



St. Marys Cement

Health Hazard Investigation Report
Perth District Health Unit
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1.0 Summary

In the fall of 2017, the Perth District Health Unit (PDHU) received multiple complaints regarding emissions from the St. Marys Cement (SMC) plant in St. Marys, Ontario, with specific concerns related to the air quality and possible adverse health impacts.

Based on information received from the community and the Ministry of Environment and Climate Change (MOECC), PDHU decided to conduct an independent health hazard investigation to determine if the air quality in St. Marys constitutes a health hazard as defined in *the Health Protection and Promotion Act*.

PDHU found that while emissions from SMC are likely contributing to local air pollution levels, they are within the acceptable standards set out by the MOECC to protect the environment and human health.

Going forward, PDHU recommends that:

- The MOECC completes one year of fixed monitoring data collection to provide a more comprehensive dataset and to share the results with PDHU and the public.
- The MOECC conducts mobile air monitoring again in 2018.
- The MOECC better defines dust events and promotes best practices to mitigate dust events.
- The MOECC continues to monitor the SMC facility for compliance with the conditions set out in the Environmental Compliance Approval (ECA), including the odour abatement plan.
- The SMC Community Liaison Committee continue to meet and report back to the community on its work.
- St. Marys residents continue to log complaints related to air quality with the MOECC and engage the SMC Community Liaison Committee to encourage SMC to comply with its odour abatement plan.

PDHU plans to:

- Investigate if there is a better way to monitor school absenteeism in St. Marys as it directly relates to days where there are a higher number of air quality complaints reported to the MOECC.
- Receive ongoing air testing results from MOECC and analyze the results to check that they continue to be within the air quality standards.
- Continue to log any complaints related to SMC and air quality and follow-up according to internal Policies & Procedures.

This Health Hazard Investigation will be shared with stakeholders and partners as well as the St. Marys community.

2.0 Introduction

The mission of PDHU is to work in partnership with our community to foster conditions in which people can be healthy. We promote health, protect health, prevent disease and provide community health services for the people of Perth County.

PDHU serves a community located in the agricultural heartland of southwestern Ontario, covering 2,218 km² of land, and home to more than 75,000 residents (Figure 1). The largest centre is the City of Stratford, with a population of 31,465 (Statistics Canada, 2016). The town of St. Marys is situated at the south end of Perth County and has a population of 7,265 (Statistics Canada, 2016). The SMC plant, established in 1912, is located on the southwest edge of town.

Figure 1: Map of Perth County and map of St. Marys, with key points of interest.



Prior to this investigation, PDHU received occasional inquiries or complaints regarding the cement plant and air quality, which were investigated in collaboration with the MOECC. No health concerns arose out of these sporadic inquiries.

In October 2017, PDHU received a complaint from a St. Marys resident related to dust and odour presumed to be coming from SMC. This was followed by several other complaints. PDHU contacted the MOECC and learned that the number of complaints related to odour and/or dust in St. Marys over the last several months was significantly higher than previously documented. The concerns included dust, odour and health impacts (specifically asthma and cancer); additionally benzene was one pollutant of special concern raised at a meeting held in November.

In accordance with the *Health Protection and Promotion Act*, “Where a complaint is made to a board of health or a medical officer of health that a health hazard related to occupational or environmental health exists in the health unit served by the board of health or the medical officer of health, the medical officer of health shall notify the Ministry of the Government of Ontario that has primary responsibility in the matter and, in consultation with the Ministry, the medical officer of health shall investigate the complaint to determine whether the health hazard exists or does not exist”.

Further, a health hazard is defined as “a condition of a premises, a substance, thing, plant or animal other than man, or a solid, liquid, gas or combination of any of them, that is likely to have an adverse effect on the health of any person.”

Accordingly, PDHU undertook a health hazard investigation, which is described in this report.

3.0 Background

3.1 Air Pollution in Ontario

Air pollution is a significant environmental risk to health, contributing to respiratory and cardiovascular disease and lung cancer. Air quality is affected by regional air flow patterns as well as local factors, such as industry and traffic. Commonly measured air pollutants include: Sulphur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), fine particulate matter (PM_{2.5}) and ground-level ozone, which is formed when nitrogen oxides (NO_x) react with volatile organic compounds (VOC) in sunlight. Air quality in Ontario improved from 2006 to 2015, with decreasing levels of SO₂, NO₂, CO and PM_{2.5} (MOECC, 2017).

All combustion in air produces NO_x, of which NO₂ is a component. Major sources of NO_x include the transportation sector, industry and utilities. Sources of SO₂ include smelters, industry and electric utilities. Fine particulate matter is produced by motor vehicles, industry, fireplaces and woodstoves, agricultural burning and forest fires.

In Ontario, Ambient Air Quality Criteria (AAQC) are used to monitor and ensure that local industry contributions to air pollution do not exceed acceptable limits, and therefore, are safe for human health. For the purposes of protecting public health, 24-hour AAQCs usually reflect protection against acute effects, where annual AAQC are set to protect against chronic effects.

3.2 Air Pollution and Health Effects

Health effects from exposure to outdoor contaminants are related to:

- The concentration of the contaminant
- The length of exposure
- The susceptibility of the population.

3.2.a Respiratory and Cardiovascular Disease (including Asthma)

The two most important risk factors for chronic respiratory disease, such as asthma and Chronic Obstructive Pulmonary Disease (COPD), are tobacco and air quality (both indoor and outdoor), including air pollution (PHAC, 2014). Acute exposures to air pollution also exacerbate existing chronic health conditions notably asthma, COPD, and cardiovascular disease.

Asthma is a “chronic inflammatory disease of the airway” that causes shortness of breath, chest tightness, coughing and wheezing. Asthma can be mild, moderate or severe and can vary from person to person and from one episode to the next. PM_{2.5}, NO₂ and SO₂ have all been linked to exacerbations of asthma.

In Canada, asthma accounts for approximately 80% of chronic disease cases, making asthma the third-most common chronic disease in Canada. Asthma is the most common chronic disease among children in Canada and continues to be a major cause of hospitalization.

The cause of asthma is not known and currently there is no cure. There are accepted risk factors, such as family history or a history of allergies. However, with medical management, it is possible to live symptom-free.

In addition to medical therapies, people with asthma are advised to avoid “triggers”. A trigger is anything that causes inflammation in the airways, which leads to asthma symptoms. Triggers vary from person to person and may include dust mites, animals, moulds, pollens, viral infections, air pollutants, smoke, exercise, cold air and intense emotions.

For this specific health hazard investigation, PDHU examined Perth County rates of COPD and rates of asthma with a detailed focus on asthma because:

- Pollution and specifically PM_{2.5}, NO₂ and SO₂ have all been linked to exacerbations of COPD and asthma
- Some community members expressed concerns about air quality in St. Marys with regard to asthma in children.

Based on this information, examining the local rates of COPD and asthma would help answer the questions the community had related to emissions asthma and COPD.

3.2.b Cancer

Cancer is the uncontrolled growth and spread of abnormal cells that can arise out of any tissue in the body due to an alteration of the genes which normally instruct our cells in healthy growth. There are more than 200 types of cancer making it a common illness, although certain types of cancer are uncommon. Each type or family of cancers has its own causes and treatments, which may differ from that of other families of cancers. Carcinogenesis (which is the formation of cancer whereby normal cells are transformed into cancer cells) can take more than a decade so it can be difficult to pinpoint a cause.

The cause of cancer is multifactorial, meaning that a complex interaction of genetic, environmental, medical, and lifestyle risk factors may result in the cellular changes that lead to cancer. The presence of a risk factor doesn't mean that an individual will develop cancer, nor does the absence of risk factors mean that an individual will not develop cancer. The risk factor may be causative or may be a marker for some other association.

For some cancers, causal risk factors have been clearly identified. Examples include smoking and lung cancer, sun exposure and skin cancers, and the HPV virus and cervical cancer. One of the most common and important 'causes' of cancer is age. The risk of cancer increases as we get older with only 2.3% of cancers occurring before the age of 30. As we age, our bodies are less able to 'correct' the errors that lead to cancer.

Modifiable risk factors are behaviours and exposures that can raise or lower a person's risk of cancer. They are modifiable because they can, in theory, be changed. Tobacco use, alcohol consumption and excess body weight (overweight and obesity) each increase a person's risk of developing several types of cancer. Physical activity and healthy eating (frequently assessed by vegetable and fruit consumption) are associated with a reduced risk of developing several cancers.

For this specific health hazard investigation, PDHU examined Perth County rates of lung cancer, colorectal cancer, non-Hodgkin lymphoma (NHL), and acute myelogenous leukemia. These cancers were chosen because:

- Air pollution and PM_{2.5} are known to cause lung cancer
- Sufficient exposure to benzene is known to cause acute myelogenous leukemia
- A Public Health Ontario review of scientific literature identified studies where health impacts, including specific cancers (i.e. lung, colorectal, and NHL) and respiratory diseases were observed in communities surrounding industrial sources of air pollution.

Based on this information, PDHU examined the local rates of these four types of cancer to help answer the questions that the community had regarding emissions from SMC and cancer.

3.3 Additional Concerns Raised by St Marys Residents

3.3.a Dust

Dust can be described by its size in microns. For comparison, human hair is 50 – 70 microns thick, and pollen/mold are 10 microns.

Coarse Particulate Matter (described as PM₁₀) is up to 10 microns. PM₁₀ is filtered by the nose and upper airway. It is more of a nuisance, which settles out quickly and can be seen coating surfaces, and it more likely originates from local industrial activity.

Fine Particulate Matter (described as PM_{2.5}) is 2.5 microns or smaller. Sources of PM_{2.5} include motor vehicles, industry, fireplaces and woodstoves, agricultural burning and forest fires. PM_{2.5} is of most concern since it can enter the lungs and lead to adverse health effects, such as exacerbation of respiratory and cardiovascular disease and lung cancer. It can travel over long distances and local levels are less likely influenced by local industrial activity.

People with asthma, cardiovascular or lung disease, as well as children and elderly people, are considered to be the most sensitive to the effects of fine Particulate Matter.

In the *Environmental Burden of Cancer in Ontario* report, Cancer Care Ontario (CCO) and Public Health Ontario (PHO) estimate that PM_{2.5} exposure causes an estimated 560 new cancers each year in Ontario (2016).

Both air pollution and PM_{2.5} have been classified by the International Agency for Research on Cancer (IARC) as carcinogens that cause lung cancer.

3.3.b Odour

The odour detection threshold of a substance is the lowest concentration that humans can smell. Individual sensitivity to odour varies; when a particular substance exceeds the odour detection threshold that does not necessarily mean that it is detectable to all individuals in a population. The presence of an odour in itself does not mean that there is an exceedance of a standard or an acute health risk.

Generally, an outdoor environmental odour is not used as an indicator of whether there is an increased risk of harm to human health. Some individuals will experience headaches, nausea, irritated airways, cough and stress due to an odour even below hazardous levels of a substance. Odours should be avoided where possible, and for this reason, an odour abatement plan may be issued to an industry by the MOECC.

3.3.c Volatile Organic Compounds (including Benzene)

Volatile organic compounds (VOCs) are precursors of ground-level ozone and PM_{2.5}. The province of Ontario monitors VOCs using specialized, non-routine techniques to identify the trace amounts present in gaseous form.

Benzene is a VOC identified as a particular concern to some citizens in St. Marys. Trace amounts of benzene are found in petroleum and coal, and benzene is a byproduct of the incomplete combustion of many materials. Sources of benzene include industry, fuel evaporation from gasoline stations and motor vehicle exhaust. In Ontario, levels of six VOCs including benzene decreased from 2005 – 2014 (MOECC, 2017).

Benzene may be present in pollution and has been classified by IARC as a carcinogen that, with sufficient exposure, causes bone marrow dysfunction, including acute myelogenous leukemia (AML).

In the *Environmental Burden of Cancer in Ontario* report, Cancer Care Ontario (CCO) and Public Health Ontario (PHO) estimate that exposure to benzene contributes to fewer than 10 cases of cancer per year (2016).

3.4 Cement Plants and Health Effects

According to the United States Environmental Protection Agency (2016), cement plants are a significant source of SO₂, NO_x, and CO.

A 2016 report by Public Health Ontario, “Review of Health Effects from Cement Plant Operations,” found that there was limited published literature about health effects related to community exposures to cement plant operations and similar industries (Lalvani and Chung, 2016).

In the review, a causal relationship between the proximity to a cement plant and an excess risk of cancer and other health effects could not be established. However, published literature was identified that found health impacts in the surrounding communities, including specific cancers - lung cancer, colorectal cancer – and respiratory diseases.

4.0 Investigation

PDHU’s investigation included the following actions:

4.1 Consultation with the Ministry of Environment and Climate Change (MOECC)

PDHU staff met with MOECC staff on November 6, 2017, and March 29, 2018, in person and on November 21, 2017, by teleconference. PDHU staff has continued to correspond with MOECC staff throughout the investigation.

PDHU requested and reviewed the following information from MOECC regarding air quality in St. Marys and SMC:

Odour and Dust Complaints

- The MOECC received complaints about the SMC plant, collecting details such as location, date, time, weather conditions, and other observations. The MOECC confirmed that 50 complaints attributed to the St. Marys Cement facility were received in 2016. In 2017, 270 were received. Odour complaints increased in 2017 and at least 30 different people filed complaints. Many complaints described an “acrid, burning, plastic,” and there seem to have been more complaints during a southwest wind.

