacists. Key opinion leaders report that lack of regulations have an impact on test quality. A respiratory therapy site director in Manitoba says that anyone can just be shown to use the equipment and how to perform the test, which he believes has an impact on the quality of spirometry.

### Is there any formal quality assessment of labs?

Discrepancies between provinces exist in this area of spirometry as well. For example, in British Columbia, spirometry is accredited via two streams—community (usually physician's offices) and pulmonary function labs through the Diagnostic Accreditation Program. In Ontario, the College of Physicians and Surgeons of Ontario conducts quality assurance assessments of all independent pulmonary function labs. In other provinces, such as Newfoundland and Labrador and Saskatchewan, no regulations or accreditation program exist.

Considering the importance of spirometry in asthma diagnosis and in managing treatment, it is critical that the equipment used is set up and maintained correctly and that professionals performing the test are properly trained and proficient, as these factors could seriously affect the outcome of the test.

### Number of centres providing methacholine challenge testing per 100,000 population

The rate of centres providing methacholine challenge testing per 100,000 population varies throughout Canada, where some health regions have no centres while others have about three centres per 100,000 people.

Methacholine challenge (or bronchial challenge) testing is recommended when a patient has asthma symptoms, but a spirometry test does not indicate asthma or in evaluation for occupational asthma. In one study of adults with symptoms of obstructive pulmonary disease, 63 per cent had normal spirometry. Methacholine challenge testing later identified asthma in 47 per cent of those individuals with normal spirometry.<sup>15</sup> This type of testing is an important part of comprehensive asthma diagnosis.

## Treatment

### Over-reliance on short-acting beta agonists (SABAs)

According to Canadian Thoracic Society Guidelines, regular need for a reliever medication (of any kind) merits re-evaluation to identify the reason(s) for poor asthma control. For SABAs, regular use is defined as more than three doses per week.<sup>16</sup> In our 2018 Asthma Survey, 56 per cent of respondents with asthma reported using their inhaler more than three times a week in the past 12 months.

Regular or excessive use of SABAs indicates asthma is not controlled or not being treated properly with inhaled corticosteroids (preventer medicine), which produce sustained improvement in lung function and reduce the risk of asthma exacerbations. Some people think they can skip the preventer medicine and only use the rescue medicine, which can be dangerous. SABAs do not control asthma over the long term.

In one study, inappropriate use of SABAs in any given year was associated with a 45 per cent increase in the risk of asthma-related hospital admissions in the following three months and a 25 per cent increase in emergency room visits.<sup>17</sup>



### **OCS (oral corticosteroid) usage in severe asthma**

In our 2018 Asthma Survey, 35 per cent of respondents reported they were taking, have taken or have a standing prescription for OCS. Seven per cent of all respondents were currently taking OCS. The likelihood of taking OCS grew with symptom severity. Seventy per cent of respondents with severe asthma reported they were taking, have taken or have a standing prescription for OCS. Thirty per cent of respondents with severe asthma said they were currently taking OCS.

Most current OCS users (defined in our survey as those currently taking prednisone or who have a standing prescription for it) have taken OCS pills at some point in the last 12 months (76 per cent), with 54 per cent indicating somewhere between one and three courses. Two in 10 (23 per cent) have taken it more frequently than that (i.e. four or more courses), while 20 per cent have taken zero courses. Those with a severe case of asthma are far more likely to have taken corticosteroids this year (90 per cent vs. 67 per cent among those with a mild case); they are also far more likely to have taken four or more courses (45 per cent vs. 13 per cent among those with a mild case).

A short course of OCS, usually about five to 10 days, referred to as a steroid burst, is used to treat acute, severe asthma exacerbations. Courses of more than five days or more than two bursts in 12 months indicate poor asthma control. Oral corticosteroids can cause side effects such as weight gain, bruising and mood changes and relying on OCS indicates that asthma treatment is not working. Because of these factors, patients taking regular courses of OCS could be considered for treatment using respiratory biologics. These other treatment options could significantly improve their quality of life.

### **Are asthma patients being treated with biologics?**

According to our 2018 Asthma Survey, 14 per cent have been deemed candidates for biologics, but only half that (seven per cent) are currently taking them. The other seven per cent did not end up pursuing them due to a lack of access (in their drug coverage or to a clinic that could administer the treatment). Another 12 per cent aren't candidates for biologics. Overall, candidates tend to come from all provinces but are slightly more likely to be male (18 per cent) than female (10 per cent) and more likely to be younger (i.e. under 45: 20 per cent vs. 45+: six per cent), to have been diagnosed with asthma as a child (16 per cent), have a moderate or severe case of asthma and be smokers or past smokers.

Sixty-three per cent have never discussed biologics as an option with their healthcare provider. This indicates that greater awareness of respiratory biologics is needed, by both healthcare providers and patients. Patients need to know all their options and when other treatments are not working, biologics could significantly improve patients' lives.

## Coverage

### Who has public insurance?

The federal Non-Insured Health Benefits programs provides coverage for First Nations and Inuit residents. Every province provides a drug plan for seniors and they also have plans to support low-income families or individuals. Some have programs that all residents can apply to, with coverage geared to income. Other programs in some provinces support children and adults with disabilities or living in residential care facilities. Ontario has a plan for residents age 24 or younger, while PEI has one for children under or 19 or for full-time students aged 19 to 25. In Saskatchewan, families pay a maximum of \$25 for children 14 and under. The Northwest Territories, Nunavut and Yukon have programs for residents with specified conditions, which include asthma.

### Cost/coverage of inhalers

The types/brands of inhalers covered by provincial drug plans are similar in each province. Despite this, large portions of the population are left out of coverage, for example, Ontario residents between 25 and 64 with no private group coverage who do not qualify for any low-income or other assistance or whose private plans only provide partial coverage.

### Cost/coverage of biologics

While some provincial drug plans are still evaluating these treatments for reimbursement, some provinces do provide coverage with special authorization criteria, which might include having severe persistent asthma despite optimized standard therapy, being a non-smoker or having a certain number of exacerbations in a year. Meanwhile, some private drug plans have reviewed and included these treatments in their formularies, while others continue to evaluate.

### Provincial models for physician billing, including incentives for physicians who manage a patient with asthma

Some provinces, such as British Columbia, have special billing codes for care of patients who have co-existing chronic conditions, which include asthma. Manitoba has a code for annual management of asthma. Care must include certain aspects, such as development of a patient care plan. Other provinces, such as New Brunswick and Newfoundland and Labrador do not specifically mention asthma in their list of billing codes.

## Patient support

### Number of asthma patients using asthma action plans

According to our 2018 Asthma Survey, 44 per cent of respondents know what an asthma action plan is and 22 per cent have one in place, especially those with moderate or severe cases of asthma. Over the past 12 months, 15 per cent have received a written action plan from their family physician. Written action plans are more likely to have been given to those with moderate (22 per cent) or severe (32 per cent) cases of asthma, rather than mild ones (10 per cent). Those familiar with an asthma action plan usually learned of it through a healthcare provider (84 per cent), such as their family physician (46 per cent).

Patient and caregiver education is an essential part of asthma management. People with asthma need to understand the disease, its severity and triggers, as well as proper inhaler technique. According to the Canadian Asthma Management Consensus Summary 2010: “Asthma education is an essential component of asthma management for all patients. Guided self-management, combining asthma education, regular medical review, self-assessment and a written action plan have been shown to reduce hospitalizations, emergency visits, urgent physician visits, missed days at work or school, days of restricted activity and improved pulmonary function in children and in adults.”<sup>18</sup>



### **Number of licensed certified respiratory educators in Canada**

Canada has 1,362 certified respiratory educators. Most of these are in Ontario (566) and Alberta (350).

### **Number of certified asthma educators in Canada**

Canada has 355 certified asthma educators, with 113 in Ontario and 90 in Alberta.

### **Emergency Care Pathways**

An emergency care pathway is designed to promote appropriate assessment of an asthma exacerbation that has led to an ER visit, evidence-based asthma treatment, patient education prior to discharge, comprehensive discharge instructions and arrangements for follow-up care.

The Government of Ontario funded the development of a standardized asthma care pathway for adults. Following a successful pilot study, the Government of Ontario funded The Lung Association-Ontario to design and support a roll-out of the care pathway, making it available to all Ontario ERs through regional workshops between 2008 to 2011. A study found more than one-third of reporting Ontario ERs are using a standardized adult asthma care pathway.<sup>19</sup>

Another study compared emergency department management, admissions, repeat ER visits and length of stay between five Ontario sites with a care pathway and five control sites not using one.<sup>20</sup> Sites using the care pathway showed significant increases in the use of metered dose inhalers, inhaled steroids, referrals, documentation of teaching, patient recollection of teaching and oxygen. The length of stay for discharged patients increased by an average of 16 minutes. There was no significant difference in the amount of repeat ER visits.

