

Nicole Rakowski  
Research Summary

### Abstract

Many scientific findings have shown that the effects of pollution on human health are enormous, including higher rates of lung disease, respiratory illnesses and chronic obstructive pulmonary disease (COPD). Hamilton will continue to suffer significantly if fossil fuel emissions are not reduced. This paper investigates how individuals' health has been affected, and how that creates a burden for the health care system in Hamilton. Understanding the main contributors to pollution in Hamilton and possible solutions to improve air quality is of significant importance as it can lead to a better understanding on the Earth's state in the future.

### Introduction

Many major urban cities around the world have far exceeded the World Health Organization's standards for key air contaminant levels.<sup>1</sup> Pollutants that exist in the air and exposure to particulate matter and ozone have been proven to be associated with numerous diseases such as chronic obstructive pulmonary disease (COPD) and many other serious conditions.<sup>2</sup> Although cigarette smoking is the leading cause of COPD, long-term exposure to air pollution leads to thousands of cases and is one of the leading causes of morbidity and mortality among low, middle and high income countries.<sup>3</sup>

Air pollution causing respiratory and cardiovascular diseases has emerged as a major public health concern.<sup>4</sup> According to the Clean Air Hamilton, Hamilton far exceeds government targets of air pollution emissions by approximately 20 days per year. It is currently ranked as one of the top cities having the highest ambient air pollution in Canada, which makes exposure to human health such a particularly important issue.<sup>4</sup>

### Methods

A thorough literature review of dated and current reports/ research articles that discussed how

Additionally, she analyzed which air pollutant types were the most detrimental to human health. The author then pursued to collect admission rates and cost statistics directly from Hamilton Health Sciences. This information can be very useful for researchers who are trying to create new policies in the city in regards to reducing emission rates, decreasing healthcare costs and seeing how that has an effect on the current demographic.

### Results

The highest concentration levels of pollution seem to be predominantly found near major intersections as well as along heavily congested roads that are affected by dirt track-out in industrial sections of the city.<sup>5</sup>

As outlined by Clean Air Hamilton, a combination of factors has led to the creation of the marked gradient pollutant exposures.<sup>6</sup> These factors include: the close situation of heavy industrial sites not only in relation to each other, but also to the harbour that is located on the northeast side of the city, meteorological circumstances due to wind patterns, the Hamilton escarpment acting as a downwind barrier and trap pollutants, the existence of four major highways and various modes of transportation such as rail and long-range air pollution that travels from industrialized regions in the mid-western United States.<sup>6</sup>

Literature suggests that air pollution can be linked directly to increased rates of mortality as well as respiratory illnesses.<sup>7,8</sup> Some studies have also shown the link between exposure to PM, O<sub>3</sub>, NO<sub>2</sub> and emission sources and the increased vulnerability to respiratory infections.<sup>7</sup>

Exposure to air pollutants has led to increased hospital admissions.<sup>2,9,11</sup> According to Jerrett and Sahsrorovglou, there are five main air pollutants that result in nearly 100 deaths and 620 hospital admissions each year in Hamilton. O<sub>3</sub> is said to have the most severe impact on respiratory health,

Literature review on the effects of pollution on respiratory illnesses in Hamilton and its cost on the healthcare system.

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Assessment Study approximated that NO<sub>2</sub>, O<sub>3</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, and CO have caused 186 premature deaths, 395 respiratory hospital admissions and 322 cardiovascular hospitalizations per year.<sup>12</sup> Clean Air Hamilton has projected that by 2026, there will be approximately 500 premature deaths, 1,200 hospital admissions and 4,250 emergency department visits due to air pollution.<sup>13</sup>

The total number of HHS and St. Josephs Hamilton Emergency Department visits for individuals with chronic respiratory illnesses by the sub LHIN (Local Health Integration Network) planning area can be seen in Table 1 below. It is evident that the most inpatient visits are by those individuals who live in the Hamilton Outer and Urban Core, while those from East Niagara experience the least Inpatient Visits. This supports previous literature in that those who are located in the core of the city, where there is a significantly greater amount of air pollution may be the most affected.

The cost of caring for the above patients in both Hamilton Health Sciences and St. Joseph's Hamilton is significantly high. For the 6,406 emergency room visits alone, the IDS report estimates the cost to be between \$1.7 to \$2.5 million annually.<sup>14</sup> In addition, the cost for the 2,853 acute inpatient cases costs the healthcare system between \$36.3 to \$36.9 million. These values were based on Hamilton Health Sciences average costs for the 2014/2015 fiscal year.<sup>14</sup>

**Discussion**

Over recent years, there has been much debate over whether indoor versus outdoor air pollution poses the most serious threat to public health. It is well known that air pollution is a growing concern in many countries around the world, especially developing regions and rapidly expanding cities. Policymakers need more concrete evidence other than just stating that high levels of pollution lead to premature deaths and life-threatening respiratory conditions.<sup>16</sup>

Sub LHIN Planning Area	Inpatient Visits	% of Total	Rate Per 1,000 Pop	Sub LHIN Pop
04 Hamilton Outer Core	2,247	35.1%	9.7	232,640
04 Hamilton Urban Core	1,897	29.6%	19.4	97,770
04 Stoney Creek	472	7.4%	7.2	65,115
04 West Niagara	335	5.2%	5.4	61,645
04 Glanbrook	246	3.8%	11.0	22,440
04 Dundas	195	3.0%	7.8	24,900
04 Ancaster	195	3.0%	5.3	36,920
04 Burlington	135	2.1%	0.8	175,780
04 Haldimand and Norfolk	106	1.7%	1.1	94,630
04 Flamborough	102	1.6%	2.5	40,075
04 Brant and Brantford	81	1.3%	0.6	129,290
04 North Niagara	30	0.5%	0.2	164,730
04 New Credit and Six Nations	26	0.4%	.	.
04 South Niagara	22	0.3%	0.2	92,000
04 East Niagara	15	0.2%	0.1	112,960
Other	302	4.7%	.	.
Grand Total	6,406		4.5	

Table 1. Total Number of HHS/St. Joseph's ED Visits With Chronic Respiratory Illnesses by Sub LHIN Area (14)

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Detailed evidence is needed to make the appropriate decisions and to set priorities that can better the global population. For instance, should the majority of funding be used towards reducing air pollution, or rather be spent on education, prevention methods, sanitation, etc?<sup>16</sup>

Although the majority of the research previously described focuses on outdoor pollution and how that affects respiratory health, there is little mention of indoor pollution as discussed by Paustenbach.<sup>17</sup> For instance, smoking indoors or lacking a proper ventilation system when cooking can all pose a threat to human health and have a significant impact on pollution exposure.<sup>18</sup> Studying both indoor as well as outdoor exposure can help researchers conduct future studies in relation to pollution levels.

### **Conclusion**

In recent years, Hamilton's Air Quality has significantly improved as a result of community wide efforts and the implementation of sustainable regulations and technologies. By educating and encouraging local industries to change their behavioural patterns, Clean Air Hamilton's dedicated efforts have resulted in reduced air emissions for the city of Hamilton.<sup>15</sup>

According to Clean Air Hamilton (6), the city has developed a number of long term strategic processes that focus on reducing emissions while adapting to the changes of climate change. Some of these initiatives include Hamilton's 30-year Growth Related Integrated Development Strategy (GRIDS), The New Official Plan as well as the Transportation Master Plan.

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