Air and Dust Monitoring

- PDHU was informed that the MOECC had installed an air monitoring station downwind (southwest) of the plant. The monitoring station is to be in place for a full year and is collecting data on particulate matter (PM_{2.5/10}), nitrogen oxides (NO_x), and sulphur dioxide (SO₂).
- PDHU received three months of air testing results from the air monitoring station. The data shows no exceedances of current standards and guidelines or limits set by Ontario’s Ambient Air Quality Criteria (AAQC).
- PDHU was also informed that the MOECC conducted exploratory mobile air monitoring in 2016 and additional mobile air monitoring in November 2017. The 2016 mobile air monitoring focused on Total Suspended Particles (TSP), PM₁₀, PM_{2.5}, SO₂ and VOCs. The 2017 mobile air monitoring measured volatile organic compounds (VOCs) and small Particulate Matter upwind and downwind of SMC.
- The air mobile monitoring results show that SMC facility is contributing to local ambient pollution levels, including benzene and coarse dust (PM₁₀); the levels of benzene are consistent with what is seen in nearby communities such as London, Hamilton and Windsor.
- The air testing results were also shared with PHO.

Regulatory Compliance

- The regulatory framework for industry, such as the SMC plant, includes several components. The MOECC provides authorization for the regulated discharge of contaminants to the natural environment by issuing an Environmental Compliance Approval (ECA). An ECA outlines legally binding conditions of operation to ensure that the environment and community are protected from the adverse effects of any contaminants that are produced by the business's operations. Demonstration of compliance is facilitated through the use of government approved dispersion models and detailed reports. Additionally, the MOECC conducts risk-based inspections to ensure compliance; these may be cyclical, based on geography or sector, or inspections may be triggered by a complaint or a change in operating methods.
- The MOECC has historically inspected the SMC facility on a cyclical basis with no history of significant compliance issues. In the spring of 2015, SMC requested an amendment to their ECA (specifically seeking Limited Operational Flexibility), triggering a review of the application and MOECC inspections in December of 2017 and March of 2018.
- In August 2017, the MOECC issued an amended Air Environmental Compliance Approval (ECA) to SMC. The amended ECA requires SMC to:
 - Conduct odour testing
 - Prepare and implement an odour abatement plan
 - Conduct source testing at the cement kiln stack and report to MOECC
 - Follow best management practices to manage fugitive dust emissions
 - Set up a Community Liaison Committee.
- SMC conducted source testing in late November 2017 in accordance with MOECC standards and the MOECC has stated that the emissions meet the provincial standards. PDHU also received the source testing results directly from SMC.

PDHU also requested and reviewed the following reports:

- St. Marys Cement Company (SMC) St. Marys Cement Plant ECA (Air) Amendment Application (MOECC # 1428-9&6REW) – Review Questions and Answers –Package 2 and related memos
- Memorandum 2016 Mobile Monitoring at SMC
- 2017 Mobile TAGA Survey in the Vicinity of SMC
- 2017- 2018 Monitoring Survey in the Vicinity of SMC: Interim Report

4.2 Consultation with Public Health Ontario (PHO)

PDHU consulted with PHO, the scientific arm of public health in Ontario, for guidance and expertise in conducting a health hazard investigation related to air quality in St. Marys.

PDHU shared with PHO all the air quality testing results received from MOECC, as noted above. PHO reviewed and interpreted MOECC air quality monitoring data. PHO staff who worked on the review have expertise in:

- Environmental and occupational health
- Environmental health analysis
- Toxicology and exposure assessment.

PHO also provided guidance on addressing concerns related to asthma in the community, especially with regards to children and schools in the vicinity of SMC, and how best to measure the impact, if any. Consideration was given to completing a survey as was suggested by a parent. PHO has experience with conducting school surveys related to health issues but has found that this method is generally not

helpful for drawing conclusions or causation. Based on this feedback, PDHU decided instead to examine school absenteeism as a method to further explore this issue.

4.3. Review of literature

PDHU compiled and researched information applicable to this issue. Notably, in 2016, PHO completed a review of health effects from cement plant operations. See References (page 35) for the list of literature.

4.4 Review of local health statistics (and as compared to Ontario where applicable)

PDHU collected health-related data from the following sources:

- Cancer Care Ontario (CCO): Perth County data regarding specific cancers of interest (as determined in a review of literature) by municipality. Additional analysis was completed by PDHU staff.
- PHO Snapshots (hospitalizations) and NACRS (IntelliHealth; emergency room visits): Perth County data regarding asthma age-standardized and age-specific rates, by municipality (where possible).
- PHO Snapshots: Perth County data regarding COPD hospitalization rates, compared to Ontario.
- Canadian Community Health Survey of Statistics Canada: Perth County smoking rates by municipality.
- Avon Maitland District School Board and the Huron-Perth Catholic District School Board: school absenteeism data. Analysis was completed by PDHU staff.
- MOECC: local air quality history.

4.5 Other PDHU Activities

- Attended a meeting with the Town of St. Marys on November 8, 2017
- Attended a Town Hall meeting led by the MOECC on December 4, 2017
- Responded to enquiries from community members
- Supplied statements to the Town of St. Marys related to our investigation to post on its website
- Reviewed the 2017 SMC Source Testing Results
- Updated the PDHU website
- Informed the PDHU Board of Health.

5.0 Results

5.1 Air Quality Testing

The independent and scientific review provided by PHO based on air quality testing provided by the MOECC concludes that:

- The fixed site monitoring is showing a contribution from the SMC facility to local ambient pollutant levels. Despite this, all the pollutants are below applicable air quality limits in the preliminary report.
- Odours, noted by MOECC staff and St. Marys residents through the MOECC complaints process, are not necessarily a health hazard and can be addressed by an odour abatement plan.
- Short-term dust events were not captured meaningfully in the MOECC data, and could be more accurately described in the MOECC complaint log. MOECC staff did observe visible dust downwind of the facility. Stationary air monitoring results show that PM_{2.5} levels were dominated by regional levels. PM₁₀ levels were possibly affected by contributions from SMC.

- A small number of mobile benzene results were over the guidance values used for assessment; however, these data cannot be used to estimate long-term exposure.

5.2 Respiratory Illness in Perth County

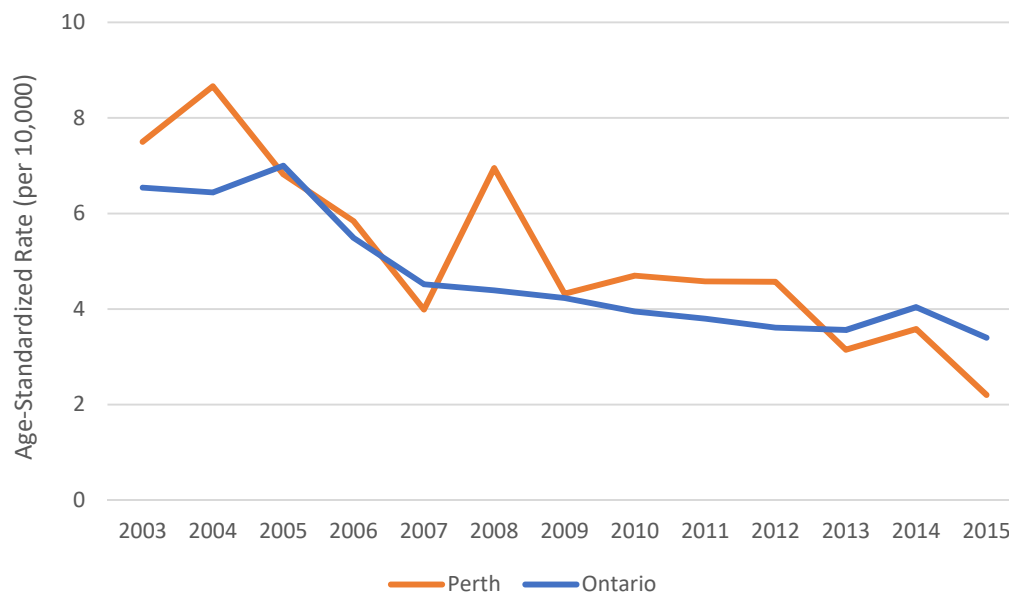
Given what we know about air pollution causing respiratory disease, including asthma exacerbations, and given community concerns, we analyzed local data on COPD and asthma, with additional detail on asthma. After consulting with PHO, we also decided to examine school absenteeism rates in St. Marys and North Perth. Finally, in order to give full context, we also examined the history of local air quality in Perth County as well as local smoking rates.

Figures 2 through 6 show that rates of asthma, as shown through hospitalizations and emergency room department visits, decreased over time for all municipalities (including St. Marys), Perth County and Ontario. Age-standardized rates of hospitalizations due to COPD did not change over time for Perth County and Ontario (Figure 7). The age-standardized rate of hospitalizations due to COPD among Perth County residents was higher over time compared to Ontario.

Notes:

- Interrupted lines on figures are the result of small numbers or unreliable estimates. Data were standardized to the 2011 Canadian standard population when describing “age-standardized rates (per 10,000 or 1,000 people)”.
- Where the results show a statistically significant difference over time and are noteworthy to this investigation, a comment is provided.

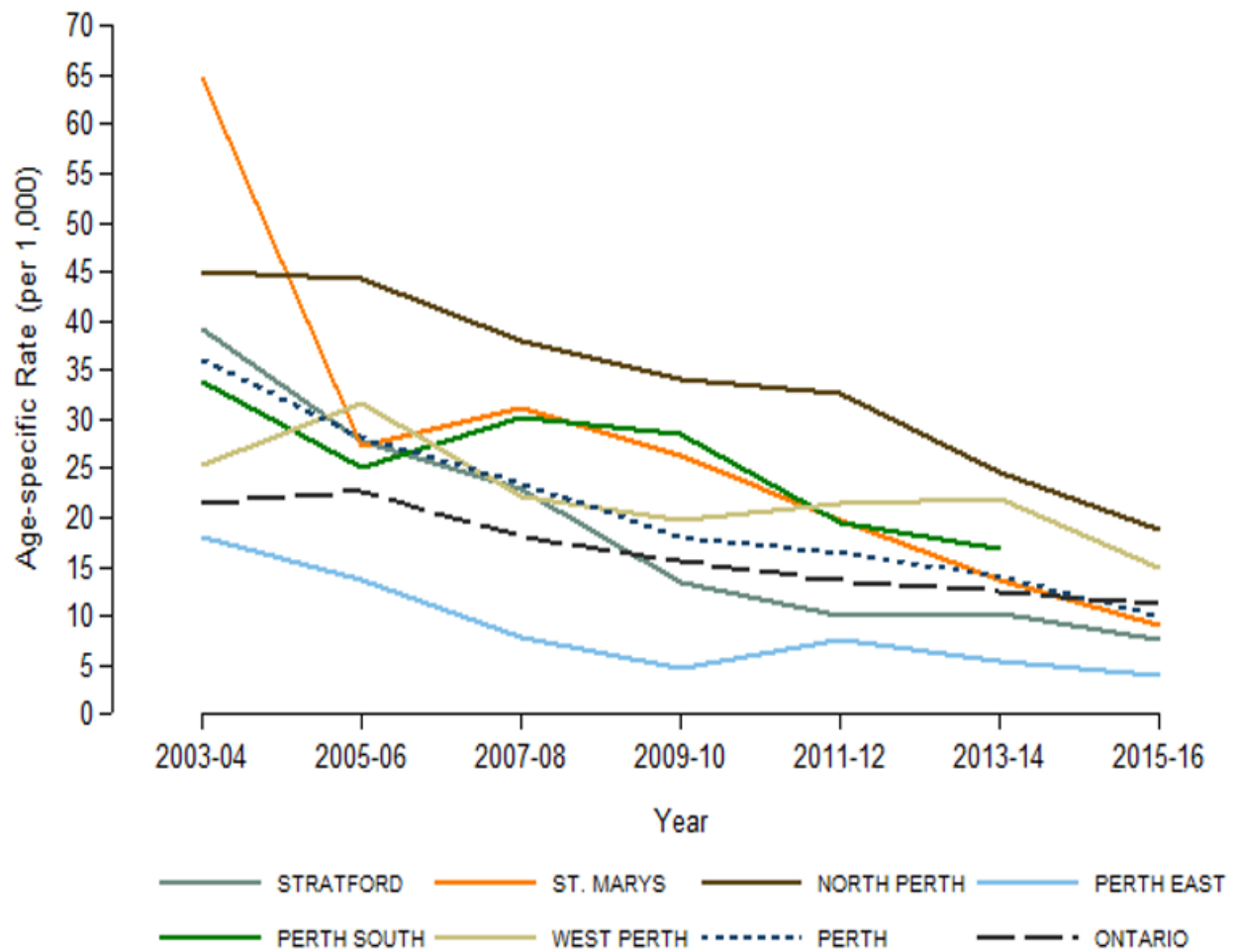
Figure 2: Asthma hospitalizations: age-standardized rates (per 10,000) among Perth County (including Stratford and St. Marys) and Ontario residents, 2003-2015



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: 5 Apr 2018.

- The age-standardized rates (per 10,000) of hospitalizations due to asthma-decreased over time among Perth County and Ontario residents (Figure 2).