Uptake of ER care pathways in other provinces has been varied. Acute childhood asthma pathways are used by Alberta Health Services. A Nova Scotia respirologist reported that province tried to implement emergency care pathways without a lot of success. For example, it is “hit and miss” who is referred for follow-up after a visit. Saskatchewan has no official program and usage varies by region.

## **Burden of disease**

### **Rates of ER/hospitalizations due to asthma within each province and average length of stay**

**ER:** In 2017-18, asthma attacks resulted in 64,683 emergency room visits across Canada. Of these, 57,277 cases were discharged, 673 were transferred and 6,028 were admitted.<sup>21</sup>

**Youth:** A Canadian Institute of Health Information study found that the rate of Canadians younger than 20 being hospitalized for asthma decreased 50 per cent between 2006 and 2015, dropping from 154 hospitalizations per 100,000 population to 75.<sup>22</sup> Despite this improvement, asthma continues to be one of the leading causes

of hospital stays for people younger than 20, with more than 6,000 hospitalizations in 2015–2016. In 2013-14 and 2015-16, hospitalization rates for this group were significantly higher than the Canadian average in Prince Edward Island, Ontario, Saskatchewan and the Northwest Territories. For example, the rate per 100,000 in PEI was 163 compared to the national rate of 79.

### **Direct costs of asthma (hospital, medication and physician)**

In 2017-18, asthma attacks resulted in 64,683 emergency room visits across Canada.<sup>23</sup> According to the Conference Board of Canada, the hospital, medication and physician costs of asthma in 2010 totalled almost \$1B, with the cost of hospitalization at \$250.7 million, cost of physicians who cared for asthma patients at \$196.3 million and the cost of medications at \$535.7 million. The same study estimates the average annual growth of direct costs (hospitalization, medication and physicians) will be 3.1 per cent between 2010 and 2030, with costs increasing from \$982 million in 2010 to \$1.8 billion in 2030.<sup>24</sup>

### **Indirect costs of asthma**

Asthma often affects quality of life, as it results in time away from school, work or other activities. In our 2018 Asthma Survey, among the 18 per cent of respondents who have missed school, work or social engagements because of their asthma, 62 per cent indicate it happens every few months or less often, while 34 per cent say it occurs at least once a month. The frequency is linked to the severity of asthma and whether the respondent is a smoker. Smokers are two times more likely to indicate their asthma symptoms have caused them to miss school, work or other engagements (34 per cent vs. 15 per cent among non-smokers).

### **Mental health burden of asthma**

One study found the risk for emergency room visits for mental illness increased by 13 per cent in the year after asthma diagnosis compared with the year before. The risk for outpatient physician visits for substance-related disorders increased by 21 per cent at one year and 37 per cent at two years.<sup>25</sup>

### **Socioeconomic influence on the burden of asthma**

Socioeconomic status and level of education appear to have an effect on the burden of asthma. One study<sup>26</sup> assessed associations between individual-level socioeconomic status and asthma factors in adults with asthma in Canada. Patients with lower socioeconomic status had worse asthma control, worse asthma self-efficacy and greater use of emergency health services compared to patients with a higher socioeconomic status. These findings took into account age, gender, asthma severity, current smoking, BMI and having a mood and/or anxiety disorder.

### **Outdoor air quality data**

Poor outdoor air quality can make it difficult to breathe, irritate the lungs and worsen asthma. For people with asthma, it is important to know how air pollution affects their symptoms and be able to access information on local air quality. Websites, including the Government of Canada, the Weather Network and the Air Quality Health Index list air quality information for regions across the country. Provincial Lung Association websites also provide links.

### **The flu shot and people with asthma**

The National Advisory Committee on Immunizations set a target that 80 per cent of Canadians with selected chronic conditions should get a flu shot. According to Statistics Canada, however, 32 per cent of people with these conditions (heart disease, effects of stroke, asthma, diabetes, cancer, emphysema, bronchitis, chronic obstructive pulmonary disease and obesity) had a flu shot in 2013-2014.<sup>27</sup> The rate was not broken down by condition, however, the 2011 Survey on Living with Chronic Disease in Canada found that 68 per cent of people with asthma reported having a flu vaccine.<sup>28</sup>

# ACCESS TO HEALTHCARE PROFESSIONALS

For a patient living with asthma, the journey begins when symptoms appear. Having access to a family physician is the first step necessary for investigation and proper diagnosis, through a family physician or referral to a specialist. Looking at our 2018 Asthma Survey, we are faring well in terms of access to family physicians, though the number of specialists in Canada is low.

## Access to a family physician

In 2016, there were 42,522 family physicians in Canada, representing a rate of 116 family physicians per 100,000 people.<sup>29</sup> The highest rate was in the Yukon, with 180 family physicians and the lowest was 19 per 100,000 in Nunavut. Amongst the provinces, British Columbia had a high rate of 130, while the low was Prince Edward Island at 102. Per capita rates don't tell the whole story however. For example, while the Yukon has the highest rate of family physicians, access to care is influenced by geographic distribution, as well as the fact that the territory has a low rate of specialists. This leads to family physicians or general practitioners performing the type of work specialists may do elsewhere, which translates to needing more doctors to provide the same level of care as in other regions.

A recent Fraser Institute report stated that Canada doesn't fare too badly out of 32 OECD (Organisation for Economic Co-operation and Development) countries, ranking eighth out of 32 in a comparison of the availability of generalist medical practitioners.<sup>30</sup> As well, the majority of respondents (82 per cent) in our 2018 Asthma Survey identified that they have access to a primary care physician. Yet, concerns over family physician shortages in Canada are well documented and widespread. According to a Statistics Canada Primary Health Care report, in 2015, 16.8 per cent of Canadians aged 12 or older, or roughly five million people, reported they did not have a regular healthcare provider they see or talk to when they need care or advice for their health.<sup>31</sup>

Since our 2018 Asthma Survey showed that a family physician was the one who usually diagnosed respondents with asthma (66 per cent) and family physicians are also the first step toward seeing a needed specialist, it is especially important that Canadians have access to a family physician. Beyond diagnosis, a 2011 Survey on Living with Chronic Diseases in Canada, found that for 83.8 per cent of asthma patients, a family physician or general practitioner was most responsible for their care.<sup>32</sup>

## Access to clinical immunology/allergy and respirology physicians (pediatric and adult)

Even though more than three million Canadians have asthma, there is only an average of two respirology physicians for every 100,000 Canadians. For every 10,000 adults with asthma, there are about three respirology physicians. For children with asthma, the number is closer to 0.87 respirology physicians for every 10,000. The ratios for allergy and immunology physicians are even lower.

Wide discrepancies exist in access among provinces. For example, according to 2017 Canadian Medical Association data, Quebec has three respirology physicians (adult and pediatric) per 100,000 population, while Nova Scotia has 0.9.<sup>33</sup> But per capita numbers do not tell the whole story. For example, Dr. Erika Penz, a respirologist and assistant professor, Division of Respirology, Critical Care and Sleep Medicine, University of Saskatchewan, says she has patients who drive six to seven hours for an appointment. In fact, in Saskatchewan, all 23 adult respirologists are in the former Saskatoon and Regina Qu'Appelle health regions. A resident of

Stony Rapids in northern Saskatchewan would have to travel more than 1,000 kilometres to see a physician in Saskatoon. In Manitoba, all 12 adult respirologists are in the Winnipeg Regional Health Authority.

Dr. Mark FitzGerald, director, Centre for Heart and Lung Health in Vancouver, reports that despite having 15 to 20 doctors in his clinic, the wait time is still three to six months. He usually saves spots in case he needs an appointment for an urgent case. Nova Scotia does not have many respirologists outside of Halifax, so most residents are referred to a general internist, reports Dr. Paul Hernandez, chief, Division of Respirology and Medical Director of the Pulmonary Rehabilitation Program and Medical Intermediate Care Unit at QEII Health Sciences Centre in Halifax.

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## DIAGNOSIS

Healthcare providers diagnose asthma in different ways. Some patients are diagnosed using a physical exam, while others are also sent for a spirometry test, which is considered the gold standard for diagnosing asthma, according to the Canadian Thoracic Society (CTS). It is only through proper testing and access to these tests, that patients can be accurately diagnosed, and therefore, correctly treated.

### Importance of spirometry testing

CTS guidelines state that the foundation of asthma management for patients six years old and up is establishing an accurate diagnosis based on objective measures, for example spirometry. In fact, in 2010, the CTS revised its asthma management continuum in part to reflect the importance of ensuring a diagnosis is confirmed with objective assessment of lung function and regular reassessment of spirometry or peak expiratory flow (PEF) in monitoring asthma control, with spirometry as the preferred method.<sup>34</sup>

During a spirometry test, which may also be called a pulmonary function test or lung function test, the patient takes in a big breath and then blows as hard and long as they can into a machine. The machine measures how much air they can blow out from their lungs and how fast they can blow it out. Spirometry results tell the doctor if the patient's lungs are functioning normally and measures such factors as the largest amount of air the patient can blow out after taking their biggest breath in and the amount of air they can blow out in the first second. If a patient is already diagnosed with asthma, spirometry can help determine if current treatment is working.