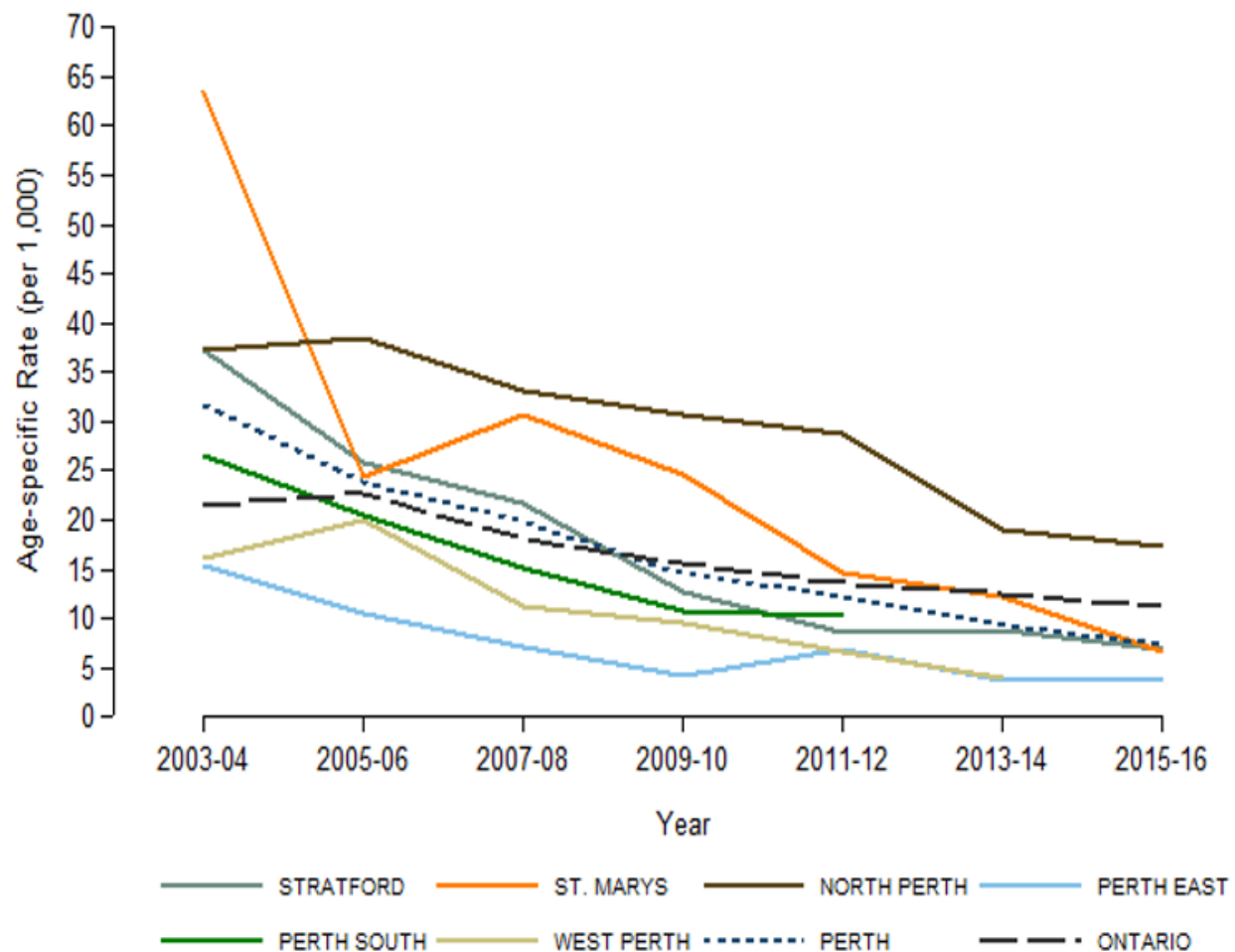
Figure 3: Emergency department visits due to asthma at any Ontario hospital: Age-specific rates (per 1,000) of residents aged 0 to 19 years of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO. Ambulatory Visit Cube (NACRS, CIHI).
Extracted: Nov 3, 2017

- The age-specific rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital decreased over time for young residents of Perth County, its municipalities and Ontario (Figure 3).
- The age-specific rate (per 1,000) of emergency department visits due to asthma at any Ontario hospital was higher in 2003-04 for young St. Marys residents compared to the other Perth County municipalities and Ontario; the reason is unknown at this time.

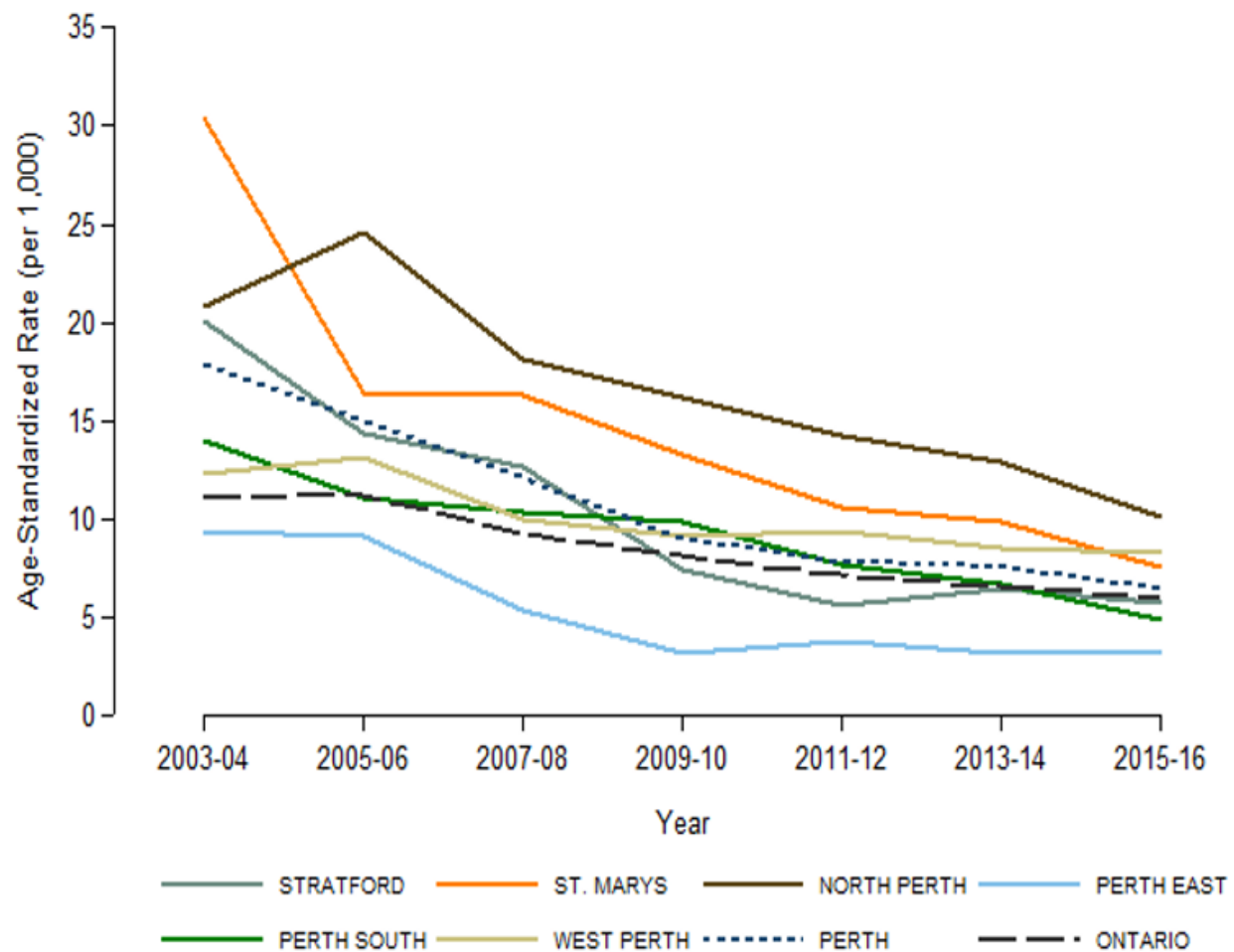
Figure 4: Emergency department visits due to asthma at any Perth County hospital: Age specific rates (per 1,000) residents aged 0 to 19 years of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO. Ambulatory Visit Cube (NACRS, CIHI).
Extracted: Nov 3, 2017

- The age-specific rates (per 1,000) of emergency department visits due to asthma at Perth County hospitals decreased over time for young residents from Perth County, its municipalities and Ontario (Figure 4).
- The age-specific rate (per 1,000) of emergency department visits due to asthma at Perth County hospitals was higher in 2003-04 for young St. Marys residents compared to other Perth County municipalities and Ontario; the reason is unknown at this time.

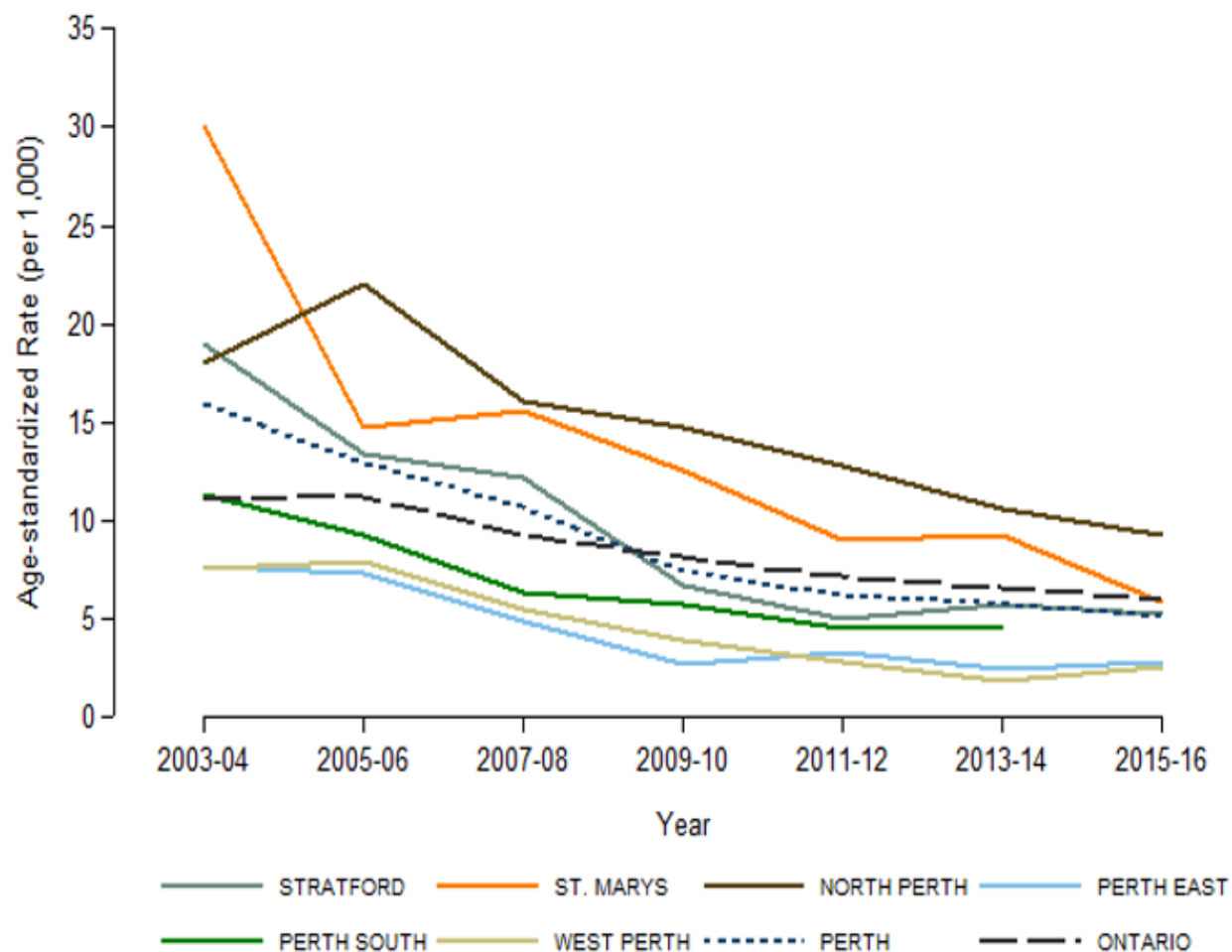
Figure 5: Emergency department visits due to asthma at any Ontario hospital: age-standardized rates (per 1,000) residents of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI).
Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital decreased over time for residents of Perth County, its municipalities and Ontario (Figure 5).
- Compared to Ontario, the age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital were higher in residents from St. Marys and North Perth, lower in residents from Perth East, and no different in residents from Stratford, West Perth, South Perth and Perth County.

Figure 6: Emergency department visits due to asthma at any Perth County hospital: age-standardized rates (per 1,000) among residents of Perth County, its municipalities and Ontario, 2003-2016

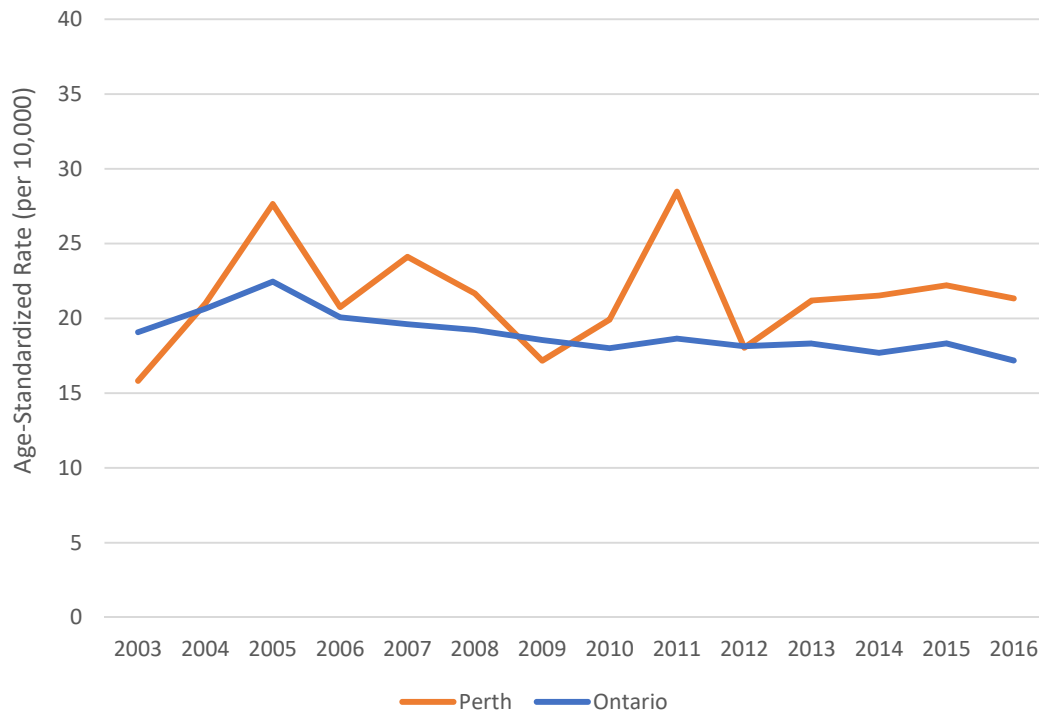


Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI). Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma in Perth County residents attending any emergency department in Perth County hospitals decreased over time for all geographical areas (Figure 6).
- Compared to Ontario, the age-standardized rates (per 1,000) of emergency department visits due to asthma at any Perth hospital were higher in residents from St. Marys and North Perth, lower in residents from Perth East and West Perth compared to Ontario, and no different in residents from Stratford, Perth South, and Perth County.
- Some of this variation may be due to practice patterns, as North Perth and St. Marys both have small primary hospitals where it is common practice for the on-call physician to see lower acuity patients in the emergency department.

For additional local data on asthma rates, see Appendix A: Additional Local Health Data.

Figure 7: Hospitalizations for Chronic Obstructive Pulmonary Disease: Age-standardized rates (per 10,000) in Perth County (including Stratford and St. Marys) and Ontario residents, 2003-2016



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: 5 Apr 2018.

- The age-standardized rates (per 10,000) of hospitalization for COPD did not change over time among Perth County residents and decreased over time among Ontarians (Figure 7).
- The age-standardized rates (per 10,000) for hospitalizations due to COPD was significantly higher among Perth County residents than among Ontarians.

5.3 Cancer in Perth County

PDHU compiled data provided by Cancer Care Ontario related to lung cancer, colorectal cancer, non-Hodgkin lymphoma (NHL) and acute myelogenous leukemia (AML) in Perth County, given community concerns and the information we identified regarding air pollution and its potential adverse health effects in the *Background* section of this report.

Since smoking and air quality are the most important risk factors for lung cancer and COPD, we also examined local smoking rates and local air quality history to better inform our understanding of lung cancer rates.

Table 1 and Figures 8 through 11 show that there are no statistically significant patterns of differences among the six municipalities when comparing age-standardized incidence rates of the four selected cancers in Perth County.

Figures 12 and 13 show that the prevalence of daily smoking is higher for all Perth County municipalities combined compared to the daily smoking prevalence among Ontarians.

Where the results show a statistically significant difference over time and are noteworthy to this investigation, a comment is provided.

Table 1: Lung cancer, colorectal cancer, non-Hodgkin lymphoma (NHL), and acute myeloid leukemia (AML): Age-standardized incidence rates (per 10,000) among residents of Perth County, its municipalities, and Ontario, 1994-2013

Cancer Type	Year Range	St. Marys	Stratford	North Perth	West Perth	Perth East	Perth South	Perth County	Ontario
Lung Cancer	1994-1998	7.2	7.4	3.3	3.6	3.1	5.7	5.4	5.6
	1999-2003	6.4	7.9	6.9	7.1	5.2	10.3	6.9	5.4
	2004-2008	5.6	7.4	5.6	6.8	4.6	8.1	6.5	5.2
	2009-2013	4.3	7.0	5.7	5.9	3.2	10.4	6.2	5.4
Colorectal Cancer	1994-1998	5.8	6.7	8.2	8.9	6.8	9.7	7.2	5.0
	1999-2003	5.7	6.3	8.1	9.0	6.1	8.3	7.1	5.1
	2004-2008	7.8	6.0	7.4	4.7	8.2	10.5	6.9	4.9
	2009-2013	4.6	6.7	5.8	8.2	5.0	9.2	6.7	4.8
Non-Hodgkin Lymphoma	1994-1998	2.3	2.3	2.0	2.4	2.1	-	2.2	1.6
	1999-2003	2.8	1.4	2.9	2.3	1.7	-	1.9	1.7
	2004-2008	2.0	2.0	1.9	3.3	1.4	-	2.2	1.8
	2009-2013	2.6	2.5	2.2	2.4	3.8	-	2.8	2.0
Acute myeloid leukemia	1994-1998	0	-	-	-	-	0	0.35	0.35
	1999-2003	-	-	-	-	-	0	0.49	0.37
	2004-2008	-	0.44	-	-	-	-	0.44	0.40
	2009-2013	-	0.33	-	-	-	0	0.33	0.41

Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

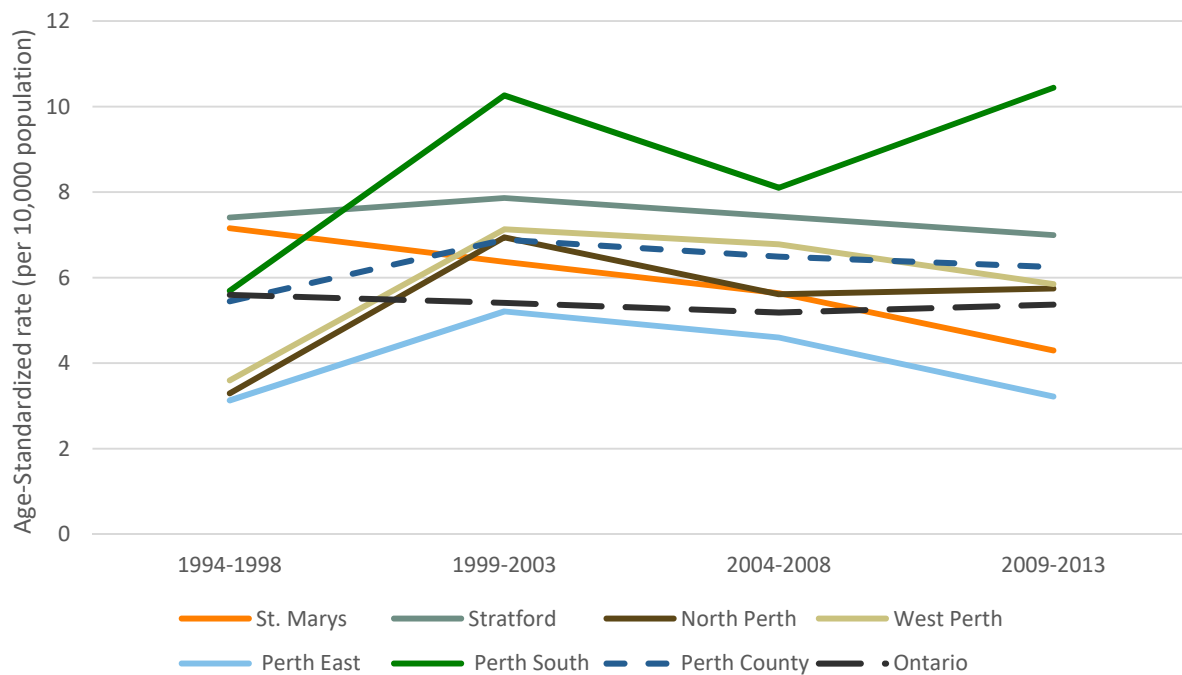
Notes:

- Data are standardized to the 2011 Canadian standard population with regard to age distribution
- 0 indicates 0 cases within time period
- A dash (-) indicates that the number of cases within the time period was less than 6
- Shaded cells indicate that the number of cases is small (6 - 19) and results are statistically unreliable (interpret with caution).

Summary

There are no statistically significant patterns of differences when comparing the age-standardized incidence rates of colorectal cancer, non-Hodgkin lymphoma (NHL), and acute myeloid leukemia (AML), between the six municipalities. The age-standardized incidence rates of lung cancer in Stratford were higher compared to Perth East and Ontario.

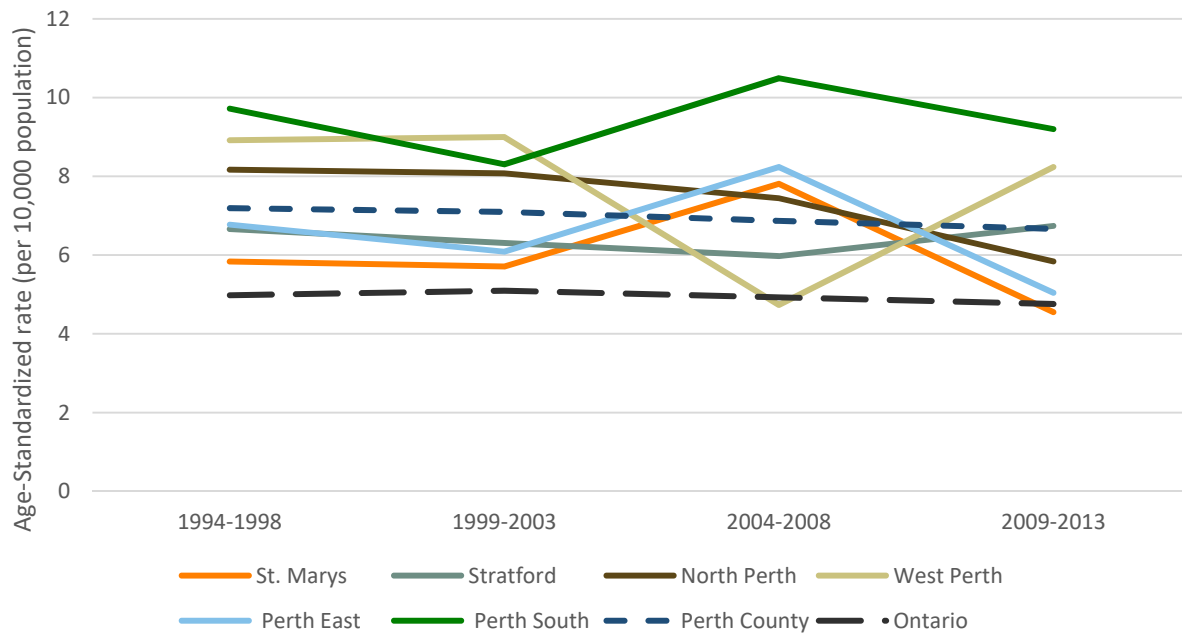
Figure 8: Lung cancer: Age-standardized incidence rates (per 10,000) among residents of Perth County, its municipalities, and Ontario, 1994-2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- The age-standardized incidence rates (per 10,000) of lung cancer among Stratford residents were higher compared to Perth East and Ontario at each time period (Figure 8); there were no differences between the residents in other municipalities, including St. Marys, and Ontario.
- In the time period 1999-2003 to 2009-2013, Perth County had higher age-standardized incidence rates of lung cancer compared to Ontario.