### Percentage of patients with an asthma diagnosis who had spirometry

According to our 2018 Asthma Survey, 67 per cent of respondents with asthma reported having had spirometry testing, while a 2016 Lung Association Asthma Study found that 75 per cent of general practitioners treating asthma patients obtained spirometry test results for patients aged six and over.<sup>35</sup> A 2012 study found that 42.7 per cent of the 465,866 Ontarians newly diagnosed with asthma received pulmonary function testing between one year prior and 2.5 years following the time of diagnosis.<sup>36</sup>

## Wait times for spirometry

A review of every health region across Canada (illustrated in the snapshot) shows a variation of wait times between about one week to eight to 20 weeks (urgent tests could be accommodated in a few days in many cases). In our 2018 Asthma Survey, of people with asthma who had spirometry, 37 per cent waited less than one month, 24 per cent waited one to less than three months, 12 per cent waited three to less than six months, six per cent waited six months to less than a year and four per cent waited a year or longer. Regionally, residents in the Atlantic Provinces (47 per cent) were least likely to get this test in under three months (vs. 65 per cent in the West, 62 per cent in Ontario and 59 per cent in Quebec).

A Journal of American Medical Association study<sup>37</sup> underscored the importance of spirometry. The study aimed to determine whether a diagnosis of current asthma could be ruled out in randomly selected adults with physician-diagnosed asthma. Current asthma was ruled out in 203 of 613 participants and this group was less likely to report they had spirometry at the time of diagnosis, which was later confirmed by community physician reports. Only 43.8 per cent of participants in whom asthma was ruled out had evidence of having had spirometry, bronchial challenge testing or serial measurements of peak flows in the community, compared with 55.6 per cent of those in whom asthma was confirmed.

Of the community physicians who were contacted and had initially diagnosed asthma, the diagnosing physician provided evidence of spirometry and/or bronchial challenge testing and/or serial peak flow testing having been done to confirm diagnosis in 269 of 530 patients (50.8 per cent). For the remaining patients, asthma was diagnosed based on symptoms and/or physical findings alone.

In a recent Asthma Canada Speakers Series Webinar on proper diagnosis and correct testing,<sup>38</sup> the leader of the study, Dr. Shawn Aaron, senior scientist, Clinical Epidemiology Program at the Ottawa Hospital Research Institute and chief of Respiratory Medicine at The Ottawa Hospital, told the stories of two patients that illustrated the importance of spirometry.

A 19-year-old non-smoker with a chronic cough and some wheezing had been put on antibiotics by her family physician. When she didn't improve and a chest x-ray was clear, her doctor prescribed more antibiotics and referred her to Dr. Aaron. After more than a year, her doctor had never ordered spirometry. A spirometry test confirmed she had asthma.

In another case, a 44-year-old female was referred to Dr. Aaron for difficult to control asthma. She had been short of breath and wheezing for four years. After seeing Dr. Aaron, spirometry did not show asthma, but rather indicated an upper airway obstruction. Dr. Aaron performed a procedure to enlarge her upper airway and open up her trachea. Shortly after, her problems completely resolved.

## Quality of spirometry testing and interpretation

The national snapshot shows wide variability in regulation and accreditation of spirometry testing. Alberta has comprehensive guidelines regarding accreditation and who is allowed to perform spirometry, including their training and experience. Other provinces, such as New Brunswick and Manitoba, have no accreditation program or regulations determining who can perform spirometry, but individual organizations may have regulations. For example, the Winnipeg Regional Health Authority uses only professionals who have completed approved training, including respiratory therapists, nurses and pharmacists. A respiratory therapy site director in Manitoba says that anyone can just be shown to use the equipment and how to perform the test, which he believes has an impact on the quality of spirometry.



Dr. Penz says that often when patients come for an appointment with spirometry test results that were performed in family practice offices, the quality of the results is not satisfactory. In Nova Scotia, where there is no formal quality assessment, Dr. Hernandez said that because spirometry is performed in a hospital or healthcare setting by healthcare professionals people assume it is high quality, but that is not always the case.

## Number of centres providing methacholine challenge testing

Methacholine challenge (or bronchial challenge) testing is recommended when a patient has asthma symptoms, but a spirometry test does not indicate asthma or in evaluation for occupational asthma. The patient inhales methacholine, a drug that can cause narrowing of the airways, similar to what happens in asthma. A breathing test is repeated after each dose of methacholine to measure the degree of narrowing of the airways. The dose is increased until the patient experiences a 20 per cent drop in breathing ability or they reach a maximum dose with no change in lung function. If methacholine causes a 20 per cent or greater decrease in breathing ability, an asthma diagnosis should be considered. Otherwise, an asthma diagnosis is unlikely.

In one study of adults with symptoms of obstructive pulmonary disease, 63 per cent had normal spirometry. Methacholine challenge testing later identified asthma in 47 per cent of those individuals with normal spirometry.<sup>39</sup>

The extent to which methacholine challenge testing is performed in Canada varies. A 2018 study<sup>40</sup> found that physicians from Québec perform four times more methacholine challenge tests per year than other provinces, while physicians from Alberta perform nearly eight times fewer tests (acknowledging for population size and asthma rates).

The study also states that between about 60 and 90 per cent of adults show normal spirometry despite respiratory symptoms. In this case, if asthma guidelines are being followed, the proportion of people with asthma getting methacholine challenge testing should roughly match these percentages. Between 2000 and 2014, it is estimated the equivalent of nearly 60 per cent of people with asthma had methacholine challenge testing in Québec, while in Ontario this number was just more than 30 per cent. Throughout the rest of Canada, the rate was under 25 per cent.

The study authors suggest some reasons that could account for these differences include the need for testing for occupational health claims in some provinces and the number of respirologists, immunologists or allergists in a province, since specialists are more likely to recommend testing. Interestingly, the number of pulmonary function labs in each province and the fee that physicians receive for conducting or interpreting the test do not have a notable impact on rates of methacholine challenge testing. The authors also suggest that certain provinces may be under-prescribing testing, increasing risks for misdiagnosis.

# TREATMENT

Proper diagnosis can help ensure a patient is treated with the correct medication or combination of medications and at the right dose. But issues can arise surrounding use of reliever inhalers, the need for oral corticosteroids due to poor asthma control and awareness and access to optimal treatments.

## Over-reliance on short-acting beta agonists (SABAs)

Inhaled corticosteroids and other controller medications produce sustained improvement in lung function and reduce the risk of asthma exacerbations. Reliever medications, such as short-acting beta agonists (SABAs), can quickly resolve symptoms but do not affect underlying inflammation. In fact, use of SABAs, when not properly balanced with controller medication, can worsen asthma control and increase symptoms.<sup>41</sup>

Despite guidelines regarding SABA use, many patients continue to use them inappropriately. CTS guidelines state that regular need for a reliever medication (of any kind) warrants re-evaluation to identify the reasons for poor asthma control. For SABA, regular use is defined as more than three doses per week.<sup>42</sup>

In our 2018 Asthma Survey, 56 per cent of respondents with asthma reported using their inhaler more than three times a week in the past 12 months.

A recent study of asthma patients between 14 and 55 years of age in BC<sup>43</sup>, found that in 7.3 per cent of patient years, SABA was used inappropriately and in 0.9 per cent of patient years, SABA use was excessive. The study defined inappropriate use as no inhaled corticosteroids (ICS) with two or more puffs of SABA per week or use of more than nine canisters of SABA a year and no more than 100 µg/day of ICS. Excessive use was defined as filling prescriptions for more than 12 canisters of SABA in one year.

The study found that patients who received an appropriate amount of ICS, visited a specialist or had better continuity of care were less likely to use SABAs inappropriately in the following year. Patients who had more frequent general practitioner visits for asthma had a higher likelihood of inappropriate SABA use in the following year.

Another study in BC showed an encouraging trend—from 2002 to 2013, inappropriate prescriptions of SABAs fell by half (from 8.7 per cent to 4.6), while excessive SABA prescriptions declined by more than 60 per cent (1.1 to 0.4). The average annual decrease in inappropriate use was 5.1 per cent each year.<sup>44</sup> Study authors believed possible reasons for this may be healthcare providers and patients following guidelines and increased access to more effective medications.

## OCS (oral corticosteroid) usage in severe asthma

A short course of OCS, usually about five to 10 days, referred to as a steroid burst, is used to treat acute asthma exacerbations. More than two bursts in 12 months indicate poor asthma control.

Most current OCS users in our 2018 Asthma Survey (those currently taking Prednisone or who have a standing prescription for it) have taken corticosteroid pills at some point in the last 12 months (76 per cent), with 54 per cent indicating somewhere between one and three courses. Twenty-three per cent have taken it more frequently (four or more courses), while 20 per cent have taken none. Those with severe asthma are more likely to have taken corticosteroids this

year (90 per cent vs. 67 per cent of those with mild asthma). They are also far more likely to have taken four or more courses (45 per cent vs. 13 per cent among those with mild asthma).