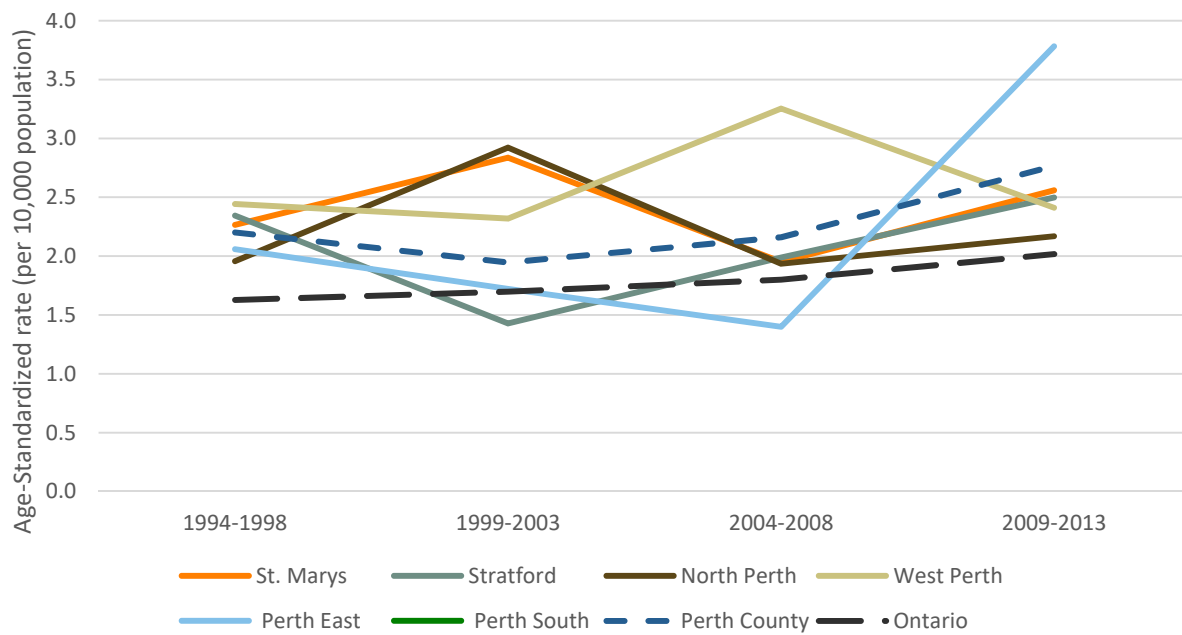
Figure 9: Colorectal cancer: Age-standardized incidence rates (per 10,000) among residents of Perth County, its municipalities, and Ontario, 1994-2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- The age-standardized incidence rates (per 10,000) for colorectal cancer among Perth County residents were higher compared to Ontarians over all time periods (Figure 9).

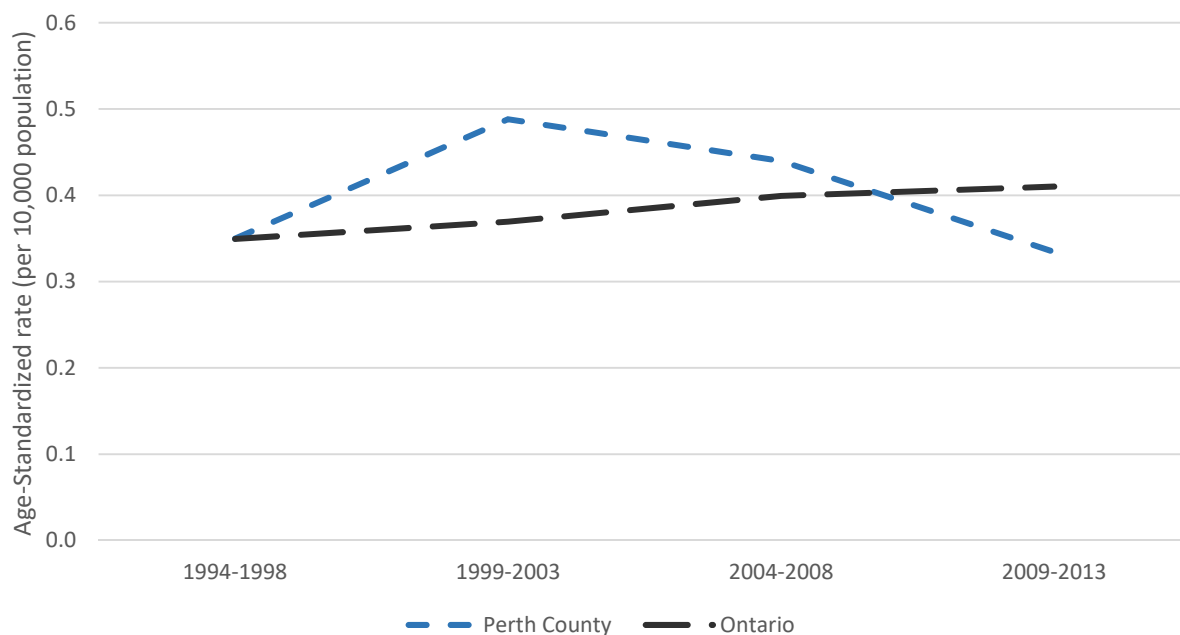
Figure 10: Non-Hodgkin lymphoma: Age-standardized incidence rates (per 10,000) among residents of Perth County, its municipalities, and Ontario, 1994-2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- Over the time period, no sustained significant differences were identified in the age-standardized incidence rate (per 10,000) of NHL among residents from Perth County and its municipalities, including St. Marys, compared to Ontario (Figure 10).

Figure 11: Acute myeloid leukemia: Age-standardized incidence rates (per 10,000) among residents of Perth County, its municipalities, and Ontario, 1994-2013

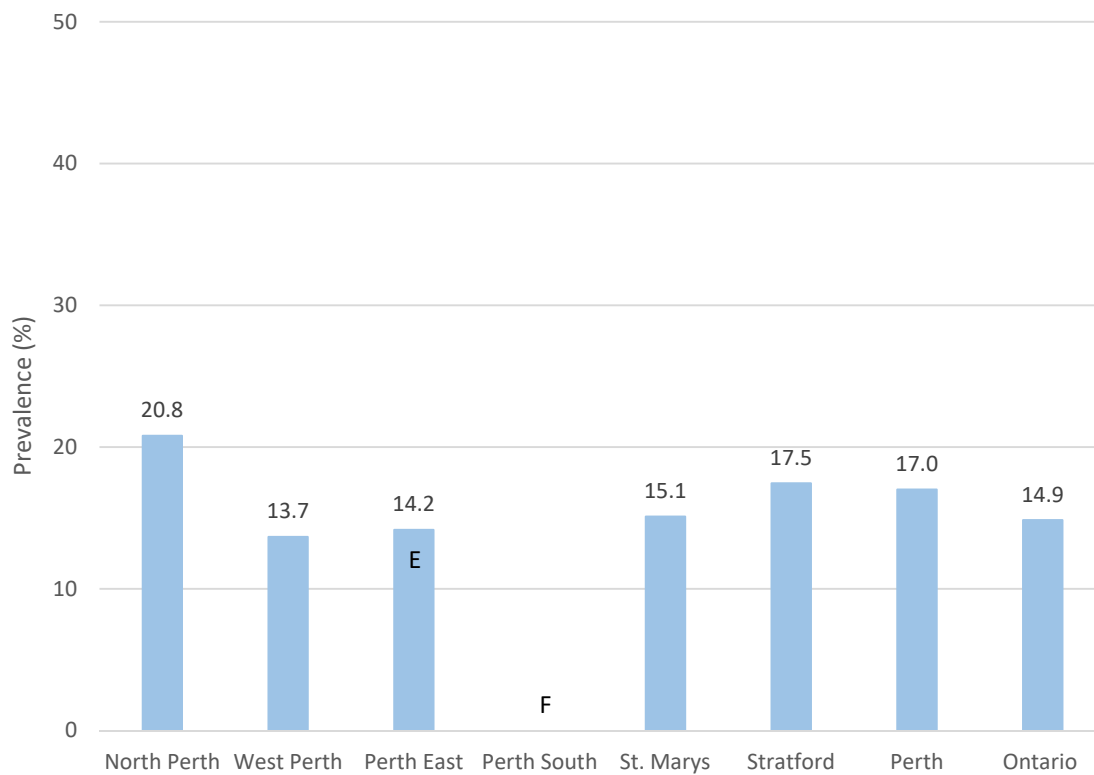


Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- The age-standardized incidence rates (per 10,000) for acute myeloid leukemia were not significantly different for Perth County compared to Ontario (Figure 11).
- The number of cases in municipalities and at most time periods were small ($n = 1-5$) and suppressed.

For additional local data regarding lung cancer, colorectal cancer, NHL, and AML, see Appendix A: Additional Local Health Data.

Figure 12: Prevalence of daily smoking among residents aged 12 and over from Perth County, its municipalities and Ontario, 2003-2014



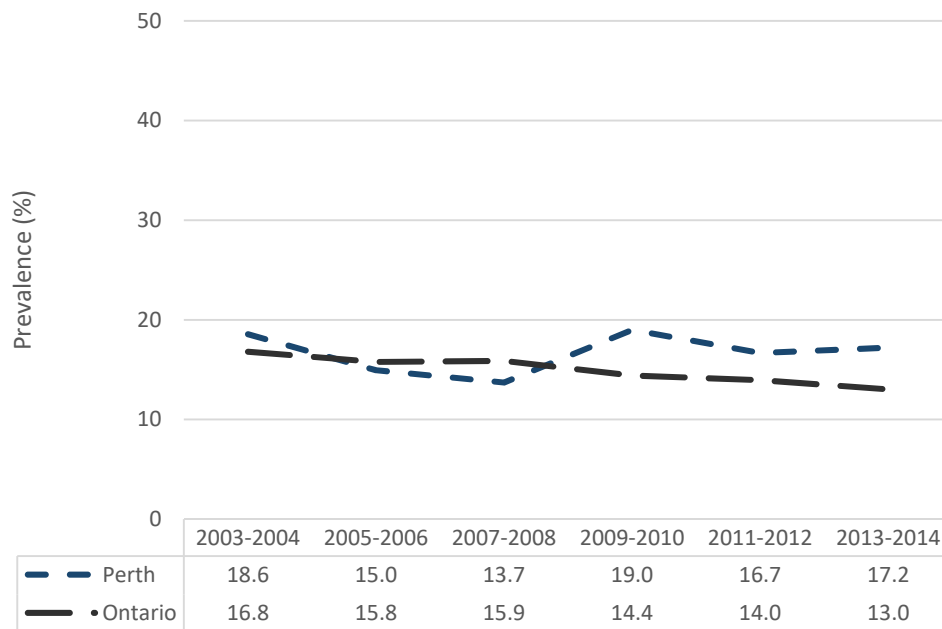
Source: Canadian Community Health Survey 2003 to 2014, Statistics Canada

E - Use with caution

F - Too unreliable to be published

- When each Perth County municipality was individually compared to Ontario, the difference in prevalence of daily smoking was not statistically significant; however, when the municipalities are combined, the prevalence of daily smoking for all of Perth County is higher than that among Ontarians (Figure 12).

Figure 13: Prevalence of daily smoking among residents aged 12 and over from Perth County and Ontario, 2003-2014



Source: Canadian Community Health Survey 2003 to 2014, Statistics Canada

- The prevalence of daily smoking remained stable overall among Perth County residents, and decreased among Ontarians (Figure 13).

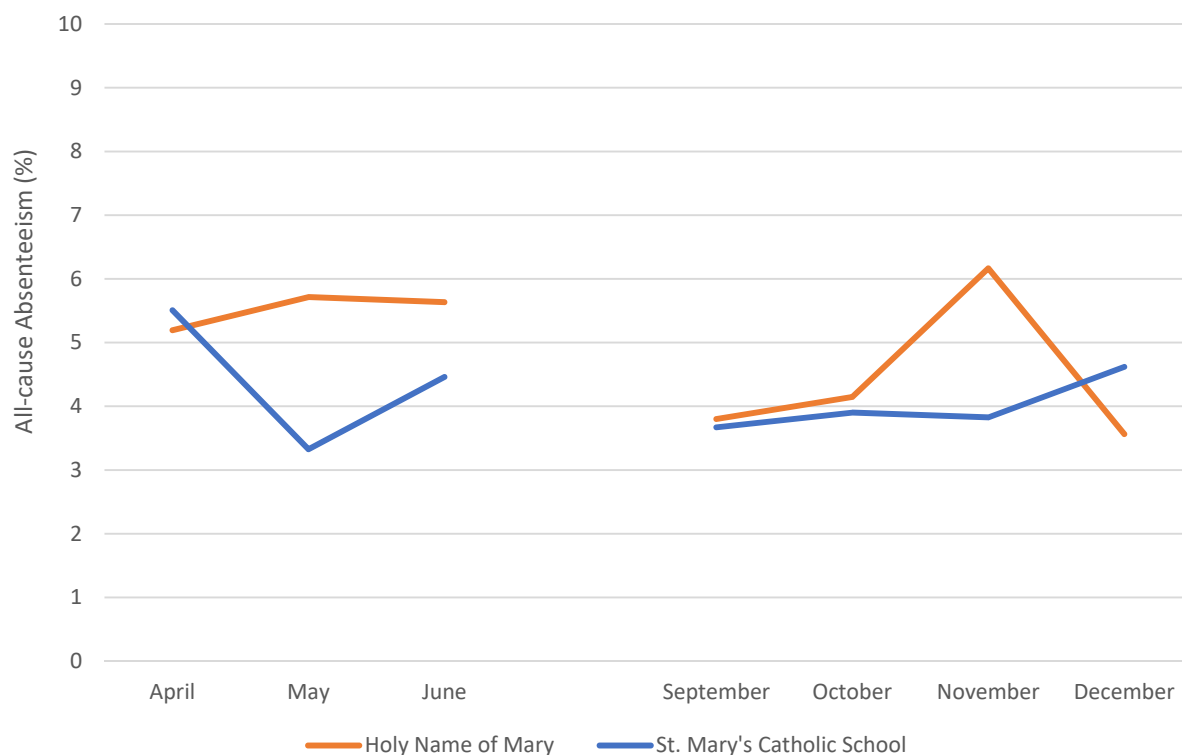
5.4 School Absenteeism

PDHU also contacted schools in St. Marys to seek feedback from school principals with regard to any concerns about air quality and adverse health effects for students. There were no concerns reported.

After consultation with Public Health Ontario, PDHU decided to examine school absenteeism in St. Marys schools as compared to schools in North Perth as a method to further examine the issue of air quality and potential adverse health effects on students.

The absenteeism data shows that daily absenteeism due to illness did not differ between elementary schools in St. Marys and Listowel. Daily absenteeism was higher in Listowel than St. Marys for secondary students, and higher in St. Marys than Listowel for students in grades 7 and 8. Therefore, no conclusions can be made from this data.

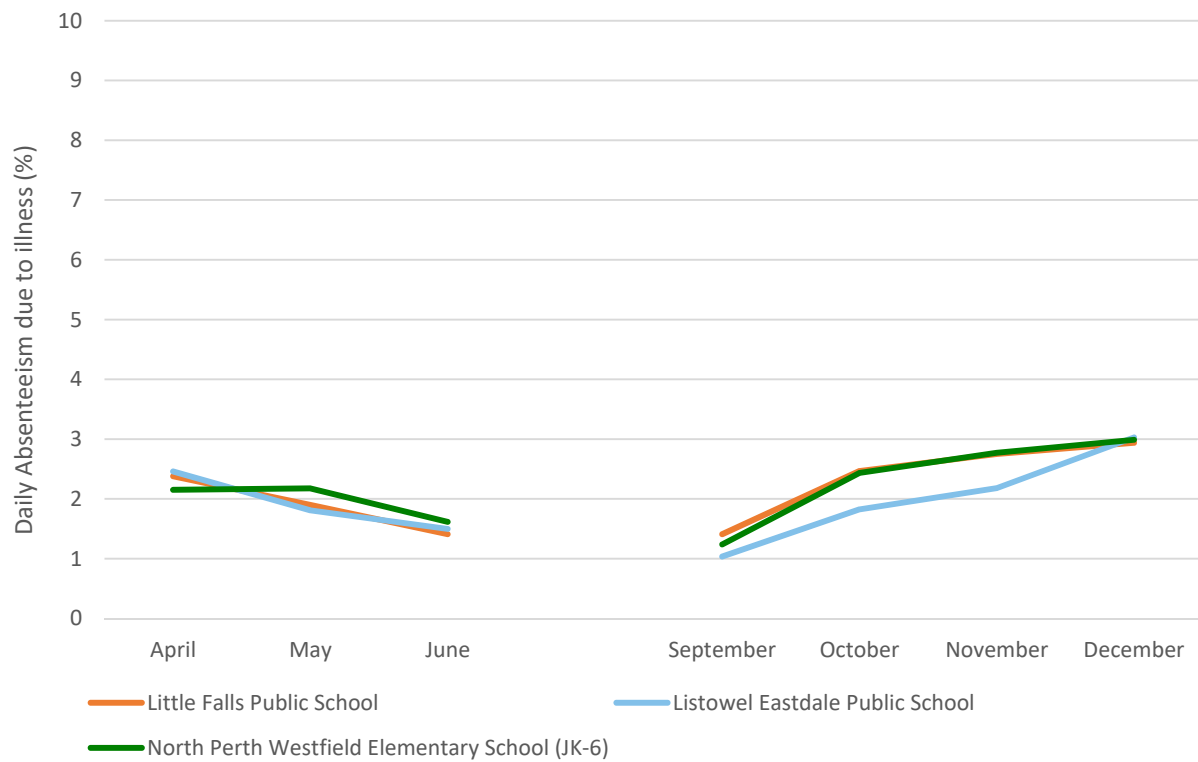
Figure 14: All-cause daily school absenteeism by month: Holy Name of Mary Catholic School in St. Marys and St. Mary's Catholic School in Listowel, 2017



Source: Huron Perth Catholic District School Board. Received Mar 21, 2018

- All-cause daily absenteeism was higher at Holy Name of Mary Catholic School in St. Marys than at St. Mary's Catholic School in Listowel in May and November 2017 (Figure 14).
- All-cause absenteeism includes all reasons (school trips, poor weather, etc.) as well as absenteeism due to illness.

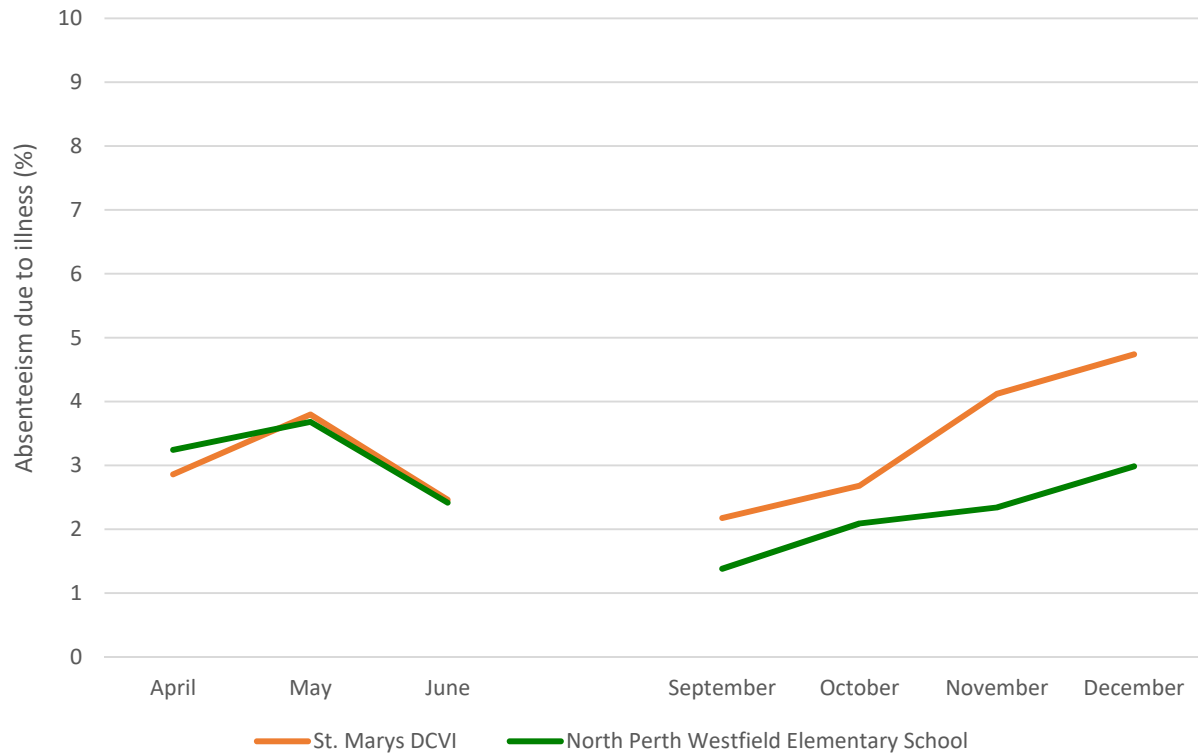
Figure 15: Daily school absenteeism due to illness by month: Little Falls Public School in St. Marys and Listowel Eastdale Public School and North Perth Westfield Elementary School in Listowel, 2017



Source: Avon Maitland District School Board. Received Mar 26, 2018

- Daily absenteeism due to illness did not differ between St. Marys and North Perth students in junior kindergarten to grade 6 (Figure 15).

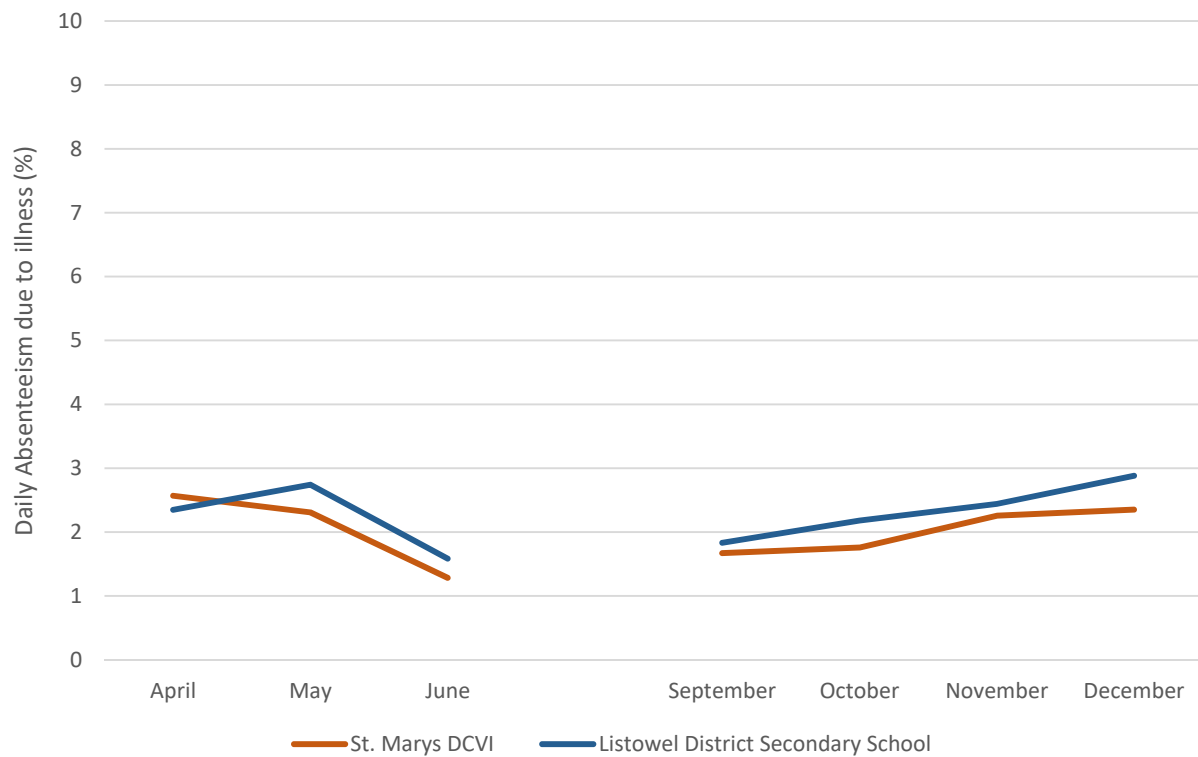
Figure 16: Daily school absenteeism due to illness by month: Grades 7 and 8 from St. Marys DCVI in St. Marys and North Perth Westfield Elementary School in Listowel, 2017



Source: Avon Maitland District School Board. Received Mar 26, 2018

- Daily absenteeism due to illness was significantly higher in grades 7 and 8 students of St. Marys DCVI compared to North Perth Westfield Elementary schools from September to December (Figure 16). In St. Marys, grades 7 and 8 are part of the secondary school and in North Perth they are part of the elementary school.

Figure 17: Daily school absenteeism due to illness by month: Grades 9 to 12 from St. Marys DCVI in St. Marys and Listowel District Secondary School in Listowel, 2017



Source: Avon Maitland District School Board. Received Mar 26, 2018

- Absenteeism due to illness was significantly higher in grades 9 to 12 students of Listowel District Secondary School compared to St. Marys DCVI (Figure 17). In St. Marys, grades 7 and 8 are part of the secondary school and in North Perth they are part of the elementary school.

5.5 Air Quality in Perth County

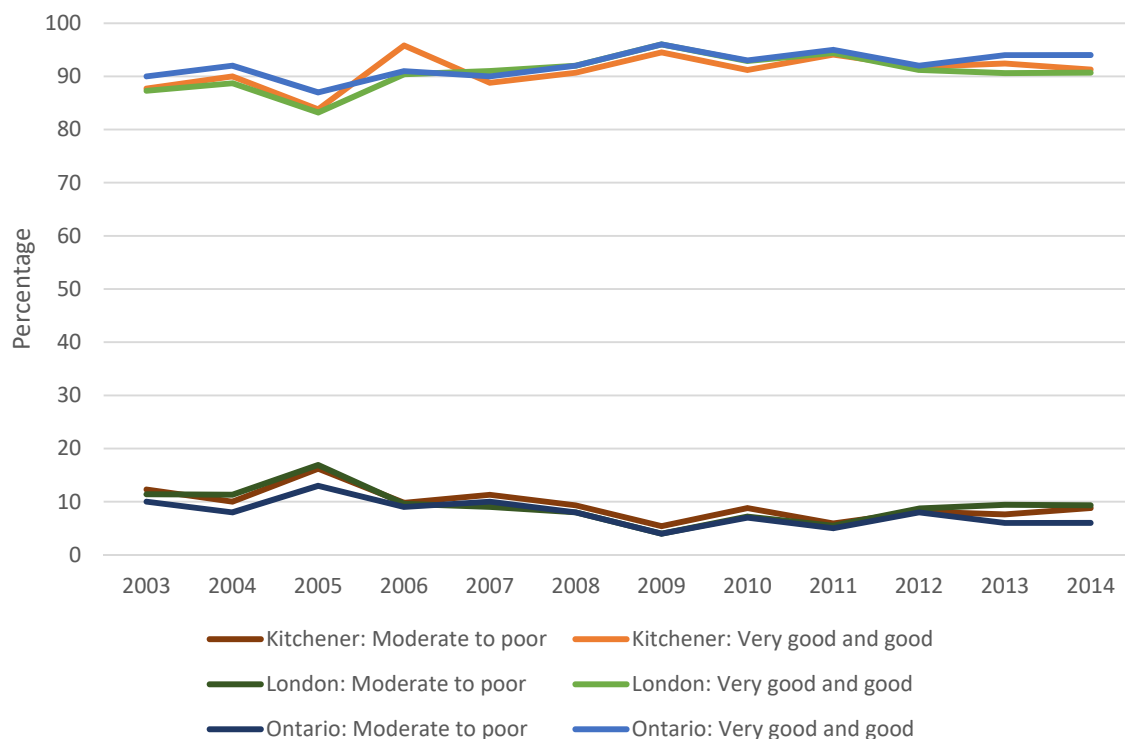
Prior to 2015, MOECC reported air quality in terms of the Air Quality Index (AQI). The AQI had a scale of 0-100+, with values usually in the range of 10-60, and poor air quality designated as values above 50.