## Treatment with biologics

Jennifer, an Ontario resident, was on a combination inhaled corticosteroid/long-acting beta2 agonist, but about every two months, her asthma would become so uncontrollable that she would need a course of Prednisone, which came with unwelcome side effects. When these medications failed to control her asthma, her respirologist suggested a biologic might help. After seven months, her asthma was still not under control. She could not be active with her grandchildren and started having to miss work as Canada Post mail carrier as she could not finish her routes.

At this point, she was on a variety of different drugs that included a controller inhaler and a daily dose of Prednisone. After entering a drug trial for a different biologic, her quality of life improved almost immediately. She was weaned off Prednisone, was eventually taken off her controller inhaler and got back to enjoying her job and being active with her family.

Biologics are a newer treatment option for moderate to severe asthma, designed to target and block a part of the immune system involved in inflammatory pathways and asthma symptoms. If a patient has continued asthma symptoms even when using controller medications properly, biologics could be considered as an add-on treatment.

A biologic is a medication made from animals, plants or cells, instead of a chemical process. Biologics for asthma are antibodies, a protein that occurs naturally in our bodies. A biologic antibody can be tailored to help control disease, for example, by shutting down lung inflammation or other processes that lead to asthma attacks.

While healthcare providers are excited by the promise of biologics, this class of medications is still new and many doctors are learning about the mechanisms and prescribing practices. According to our 2018 Asthma Survey, 63 per cent of asthma patients have never discussed biologics as an option with their healthcare provider.

Fourteen per cent have been deemed candidates for biologics, but only half of them are currently taking them. The other seven per cent did not pursue them due to a lack of access (in drug coverage or to a clinic that could administer the treatment). Another 12 per cent are not candidates for biologics. Overall, candidates tend to come from all provinces but are slightly more likely to be male (18 per cent) than female (10 per cent) and more likely to be younger (under 45: 20 per cent vs. 45+: six per cent), to have been diagnosed with asthma as a child (16 per cent) and have an asthma action plan in place (27 per cent vs. 10 per cent among those without a plan).

Cost can be a barrier to treatment with biologics for uninsured patients. Because Jennifer was part of a drug trial, the drug was provided but she worries about what will happen if her private plan will not cover it. Health technology assessment agencies have reviewed and recommended that Health Canada approve respiratory biologics for the treatment of severe asthma. Currently, provincial drug plans are reviewing these medications for reimbursement. Some provinces do provide coverage with special authorization criteria, while others are still evaluating. Some private drug plans have reviewed and included these treatments in their formularies, while others continue to evaluate. Most manufacturers also have patient support programs to assist patients with the cost of the medications and to navigate reimbursement options.

# COVERAGE

Jennifer considers herself lucky to have a private drug plan through her employer. At one time, she was on up to five or six medications, costing about \$1,000 a month. Without the coverage, she could not have afforded it. Indeed, cost is a major concern for many people living with asthma who do not have public or private coverage. The Lung Association's Asthma Control in Canada Survey in 2016 found that 31 per cent of Canadians with asthma believe the lack of affordable treatment options is a barrier to improving asthma care. In fact, of the 14 per cent not taking their medications as prescribed, 11 per cent name costs as a reason for not taking their medication.<sup>45</sup>

Each province has a formulary that lists which drugs it will pay for under its drug coverage program. While there is some variation, the types of inhalers covered by provincial drug plans is similar. All provinces have a drug coverage program for seniors and lower-income Canadians have access to provincial insurance to limit costs. Social assistance recipients have low-cost coverage in every province. Each plan has certain parameters. For example, a single senior in Ontario with income above \$19,300 after taxes pays the **first \$100** of total prescription costs each year. After that, they pay up to **\$6.11** for each drug prescribed, filled or refilled. In Alberta, seniors have premium-free coverage and pay 30 per cent of the cost of a prescription to a maximum of \$25 for listed drugs.

Examples of provincial plans include British Columbia's Fair PharmaCare plan, which covers 70 per cent of the cost of eligible prescription drugs for families with a net income less than \$15,000. Once a family has spent about two per cent of their income on drugs or related costs, the province pays 100 per cent for the rest of the year. The province offers coverage to families with higher incomes but requires them to first pay their drug costs (up to two to three per cent of their income) before receiving provincial coverage.<sup>46</sup>

Quebec requires residents not covered by private group insurance to enroll in its provincial plan and pay premiums that range from \$0 to \$616 per year, depending on family income. Individuals must pay the first \$19.90 of their drug costs, after which they pay 34.9 per cent of the cost of eligible drugs up to a monthly maximum of \$90.58 (after which all costs are covered). Premiums, deductibles and co-pays are waived for groups including residents on social assistance and children under 18.<sup>47</sup>

Despite this, large portions of the population are left out of coverage, for example, Ontario residents between 25 and 64 with no private group coverage who do not qualify for any low-income or other assistance or whose private plans only provide partial coverage. Dr. Paul O'Byrne, professor, Division of Respiriology, Department of Medicine and dean and vice-president, Faculty of Health Sciences, McMaster University, says he has heard from Ontario doctors who hand out inhalers in clinics to patients who can't afford them.

# PATIENT SUPPORT

Patient and caregiver education is an essential part of asthma management. People with asthma need to understand the disease, its severity and triggers, as well as correct inhaler technique. Many patients overestimate their **level of asthma control**. The 2016 Asthma Control in Canada survey found that 93 per cent of Canadians with asthma believe their condition is well-controlled, but nine in 10 Canadians with asthma do not have it under control according to Canadian Thoracic Society Guidelines criteria.<sup>48</sup>

In our 2018 Asthma Survey, 92 per cent of respondents said they have their condition under control, with more than half indicating it is very well under control. However, about 40 per cent of respondents said they regularly experience symptoms (wheezing, coughing and/or a hard time breathing) and 56 per cent use an inhaler more than three times in a given week. Meanwhile, almost one-third don't exercise at all because of their asthma. Access to resources such as certified respiratory educators and tools like asthma action plans help patients understand and manage their disease and improve their lives.

## Asthma action plans

According to the Canadian Asthma Management Consensus Summary 2010: “Asthma education is an essential component of asthma management for all patients. Guided self-management, combining asthma education, regular medical review, self-assessment and a written action plan have been shown to reduce hospitalizations, emergency visits, urgent physician visits, missed days at work or school, days of restricted activity and improved pulmonary function in children and in adults.”<sup>49</sup>

Our 2018 Asthma Survey found that respondents with an asthma action plan were more likely to take their medication as prescribed; discuss possible negative side effects of oral corticosteroid use with their physicians; discuss biologics as a treatment option; and look for asthma information online.

The survey showed that over the past 12 months, 39 per cent of patients with asthma have been educated on inhaler technique (especially those 65+: 53 per cent), though fewer have received any sort of asthma education (27 per cent) and only 15 per cent have received a written action plan from their family physician. Written plans are more likely to have been created for patients with moderate (22 per cent) or severe (32 per cent) asthma, rather than mild (10 per cent).

Pre-formatted, written action plans are available, including a Lung Association-Ontario version. They recommend daily strategies for control, when and how to adjust therapy and when to seek medical attention. Use of asthma action plans is inconsistent. The Lung Association-Saskatchewan reports that asthma educators are using action plans. New Brunswick reports that respiratory educators are using action plans, but patient feedback indicates that doctors are not. Manitoba, Nova Scotia and Alberta Lung Associations report action plan use is inconsistent and varies widely.

## Licensed CREs and CAEs

The certified respiratory educator (CRE) credential recognizes healthcare professionals who provide respiratory education, including education in asthma and COPD (chronic obstructive pulmonary disease). The certified asthma educator (CAE) credential recognizes healthcare professionals who provide asthma education to clients. Canada has 1,362 certified respiratory educators in Canada, 42 per cent (655) of whom are in Ontario. Canada also has 355 certified

asthma educators. While physicians and nurses can provide asthma education, they do not necessarily have the depth of knowledge of a certified educator (note: nurses may also have a CRE or CAE designation).

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## EMERGENCY CARE PATHWAYS

An emergency care pathway is designed to promote appropriate assessment, evidence-based asthma treatment, patient education, comprehensive discharge instructions and arrangements for follow-up care for patients with an asthma exacerbation that has led to an ER visit.

The Government of Ontario funded the development of a standardized asthma care pathway for adults. Following a successful pilot study, it funded The Lung Association-Ontario to design and support a roll-out of the care pathway, making it available to all Ontario ERs through regional workshops between 200 and 2011. A study found more than one-third of reporting Ontario ERs are using a standardized adult asthma care pathway.<sup>50</sup>

Another study<sup>51</sup> compared emergency department management, admissions, repeat ER visits and length of stay between five Ontario sites with a care pathway and five control sites not using one. Sites using the care pathway showed significant increases in the use of metered dose inhalers, inhaled steroids, referrals, documentation of teaching, patient recollection of teaching and oxygen. The length of stay for discharged patients increased by an average of 16 minutes. There was no significant difference in the amount of repeat ER visits.

Uptake of ER care pathways in other provinces has been varied. Acute childhood asthma pathways are used by Alberta Health Services. Dr. Hernandez reported that Nova Scotia tried to implement emergency care pathways without a lot of success. For example, it is “hit and miss” who is referred for follow-up after a visit. Saskatchewan has no official program and usage varies by region.

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# BURDEN OF DISEASE

Asthma takes its toll on the patient, as well as our healthcare system and economy. It costs millions of dollars and impacts patients' quality of life. Taking steps, such as supporting vulnerable populations or ensuring people with asthma get their flu shot, can go a long way to easing the burden of asthma.

## Direct costs of asthma

Direct costs of asthma include hospital care, emergency room and doctor visits, ambulance use, medications, blood and diagnostic tests, research and education. Indirect costs include missed school days, travel to appointments, out-of-pocket prescription costs and lost productivity (presenteeism) and missed work for people with asthma and caregivers of children with asthma.

In 2017-18, asthma attacks resulted in 64,683 emergency room visits across Canada.<sup>52</sup> And according to the Conference Board of Canada, in 2010, the cost of hospitalization for asthma was \$250.7 million. The cost of physicians who cared for asthma patients was \$196.3 million and medications cost \$535.7 million. The same study estimates the average annual growth of direct costs (hospitalization, medication and physicians) will be 3.1 per cent between 2010 and 2030, with costs increasing from \$982 million in 2010 to \$1.8 billion in 2030.<sup>53</sup>

## Indirect costs of asthma

The same Conference Board of Canada report found that indirect costs, in this case lost wages and long-term disability costs, totaled \$1.23 billion in 2010 and estimated they would rise to \$2.39 billion in 2030 at an average annual growth of 3.4 per cent.<sup>54</sup>

In addition to the financial indirect costs, are the emotional and quality of life costs. Before she found a more effective treatment, Patti, an Alberta resident with asthma, was forced to retire from her position with the RCMP because she could not do her job. She could not be active with her family or go to the gym. She could hardly walk across her house without being out of breath.

Patti is not alone. The 2016 Asthma Control in Canada Survey<sup>55</sup> found:

- 45 per cent of Canadians with asthma report having a hard time breathing with day-to-day activities.
- 43 per cent have missed out on activities they wanted to pursue because of asthma.
- One-third of Canadians with asthma have missed school, work or other social engagements due to asthma.

In our 2018 Asthma Survey, among the 18 per cent of respondents who have missed school, work or social engagements because of their asthma, 62 per cent indicate it happens every few months or less often, while 34 per cent say it occurs at least once a month. The frequency is linked to the severity of asthma and whether the respondent is a smoker. Smokers are two times more likely to indicate their asthma symptoms have caused them to miss school, work or other engagements (34 per cent vs. 15 per cent among non-smokers).

## Mental health burden

A higher prevalence of asthma was observed among people who used health services for mood and anxiety disorders compared to those who did not, according to a 2015 report from the Canadian Chronic Disease Surveillance System.<sup>56</sup> Between 2000-01 and 2009-10, asthma was the most prevalent condition among people who used health services for mood and anxiety disorders compared to those who did not. People with asthma were 1.5 times more likely to access these services.

While the cause of this relationship is not known, the report discusses research that has shown that people with depression and anxiety have an increased risk of developing chronic physical diseases and that people affected by chronic physical conditions are at increased risk of experiencing depression and anxiety. For example, the early onset of depression and anxiety has been associated with an increased risk of developing heart disease, asthma, arthritis, chronic back pain and chronic headaches. It is also possible the decreased quality of life and burden of living with a chronic disease may lead to depression or anxiety.

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# IMPROVING THE BURDEN OF DISEASE

While proper diagnosis, education and treatment are imperative for asthma management, other factors can affect quality of life for people with asthma. Taking steps to ease the burden of disease, in areas such as preventing illnesses like influenza or improving indoor air quality can go a long way to enhancing lives.

## Socioeconomic influence on the burden of asthma

Socioeconomic status and level of education appear to have an effect on the burden of asthma. One study<sup>57</sup> assessed associations between individual-level socioeconomic status and asthma factors in adults with asthma in Canada. Patients with lower socioeconomic status had worse asthma control, worse asthma self-efficacy and greater use of emergency health services compared to patients with a higher socioeconomic status. These findings took into account age, gender, asthma severity, current smoking, BMI and having a mood and/or anxiety disorder.

Many studies also discuss the influence of socioeconomic status on children with asthma. In 2018, the Canadian Institute of Health Information released a report showing that throughout the past decade, hospitalization rates for children and youth under 20 remained about 1.5 times higher in the lowest-income neighbourhoods compared with the highest-income neighbourhoods.

## Indoor air quality

Everyone's health can be affected by indoor air quality problems, but especially people with asthma. Common sources of poor indoor air quality include cigarette smoke, mould or mildew, household cleaners, high humidity and wood smoke. Steps people can take to improve air quality include covering pillows and mattresses with anti-allergy covers, using air cleaning devices and changing floor coverings. The Canadian Revenue Agency provides a tax credit for purchase of an air or water filter for people coping with a severe respiratory ailment (a prescription is needed).



## Outdoor air quality data

Poor outdoor air quality can make it difficult to breathe, irritate the lungs and worsen asthma. For people with asthma, it is important to know how air pollution affects their symptoms and be able to access information on local air quality.

Websites, including the Government of Canada, the Weather Network and the Air Quality Health Index list air quality information for regions across the country. Provincial Lung Association websites also provide links. The Air Quality Health Index provides reports for:

- 14 locations in Alberta
- 23 locations in British Columbia, plus more specific information for Vancouver
- 33 locations in Ontario, plus more specific information for Hamilton, Toronto and Windsor
- Two locations in Manitoba
- Seven locations in New Brunswick
- Five locations in Newfoundland and Labrador
- Three locations in the Northwest Territories
- Six locations in Nova Scotia, with more specific information for Halifax
- Three locations in Nunavut
- Three locations in Prince Edward Island
- Three locations in Saskatchewan
- One location in the Yukon

## The flu shot and people living with asthma

The National Advisory Committee on Immunizations set a target that 80 per cent of Canadians with selected chronic conditions should get a flu shot. According to Statistics Canada, however, 32 per cent of people with these conditions (heart disease, effects of stroke, asthma, diabetes, cancer, emphysema, bronchitis, chronic obstructive pulmonary disease and obesity) had a flu shot in 2013-2014.<sup>58</sup> The rate was not broken down by condition, however, the 2011 Survey on Living with Chronic Disease in Canada found that 68 per cent of people with asthma reported having a flu vaccine.<sup>59</sup>

While there is no cure for asthma, increasing access to diagnostic tests, treatment, patient support and education can pave the way to a better life for people with asthma. Together, we can shape an environment that will better support more effective and timely diagnosis, treatment and education and provide a strong base for awareness and advocacy to help people with asthma live normal, active lives and decrease healthcare costs and pressures.

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# RECOMMENDATIONS

*Moving the Dial on Diagnosis and Treatment of Asthma* shared the experiences of healthcare providers and people living with asthma and identified gaps and issues faced along a patient's journey. Through this, four key recommendations emerged that would improve asthma management in Canada and reduce its physical, social and financial impact.

## Nationwide strategy to increase access to accredited, high-quality spirometry

The importance of spirometry testing in asthma diagnosis has been well established in this report. As well, Canadian Thoracic Society (CTS) guidelines state that diagnosis should come from the combination of clinical history and objective measures of lung function (in patients six years of age and older), with spirometry as the preferred method.<sup>60</sup> Despite this, spirometry is not consistently used, due to lack of education, access to equipment or testing facilities or failure to follow guidelines. This can lead to over diagnosis and under diagnosis of asthma, which can be harmful to a patient's health and lead to unnecessary healthcare costs.

A strategy is needed to increase access to spirometry testing, proper education for test providers and those interpreting the results and accreditation/regulations for labs or other settings where lung function testing is performed.

In a recent Asthma Canada Speakers Series Webinar on proper diagnosis and correct testing,<sup>61</sup> Dr. Shawn Aaron, senior scientist, Clinical Epidemiology Program at the Ottawa Hospital Research Institute and chief of Respiratory Medicine at The Ottawa Hospital, pointed out that if, for example, pneumonia is suspected, a physician will send a patient for an x-ray, often right across the street, and have a report within 24 hours. Spirometry could be performed in much the same way, within a diagnostic lab, interpreted by a

respirologist and sent back to the family physician in 24 hours.

Another way to improve access is to educate primary care physicians on the importance of spirometry in making a proper diagnosis, rather than relying on a clinical exam alone. With proper education, when a primary care physician suspects a lung condition, they would send a patient for a spirometry test and have it interpreted by a specialist. Another strategy to improve access would be to increase spirometry testing in primary care offices—but this must come with proper training of the healthcare providers doing the testing and interpreting the results, as well as an accreditation system for testing the facility and verifying the provider's qualifications.