The AQI was based on pollutants that have adverse effects on human health and the environment. The pollutants were Ozone (O₃), Fine Particulate Matter (PM_{2.5}), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Sulphur Dioxide (SO₂), and Total Reduced Sulphur (TRS) Compounds.

Before 2015, smog advisories were issued to the public when widespread, elevated and persistent smog levels were forecasted to occur within the next 24 hours, or if elevated smog conditions occurred without warning and weather conditions conducive to elevated smog levels were forecasted to continue for several hours.

For this report, data were collected for 2003-2014 from the closest Air Monitoring Stations, which are in Kitchener and London.

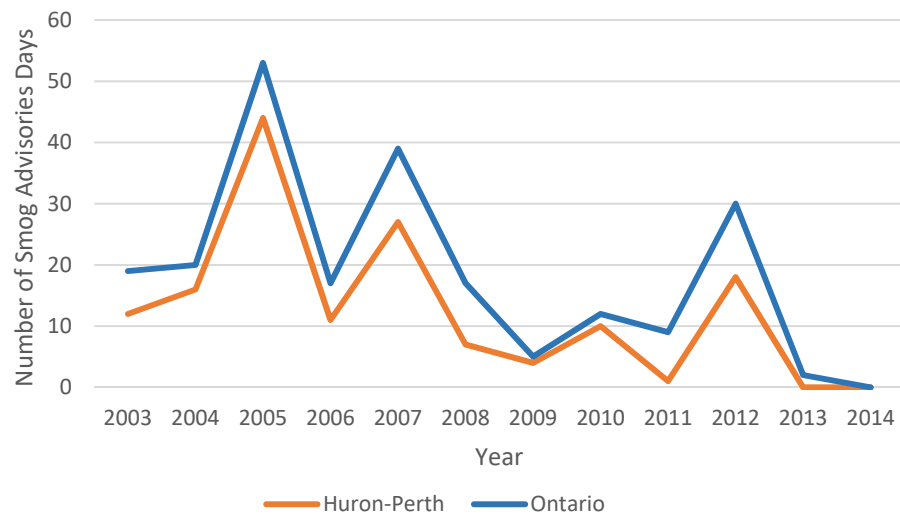
Figure 18: The percentage of time when the air quality was “moderate to poor” and “very good and good” for London, Kitchener, and Ontario



Source: Ministry of the Environment and Climate Change. Accessed: 16 April 2018

- The Air Quality Index (AQI) shows no apparent differences in the percentage of time when the air quality was “moderate to poor” and “very good and good” between London, Kitchener, and Ontario (Figure 18).
- There were no times when the AQI was “very poor”.

Figure 19: Total number of smog advisory days in Huron-Perth and Ontario



Source: Ministry of the Environment and Climate Change. Accessed: 6 April 2018

- The total number of smog advisory days appear to be lower in Huron-Perth compared to Ontario (Figure 19). Additionally, the number of smog advisories seem to be lower in Huron-Perth compared to Ontario.

6.0 Conclusions

PDHU undertook a health hazard investigation with regard to emissions from the St. Marys Cement plant (SMC).

While the SMC facility is contributing to local ambient pollutant levels, there is no evidence that those pollutants are exceeding air quality limits.

With regard to odour, MOECC staff noted odours during sampling, and attributed them to some of the compounds measured in the air monitoring surveys. In general, the presence of an odour is not used as an indicator of whether there is a risk of increased harm to human health.

With regard to dust, there was no evidence that SMC contributed to fine particulate matter (PM_{2.5}) levels. Coarse particulate matter (PM₁₀) levels were possibly impacted by contributions from SMC. However, there may be short-term dust events not captured by the MOECC testing data. MOECC staff did observe dust downwind on some occasions. All industry are required to follow Best Management Practices to prevent fugitive dust emissions.

With regard to benzene, based on the short-term samples collected by the MOECC, there was evidence that SMC is likely a contributing source. Levels of benzene measured were comparable to levels in other communities in southwestern Ontario (London, Hamilton, and Windsor) where benzene and other VOCs are routinely monitored.

PDHU examined local health data, specifically rates of lung cancer, colorectal cancer, non-Hodgkin lymphoma, and acute myelogenous leukemia, as well as asthma, and COPD. The data showed that there is no evidence of elevated rates of these adverse health outcomes in St. Marys.

No conclusion could be drawn from the school absenteeism data in St. Marys schools compared to schools in North Perth.

While the emissions from SMC have been in compliance with provincial standards, it does not discount that some people may be sensitive to the effects of dust and odour in their community. The MOECC is monitoring the SMC plant's implementation of its odour abatement plan and people in St. Marys who are affected by the odour and air quality in their town are encouraged to continue to report the issues they face to the MOECC and describe how the dust and odour are impacting their lives.

7.0 Recommendations

Going forward, PDHU recommends that:

- The MOECC completes one year of fixed monitoring data collection to provide a more comprehensive dataset and to share the results with PDHU and the public.
- The MOECC conducts mobile air monitoring again in 2018 and share the results.
- The MOECC better define dust events and promote best practices to mitigate dust events.
- The MOECC continue to monitor the SMC facility for compliance with the conditions set out in the ECA, including the odour abatement plan.
- The SMC Community Liaison Committee continue to meet and report back to the community on its work.

- St. Marys residents continue to log complaints related to air quality with the MOECC and engage with the SMC Community Liaison Committee to address any outstanding issues.

PDHU plans to:

- Investigate if there is a better way to monitor school absenteeism in St. Marys as it directly relates to days where there are a higher number of air quality complaints reported to the MOECC.
- Receive ongoing air testing results from MOECC and analyze the results to check that they continue to be within the air quality standards.
- Continue to log any complaints related to SMC and air quality and follow-up according to internal Policies & Procedures.

This Health Hazard Investigation will be shared with stakeholders and partners as well as the St. Marys community.

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Appendix A: Additional Local Health Data

The analysis of lung cancer, AML, colorectal cancer and NHL were repeated using the Standardized Morbidity Ratio (SMR), which is more appropriate to use when the number of cases are small and to compare directly to Ontario. A limitation of SMR is that it cannot be used to compare between ratios.

Table 2: Lung cancer, colorectal cancer, and non-Hodgkin lymphoma, and Acute Myeloid Leukemia (AML): standardized morbidity ratios in Perth County, its municipalities, and Ontario, 1994-2013

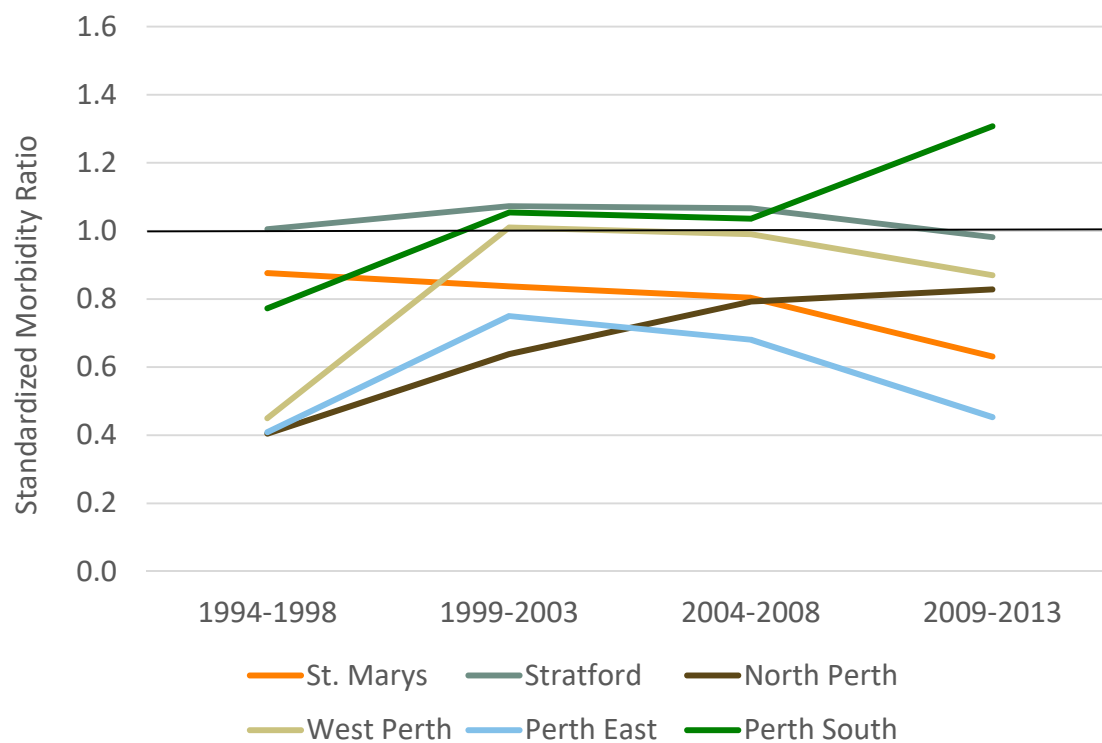
Cancer Type	Year Range	St. Marys	Stratford	North Perth	West Perth	Perth East	Perth South
Lung cancer	1994-1998	0.88	1.01	0.40*	0.45*	0.41*	0.77
	1999-2003	0.84	1.07	0.64*	1.01	0.75	1.05
	2004-2008	0.80	1.07	0.79	0.99	0.68	1.04
	2009-2013	0.63*	0.98	0.83	0.87	0.45*	1.31
Colorectal cancer	1994-1998	0.96	0.98	1.24	1.30	1.00	1.19
	1999-2003	0.88	0.96	1.23	1.26	0.87	0.86
	2004-2008	1.29	0.89	1.11	0.74	1.22	1.47
	2009-2013	0.76	1.11	0.95	1.30	0.81	1.50
Non-Hodgkin Lymphoma	1994-1998	1.12	1.09	0.91	1.00	0.91	-
	1999-2003	1.23	0.60*	1.32	1.04	0.74	-
	2004-2008	0.71	0.84	0.79	1.45	0.61	-
	2009-2013	1.06	0.96	0.83	0.96	1.54	-
Acute myeloid leukemia	1994-1998	0	-	-	-	-	0
	1999-2003	-	-	-	-	-	0
	2004-2008	-	1.07	-	-	-	-
	2009-2013	-	0.79	-	-	-	0

Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

Notes:

- 0 indicates that there were 0 cases during that time period
- - indicate that the number of cases within time period were less than 6
- * indicate significant differences of the municipality compared to Ontario
- Ratios cannot be compared with each other
- Standard morbidity ratios (SMR) were calculated as the ratio between observed number of cancer cases in each municipality and the expected number of cancer cases in each municipality.
- Ontario was used to determine expected number of cancer cases in each municipality. The SMR for Ontario is 1.
- A risk ratio larger than 1 indicates an increased risk of that outcome in each municipality compared to Ontario.
- A risk ratio smaller than 1 indicates a reduced risk of that outcome in each municipality compared to Ontario.

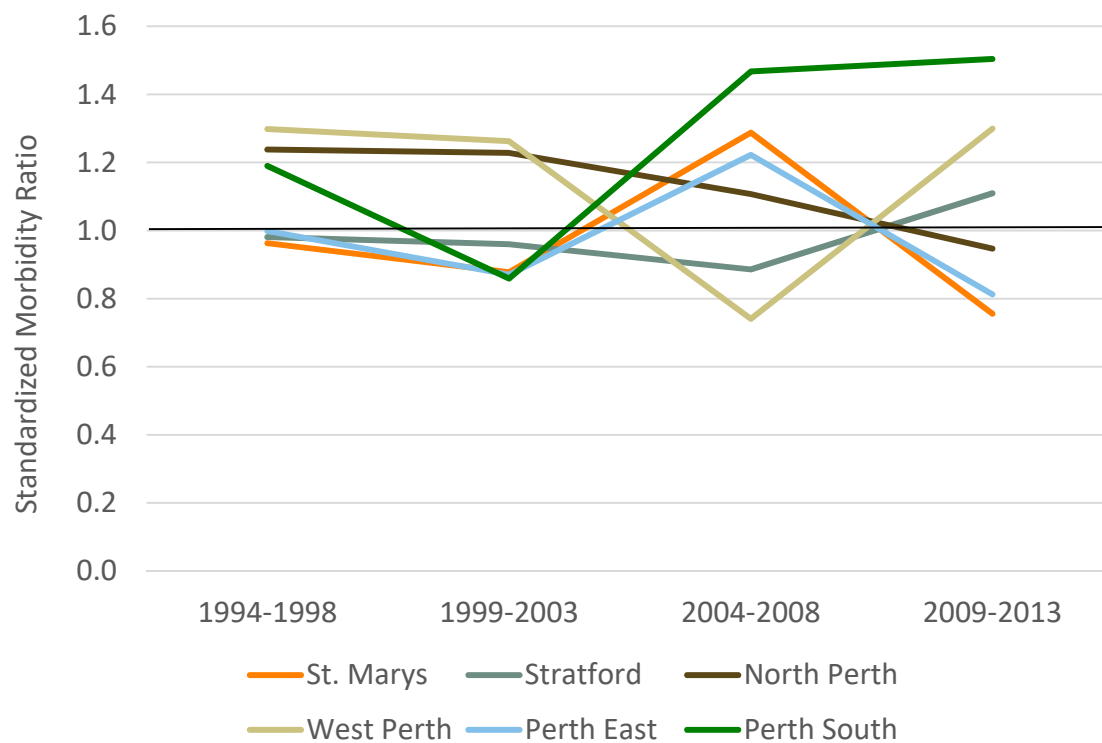
Figure 20: Lung cancer: Standardized morbidity ratios of each Perth County municipality compared to Ontario, 1994-2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- Over the time periods, no sustained significant differences were identified for lung cancer among residents of each municipality in Perth County compared to Ontario (Figure 20).