Other creative strategies are possible. For example, the London Family Health Team in Ontario created and shared a flow chart for the process of referring patients for spirometry testing, promoted training sessions to demonstrate best practice in spirometry technique and trained registered nurses on spirometry testing. Following this, the per cent of those currently smoking and those who formerly smoked over 40 years of age screened for COPD increased from 72.2 per cent in September 2010 to 98 per cent in August 2011.<sup>62</sup>

For the Asthma Toolkit Program in Colorado,<sup>63</sup> asthma specialists train primary care providers on spirometry. As part of the Lung Association Provider Education Program's online spirometry workshop, healthcare providers see a demonstration on how to do spirometry and actively work through interpreting case test results. They learn to list the terms and measurements of lung values in order to apply this to spirometry interpretation, identify criteria for test acceptability and correctly interpret 20 spirometry case studies. The online Spirometry 360 program in Washington is similar and also provides five monthly feedback reports on provider spirometry test results.

In British Columbia, for the past 20 years, only interpretation of a portion of spirometry test results (numeric data) could be approved for payment by the Medical Services Plan to private-office practitioners. As of December 2018, the province is allowing and reimbursing for interpretation of another part (graphic/flow volume loop) if the practitioner is appropriately credentialed and the facility is accredited. This new allowance permits adult and pediatric respirologists, clinical immunologists and allergists to perform complete interpretations in private practice—something only previously allowed in hospital-affiliated labs. The express purpose of this policy change was to increase access to spirometry.

A spirometry test is inexpensive and fast, costing about \$40 in Ontario. This expenditure could save the healthcare system millions of dollars, as under diagnosis of asthma leads to ER visits and hospital admissions due to exacerbations, as well as employees missing work due to uncontrolled symptoms. Over diagnosis can mean other serious conditions go undiagnosed and untreated and can cost millions of dollars in unnecessary medications that can expose patients to unnecessary side effects.

## Nationwide strategy to improve asthma control

Many patients and healthcare providers do not understand what asthma control means. Asthma control refers to how well symptoms and limitations (missing school or work or being unable to exercise) have been reduced or eliminated with treatment. Severity of asthma and control of asthma are two different things. For example, a person with severe asthma can be well controlled while a person with mild asthma may have poor asthma control.

The 2016 Asthma Control in Canada survey found that 93 per cent of Canadians with asthma believe their condition is well-

controlled, but in fact, nine in 10 Canadians with asthma do not have it under control according to Canadian Thoracic Society Guidelines criteria, which include not missing school or work due to symptoms, experiencing daytime symptoms three times a week or less and needing rescue inhalers fewer than four times a week.<sup>64</sup>

In our 2018 Asthma Survey, 92 per cent of respondents said they have their condition under control, with more than half indicating it is very well under control. But about 40 per cent of respondents said they regularly experience symptoms (wheezing, coughing and/or a hard time breathing) and 56 per cent use an inhaler more than three times in a given week. Meanwhile, almost one-third don't exercise at all because of their asthma. They have just accepted this as a part of coping, but with proper management of their disease, they could live life fully, engaging in activities they have given up.

These statistics show that better education is needed to help patients and physicians understand what asthma control actually looks like. If patients are experiencing symptoms, their asthma is not under control. They need to know how to control their asthma, which includes understanding the type of asthma they have, ensuring they have been properly diagnosed and referred to a specialist if necessary and are receiving the correct treatment.

The increased use of validated assessment tools can help improve control and aid healthcare providers in recognizing improvement or decline in control. During an appointment, healthcare providers may ask patients to report their control based on symptoms, use of inhalers and any limitations on activities. However, patients may overestimate their control when self-reporting in this way. Easy-to-use, validated tools for the assessment of asthma control can better monitor improvement or deterioration and should become part of common practice. These include

standardized questionnaires, such as the 30 Second Asthma Test, Asthma Control Check or the Asthma Control Questionnaire.

Education for healthcare professionals could also include widespread implementation and use of resources to learn about asthma and increase adherence to guidelines. These include programs such as The Lung Association – Ontario’s Provider Education Program.

Another way to improve control is through education on inhaler technique, adherence to prescribed treatments, oral/systemic corticosteroid use and over-reliance on short-acting beta agonists (SABAs). A start would simply be improved promotion of resources that already exist, for example, the Lung Association Lung Health Information Line, staffed by certified respiratory educators. As well, fewer than half of the Asthma Society of Canada’s National Asthma Patient Alliance (now the Asthma Canada Member Alliance), were aware of an asthma clinic or education centre in their area.<sup>65</sup> Since members of this alliance are more engaged than average asthma patients, this lack of knowledge shows more promotion is needed. Another strategy might be active campaigns to encourage more professionals to become certified as certified respiratory educators or certified asthma educators and to increase patient education during ER visits prior to discharge.

## Nationwide strategy on the use of asthma action plans

Asthma action plans help patients take control of their asthma, know when to adjust their medications and decide when to seek urgent care. CTS guidelines state that while verbal plans have not been shown to benefit patients, written plans, when combined with asthma education, regular medical review and self-assessment, can help reduce hospitalizations, emergency visits, urgent physician visits, missed days at work or school and days of restricted activity and help improve pulmonary function.<sup>66</sup>

Despite this, many patients report not having a written asthma action plan. Our 2018

Asthma Survey found that only 44 per cent of respondents know what an action plan is and just 22 per cent have one in place. The survey also found that respondents with an action plan were more likely to:

- Take medications as prescribed
- Discuss possible negative side effects associated with oral corticosteroids (among past and present users)
- Look up information about asthma on the internet
- Discuss treatment options, specifically biologics, with their healthcare provider

Increasing the use of asthma action plans requires educating healthcare providers and patients. Providers need to know the benefits and how to use this tool with their patients. If patients are aware of the tool, they can ask their healthcare provider about it or even bring one to an appointment (free, preformatted templates are available online through The Lung Association). Publicizing asthma action plans, through advertising and social media campaigns and literature in physician offices and asthma clinics, could prompt patients to request a plan from their healthcare provider. This simple, inexpensive tool helps save the costs of ER visits and hospitalization and can help a patient feel empowered and better able to advocate for themselves.

If asthma action plans are part of training when healthcare providers learn about asthma, they will become a standard part of care. To increase convenience, asthma action plans could also be incorporated into electronic medical record (EMR) systems to be routinely given to a patient on discharge from the hospital, emergency room or physician’s office. In one study, when an asthma action plan was integrated into the EMR, it increased the number of children hospitalized with an asthma exacerbation who received an asthma action plan. Prior to the EMR system, four per cent received an asthma action plan upon discharge, while after implementation, 58 per cent received an asthma action plan upon discharge.<sup>67</sup>

## Individualized treatment plans— right medication for the right patient at the right time

Asthma is not the same for all people. There are differences in types of asthma, causes, triggers and severity. One type of treatment does not fit all. Once a patient has a proper diagnosis—through a clinical exam, patient history and spirometry testing—a personalized treatment plan must be established. With wider acceptance that there are different types of asthma along with the emergence of biologics, it is time to reconsider asthma treatment and take a tailored, personalized approach. One key to this is referral to a specialist for patients with asthma that is difficult to manage. Another is access to proper prescription medications. Lengthy provincial public and private drug plan review of respiratory biologics for formulary listings delays access to these treatments. Without public or private coverage, it can be

difficult for patients to cover the cost of these medicines out of pocket.

Patients also need to be aware of all of their treatment options. Those who have been maximized on their inhaler therapies and continue to experience asthma symptoms may have undiagnosed severe asthma and should be referred to a specialist to determine if a more personalized treatment approach is required, such as a biologic. Otherwise, they may not be receiving the proper treatment for their asthma and are being exposed to possible serious side effects. Our 2018 Asthma Survey showed that 63 per cent of respondents had never discussed a respiratory biologic with their doctor. Increased awareness of the availability of novel treatments is needed among family physicians and patients for those who have a proper diagnosis of severe asthma. They need to know other options exist. Patients and doctors need a holistic approach to treatment—one size does not fit all.

## THE WAY FORWARD

In Finland, the Ministry of Social Affairs and Health set up a comprehensive, national asthma program from 1994 to 2004 to ease the burden of asthma on individuals and society. In 2010, it was estimated that total asthma costs (healthcare, drugs, disability and productivity loss) would have been €500-800 million annually by that point, if 1990s trends had continued with no action. Instead, the actual costs in 2010 were less than half of that, at about €200 million. The program reached deep into healthcare structures and included education of primary care providers, more spirometry testing and increased patient education, including guidance on inhaler technique and the use of written asthma action plans.<sup>68</sup>

Reducing the burden of asthma on patients in Canada, as well as direct and indirect costs to our healthcare system, will take a coordinated, comprehensive effort including the recommendations discussed above. The Lung Association, patients with asthma, healthcare professionals and government can work together to achieve effective and timely diagnosis and treatment, education and support to improve the lives of Canadians with asthma.

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# ENDNOTES

- 1 Statistics Canada. (2017). *Asthma, by age group* Table 13-10-0096-08 Asthma, by age group
- 2 Canadian Institute for Health Information. (2018). *Asthma Hospitalizations Among Children and Youth In Canada: Trends and Inequalities* <https://www.cihi.ca/sites/default/files/document/asthma-hospitalization-children-2018-chartbook-en-web.pdf>
- 3 Hermus, Greg, Stonebridge, Carole, Goldfarb, Danielle, Thériault, Louis and Bounajm, Fares. (2012). *Conference Board of Canada, Cost Risk Analysis for Chronic Lung Disease in Canada* <https://www.conferenceboard.ca/e-library/abstract.aspx?did=4585>
- 4 Statistics Canada. (2017). *Asthma, by age group* Table 13-10-0096-08 Asthma, by age group
- 5 Canadian Institute for Health Information. (2018). *Asthma Hospitalizations Among Children and Youth In Canada: Trends and Inequalities* <https://www.cihi.ca/sites/default/files/document/asthma-hospitalization-children-2018-chartbook-en-web.pdf>
- 6 Scott's Medical Database. (2016). *Supply, Distribution and Migration of Physicians in Canada, 2016: Data Tables* <https://www.cihi.ca/en/physicians-in-canada>
- 7 Public Health Agency of Canada. *Fast Facts about Asthma: Data compiled from the 2011 Survey on Living with Chronic Diseases in Canada* [http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma\\_fs\\_asthme-eng.pdf](http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma_fs_asthme-eng.pdf)
- 8 Scott's Medical Database. (2016). *Supply, Distribution and Migration of Physicians in Canada, 2016: Data Tables* <https://www.cihi.ca/en/physicians-in-canada>
- 9 ibid
- 10 ibid
- 11 Canadian Medical Association. (2018). *Respirology Profile* <https://www.cma.ca/Assets/assets-library/document/en/advocacy/profiles/respirology-e.pdf>
- 12 Scott's Medical Database. (2016). *Supply, Distribution and Migration of Physicians in Canada, 2016: Data Tables* <https://www.cihi.ca/en/physicians-in-canada>
- 13 Leger. (2016). *Lung Association of Canada, Asthma Study*
- 14 Gershon, Andrea S, Victor, J. Charles, Guan, Jun, Aaron, Shawn D, To, Teresa. (2012). Pulmonary function testing in the diagnosis of asthma: a population study. *Chest*, 141(5), 1190- 1196 [https://linkinghub.elsevier.com/retrieve/pii/S0012-3692\(12\)60275-X](https://linkinghub.elsevier.com/retrieve/pii/S0012-3692(12)60275-X)
- 15 Schneider, Antonius, Gindner, Lena, Tilemann, Lisa et al. (2009). Diagnostic Accuracy of Spirometry in Primary Care. *BMC Pulmonary Medicine*, 9(31) (<https://bmcpulmed.biomedcentral.com/articles/10.1186/1471-2466-9-31>)
- 16 Lougheed, M Diane, Lemièrre, Catherine, Ducharme, Francine M et al. (2012). Canadian Thoracic Society Asthma Clinical Assembly. Canadian Thoracic Society 2012 guideline update: Diagnosis and management of asthma in preschoolers, children and adults. *Canadian Respiratory Journal*, 19(6), e81-e88
- 17 Fitzgerald, Mark, Tavakoli, Hamid, Lynd, Larry D, Al Efraij, Khalid and Sadatsafavi, Mohsen. (2017). The impact of inappropriate use of short acting beta agonists in asthma. *Respiratory Medicine*, 131, 135-140 <https://www.sciencedirect.com/science/article/pii/S0954611117302779>
- 18 Lougheed, M Diane, Lemièrre, Catherine, Dell, Sharon D et al. (2010). Canadian Thoracic Society Asthma Management Continuum - 2010 Consensus Summary for children six years of age and over, and adults. *Canadian Respiratory Journal*, 17(1), 15-24 <https://tspace.library.utoronto.ca/bitstream/1807/87639/2/CRJ.2010.827281.pdf>
- 19 Kwok, C, DeWit, Y, Madely, CE, MacKinnon, J, To, TM, Jabbour, M, Lougheed, MD. (2018). Adult Asthma Management Resources and Pathway Implementation in Ontario Emergency Departments. *ATS International Conference, San Diego, CA*
- 20 Lougheed, M, Olajos-Clow, J., Szpiro, K, Moyse, P, Julien, B, Wang, M and Day, A. (2009). Multicentre evaluation of an emergency department asthma care pathway for adults. *Canadian Journal of Emergency Medicine*, 11(3), 215-229 <https://www.cambridge.org/core/journals/canadian-journal-of-emergency-medicine/article/multicentre-evaluation-of-an-emergency-department-asthma-care-pathway-for-adults/324F378319F075CA008447950D7216F7>
- 21 Canadian Institute for Health Information. (2018). *Emergency Department Visits: Volumes and Median Length of Stay by Triage Level, Visit Disposition and Main Problem* <https://www.cihi.ca/en/nacrs-emergency-department-ed-visits-volumes-and-median-length-of-stay-by-triage-level-visit>
- 22 Canadian Institute for Health Information. (2018). *Asthma Hospitalizations Among Children and Youth In Canada: Trends and Inequalities* <https://www.cihi.ca/sites/default/files/document/asthma-hospitalization-children-2018-chartbook-en-web.pdf>
- 23 Canadian Institute for Health Information. (2018). *Emergency Department Visits: Volumes and Median Length of*

- Stay by Triage Level, Visit Disposition and Main Problem* <https://www.cihi.ca/en/nacrs-emergency-department-ed-visits-volumes-and-median-length-of-stay-by-triage-level-visit>
- 24 Hermus, Greg, Stonebridge, Carole, Goldfarb, Danielle, Thériault, Louis and Bounajm, Fares. (2012). *Conference Board of Canada, Cost Risk Analysis for Chronic Lung Disease in Canada* <https://www.conferenceboard.ca/e-library/abstract.aspx?did=4585>
  - 25 To, Teresa, Ryckman, Kandace, Zhu, Jingqin et al. (2017). Mental Health Services Claims and Adult Onset Asthma in Ontario, Canada. *The Journal of Allergy and Clinical Immunology: In Practice*, 5(5), 1388-1393.e3 <https://www.sciencedirect.com/science/article/pii/S2213219817301137?via%3Dihub>
  - 26 Bacon, Simon L, Bouchard, Anne, Loucks, Eric B and Lavoie, Kim L. (2009). Individual-level socioeconomic status is associated with worse asthma morbidity in patients with asthma. *Respiratory Research*, 10(125) <https://respiratory-research.biomedcentral.com/articles/10.1186/1465-9921-10-125>
  - 27 Gionet, Linda. (2015). Health at a glance: Flu vaccination rates in Canada. *Statistics Canada* <https://www150.statcan.gc.ca/n1/pub/82-624-x/2015001/article/14218-eng.htm#a6>
  - 28 Public Health Agency of Canada. *Fast Facts about Asthma: Data compiled from the 2011 Survey on Living with Chronic Diseases in Canada* [http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma\\_fs\\_asthme-eng.pdf](http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma_fs_asthme-eng.pdf)
  - 29 Scott's Medical Database. (2016). *Supply, Distribution and Migration of Physicians in Canada, 2016: Data Tables* <https://www.cihi.ca/en/physicians-in-canada>
  - 30 Globerman, Steven, Barua, Bacchus and Hasan, Sazid. (2018). The Supply of Physicians in Canada: Projections and Assessment. *Fraser Institute* <https://www.fraserinstitute.org/sites/default/files/supply-of-physicians-in-canada.pdf>
  - 31 Statistics Canada. (2017). *Primary Health Care, 2015* <https://www150.statcan.gc.ca/n1/pub/82-625-x/2017001/article/14769-eng.htm>
  - 32 Public Health Agency of Canada. *Fast Facts about Asthma: Data compiled from the 2011 Survey on Living with Chronic Diseases in Canada* [http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma\\_fs\\_asthme-eng.pdf](http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma_fs_asthme-eng.pdf)
  - 33 Canadian Medical Association. (2018). *Respirology Profile* <https://www.cma.ca/Assets/assets-library/document/en/advocacy/profiles/respirology-e.pdf>
  - 34 Lougheed, M Diane, Lemièrre, Catherine, Dell, Sharon D et al. (2010). Canadian Thoracic Society Asthma Management Continuum – 2010 Consensus Summary for children six years of age and over, and adults. *Canadian Respiratory Journal*, 17(1), 15-24 <https://tspace.library.utoronto.ca/bitstream/1807/87639/2/CRJ.2010.827281.pdf>
  - 35 Leger. (2016). *Lung Association of Canada, Asthma Study*
  - 36 Gershon, Andrea S, Victor, J. Charles, Guan, Jun, Aaron, Shawn D, To, Teresa. (2012). Pulmonary function testing in the diagnosis of asthma: a population study. *Chest*, 141(5), 1190- 1196 [https://linkinghub.elsevier.com/retrieve/pii/S0012-3692\(12\)60275-X](https://linkinghub.elsevier.com/retrieve/pii/S0012-3692(12)60275-X)
  - 37 Aaron, SD, Vandemheen, KL, FitzGerald, JM et al. (2017). Reevaluation of Diagnosis in Adults With Physician-Diagnosed Asthma. *Journal of American Medical Association*, 317(3), 269-279 <https://jamanetwork.com/journals/jama/fullarticle/2598265>
  - 38 Asthma Canada. (2018). *Speakers Series Webinars: Proper Diagnosis and Correct Testing* <https://asthma.ca/get-help/webinars/>
  - 39 Schneider, Antonius, Gindner, Lena, Tilemann, Lisa et al. (2009). Diagnostic Accuracy of Spirometry in Primary Care. *BMC Pulmonary Medicine*, 9(31) (<https://bmcpulmed.biomedcentral.com/articles/10.1186/1471-2466-9-31>)
  - 40 Thériault, R and Raz, A. (2018). Patterns of bronchial challenge testing in Canada. *Canadian Journal of Respiratory Therapy*, 54(2), 41-47 <https://www.cjrt.ca/wp-content/uploads/cjrt-2018-006.pdf>
  - 41 Sadatsafavi, Mohsen, Tavakoli, Hamid, Lynd, Larry and FitzGerald, J. Mark (2017). Has Asthma Medication Use Caught Up With the Evidence?: A 12-Year Population-Based Study of Trends. *Chest*, 151(3), 612-618 <http://cictrials.ca/wp-content/uploads/Has-asthma-medication-use-caught-up-with-the-evidence.pdf>
  - 42 Lougheed, M Diane, Lemièrre, Catherine, Ducharme, Francine M et al. (2012). Canadian Thoracic Society Asthma Clinical Assembly. Canadian Thoracic Society 2012 guideline update: Diagnosis and management of asthma in preschoolers, children and adults. *Canadian Respiratory Journal*, 19(6), e81-e88 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4527232/>
  - 43 Tavakoli, Hamid, FitzGerald, J. Mark, Lynd, Larry D and Sadatsafavi, Mohsen. (2018). Predictors of inappropriate and excessive use of reliever medications in asthma: a 16-year population-based study. *BMC Pulmonary Medicine*, 18(33) <https://bmcpulmed.biomedcentral.com/articles/10.1186/s12890-018-0598-4>
  - 44 Sadatsafavi, Mohsen, Tavakoli, Hamid, Lynd, Larry and FitzGerald, J. Mark (2017). Has Asthma Medication Use Caught Up With the Evidence?: A 12-Year Population-Based Study of Trends. *Chest*, 151(3), 612-618 <http://cictrials.ca/wp-content/uploads/Has-asthma-medication-use-caught-up-with-the-evidence.pdf>
  - 45 The Lung Association. (2016). *Asthma Control in Canada™ Survey, 2016* <https://www.lung.ca/news/advocacy-tools/our-publications>
  - 46 Barua, Bacchus, Jacques David and Esmail, Nadeem. (2018). Provincial Drug Programs for Vulnerable Canadians.



---

Fraser <https://www.fraserinstitute.org/studies/provincial-drug-coverage-for-vulnerable-canadians>

- 47 *ibid*
- 48 The Lung Association. (2016). *Asthma Control in Canada™ Survey, 2016* <https://www.lung.ca/news/advocacy-tools/our-publications>
- 49 Lougheed, M Diane, Lemière, Catherine, Dell, Sharon D et al. (2010). Canadian Thoracic Society Asthma Management Continuum – 2010 Consensus Summary for children six years of age and over, and adults. *Canadian Respiratory Journal*, 17(1), 15-24 <https://tspace.library.utoronto.ca/bitstream/1807/87639/2/CRJ.2010.827281.pdf>
- 50 Kwok, C, DeWit, Y, Madely, CE, MacKinnon, J, To, TM, Jabbour, M, Lougheed, MD. (2018). Adult Asthma Management Resources and Pathway Implementation in Ontario Emergency Departments. *ATS International Conference, San Diego, CA*
- 51 Lougheed, M, Olajos-Clow, J., Szpiro, K, Moyse, P, Julien, B, Wang, M and Day, A. (2009). Multicentre evaluation of an emergency department asthma care pathway for adults. *Canadian Journal of Emergency Medicine*, 11(3), 215-229 <https://www.cambridge.org/core/journals/canadian-journal-of-emergency-medicine/article/multicentre-evaluation-of-an-emergency-department-asthma-care-pathway-for-adults/324F378319F075CA008447950D7216F7>
- 52 Canadian Institute for Health Information. (2018). *Emergency Department Visits: Volumes and Median Length of Stay by Triage Level, Visit Disposition and Main Problem*. <https://www.cihi.ca/en/nacrs-emergency-department-ed-visits-volumes-and-median-length-of-stay-by-triage-level-visit>
- 53 Hermus, Greg, Stonebridge, Carole, Goldfarb, Danielle, Thériault, Louis and Bounajm, Fares. (2012). *Conference Board of Canada, Cost Risk Analysis for Chronic Lung Disease in Canada* <https://www.conferenceboard.ca/e-library/abstract.aspx?did=4585>
- 54 *ibid*
- 55 The Lung Association. (2016). *Asthma Control in Canada™ Survey, 2016* <https://www.lung.ca/news/advocacy-tools/our-publications>
- 56 Public Health Agency of Canada. (2015). *Report from the Canadian Chronic Disease Surveillance System: Mental Illness in Canada* <https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/diseases-conditions-maladies-affections/mental-illness-2015-maladies-mentales/alt/mental-illness-2015-maladies-mentales-eng.pdf>
- 57 Bacon, Simon L, Bouchard, Anne, Loucks, Eric B and Lavoie, Kim L. (2009). Individual-level socioeconomic status is associated with worse asthma morbidity in patients with asthma. *Respiratory Research*, 10(125) <https://respiratory-research.biomedcentral.com/articles/10.1186/1465-9921-10-125>
- 58 Gionet, Linda. (2015). Health at a glance: Flu vaccination rates in Canada. *Statistics Canada*. <https://www150.statcan.gc.ca/n1/pub/82-624-x/2015001/article/14218-eng.htm#a6>
- 59 Public Health Agency of Canada. *Fast Facts about Asthma: Data compiled from the 2011 Survey on Living with Chronic Diseases in Canada* [http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma\\_fs\\_asthme-eng.pdf](http://www.phac-aspc.gc.ca/cd-mc/crd-mrc/assets/pdf/asthma_fs_asthme-eng.pdf)
- 60 Lougheed, M Diane, Lemière, Catherine, Ducharme, Francine M et al. (2012). Canadian Thoracic Society Asthma Clinical Assembly. Canadian Thoracic Society 2012 guideline update: Diagnosis and management of asthma in preschoolers, children and adults. *Canadian Respiratory Journal*, 19(6), e81-e88 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4527232/>
- 61 Asthma Canada. (2018). *Speakers Series Webinars: Proper Diagnosis and Correct Testing* <https://asthma.ca/get-help/webinars/>
- 62 The Lung Association. (2017). Drug Reimbursement: Managing costs without compromising health and access <http://lungontario.ca/wp-content/uploads/2018/07/White-Paper.pdf>
- 63 National Jewish Health. Asthma Toolkit Program: On the Road to Better Asthma Care <https://www.nationaljewish.org/education-training/feature/asthma-toolkit>
- 64 The Lung Association. (2016). *Asthma Control in Canada™ Survey, 2016* <https://www.lung.ca/news/advocacy-tools/our-publications>
- 65 Asthma Canada. *Moving Asthma Issues Forward: Key Findings from the National Asthma Patient Alliance Survey* <https://www.asthma.ca/wp-content/uploads/2017/07/research-report11.pdf>
- 66 Lougheed, M Diane, Lemière, Catherine, Dell, Sharon D et al. (2010). Canadian Thoracic Society Asthma Management Continuum – 2010 Consensus Summary for children six years of age and over, and adults. *Canadian Respiratory Journal*, 17(1), 15-24 <https://tspace.library.utoronto.ca/bitstream/1807/87639/2/CRJ.2010.827281.pdf>
- 67 Tolomeo, Concettina, (Tina), Shiffman, Richard and Bazyzy-Asaad, Alia. (2008). Electronic Medical Records in a Sub-Specialty Practice: One Asthma Center's Experience, *Journal of Asthma*, 4(9), 849-851 <https://www.tandfonline.com/doi/full/10.1080/02770900802380803>
- 68 Haahtela, T, Tuomisto, LE, Pietinalho, A et al. (2006). A 10 year asthma programme in Finland: major change for the better. *Thorax*, 61(8), 663-670. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2104683/>

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