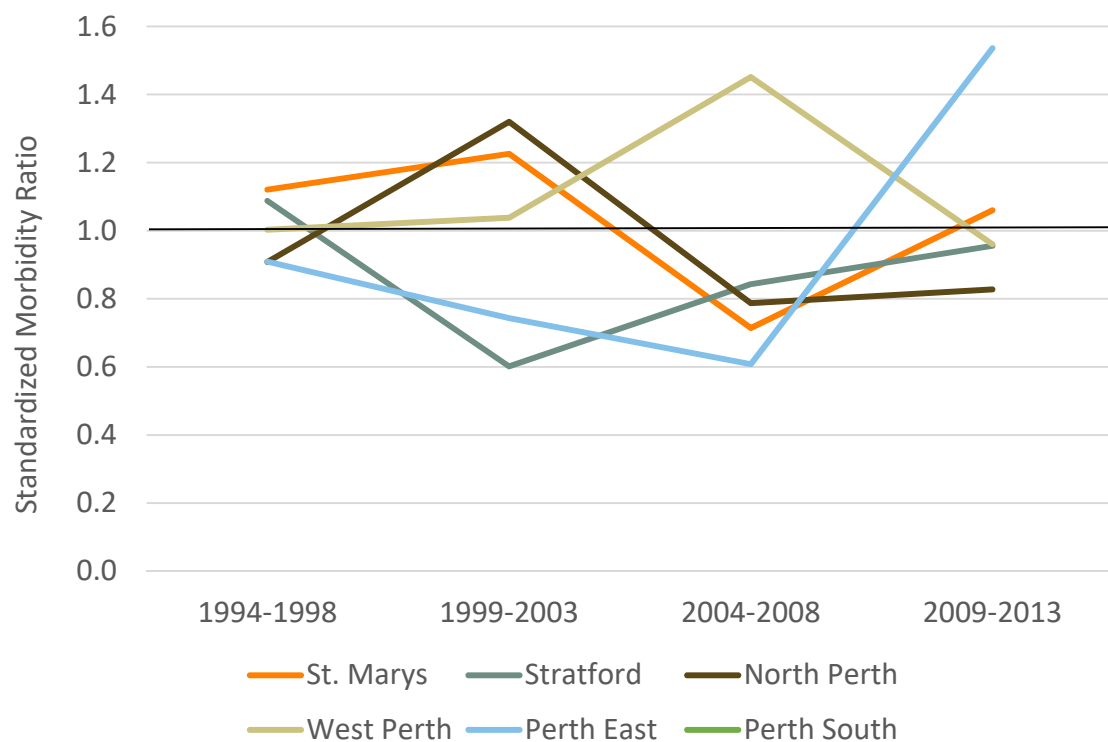
Figure 21: Colorectal cancer: Standardized morbidity ratios of each Perth County municipality compared to Ontario, 1994 - 2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- Over the time periods, no significant differences were identified for colorectal cancer among residents of each municipality in Perth County, including St. Marys, compared to Ontario (Figure 21).

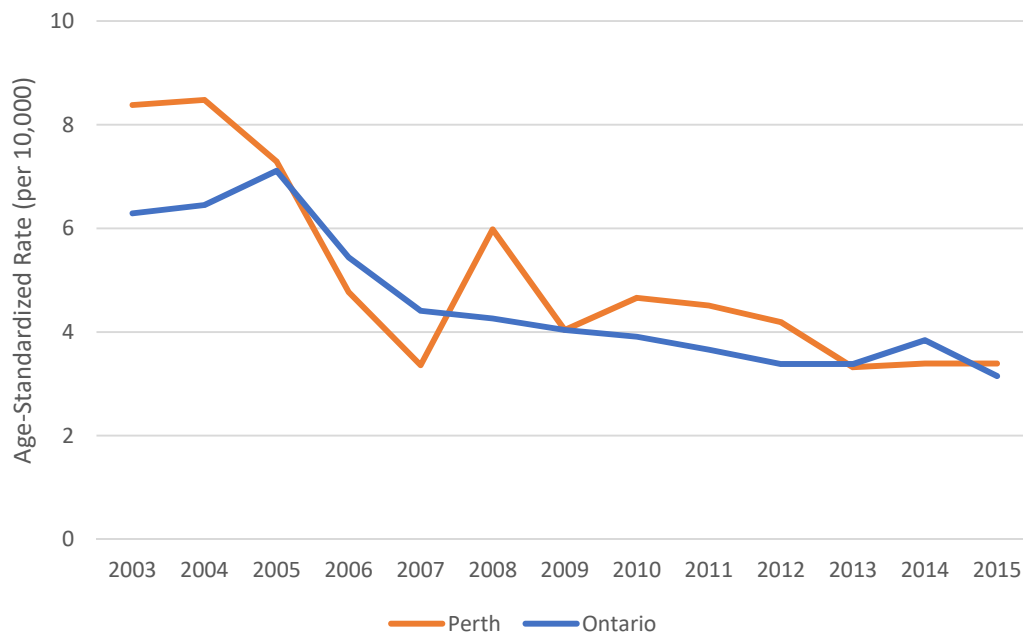
Figure 22: NHL: Standardized morbidity ratios of each Perth County municipality compared to Ontario, 1994 - 2013



Source: Ontario Cancer Registry (November 2016), Cancer Care Ontario

- Over the time periods, no sustained significant differences were identified for NHL among residents of each municipality in Perth County, including St. Marys, compared to Ontario (Figure 22).

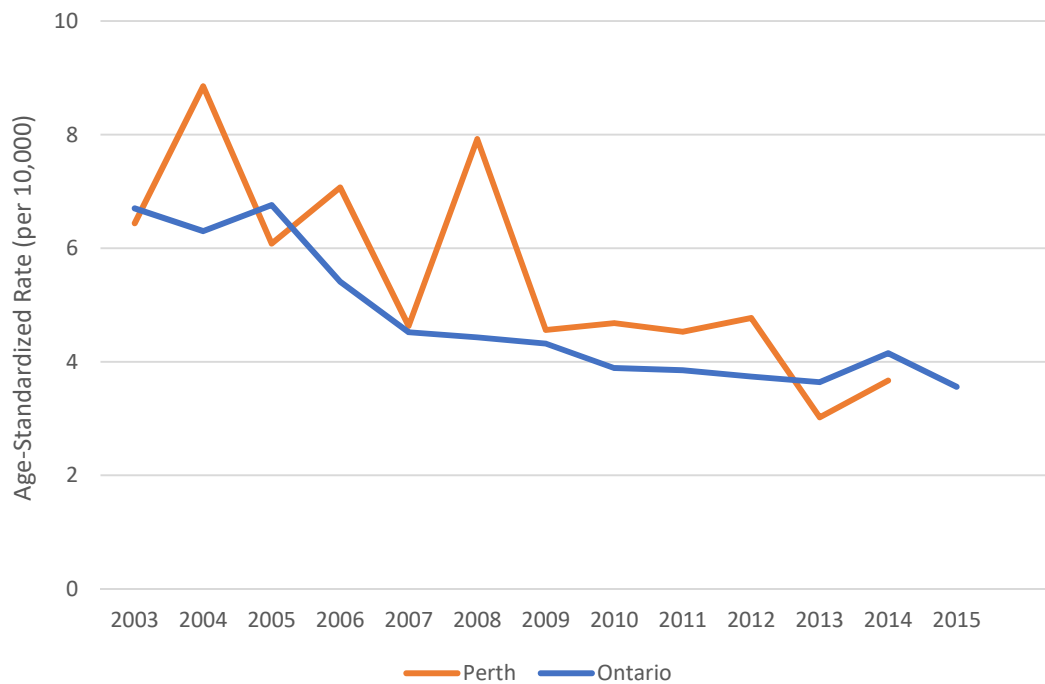
Figure 23: Asthma hospitalizations: Age-standardized rate (per 10,000) in Perth County (including Stratford and St. Marys) and Ontario males, 2003 – 2015



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: Oct 31, 2017

- The age-standardized rates (per 10,000) of hospitalizations due to asthma decreased over time among Perth County and Ontario males (Figure 23).

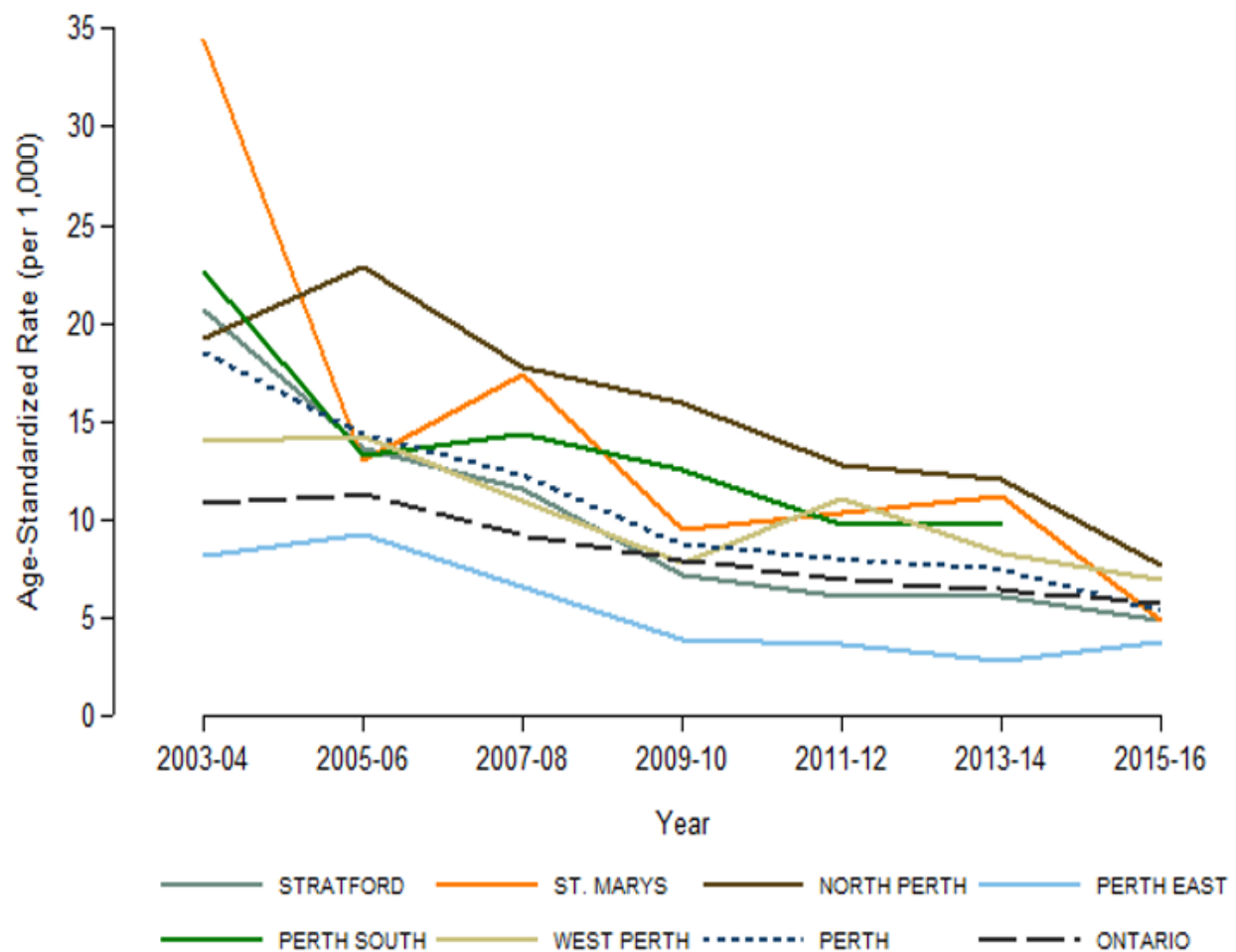
Figure 24: Asthma hospitalizations: Age-standardized rate (per 10,000) in Perth County (including Stratford and St. Marys) and Ontario females, 2003 – 2015



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: Oct 31, 2017

- The age-standardized hospitalization rates (per 10,000) due to asthma decreased over time among Perth County and Ontario females (Figure 24).

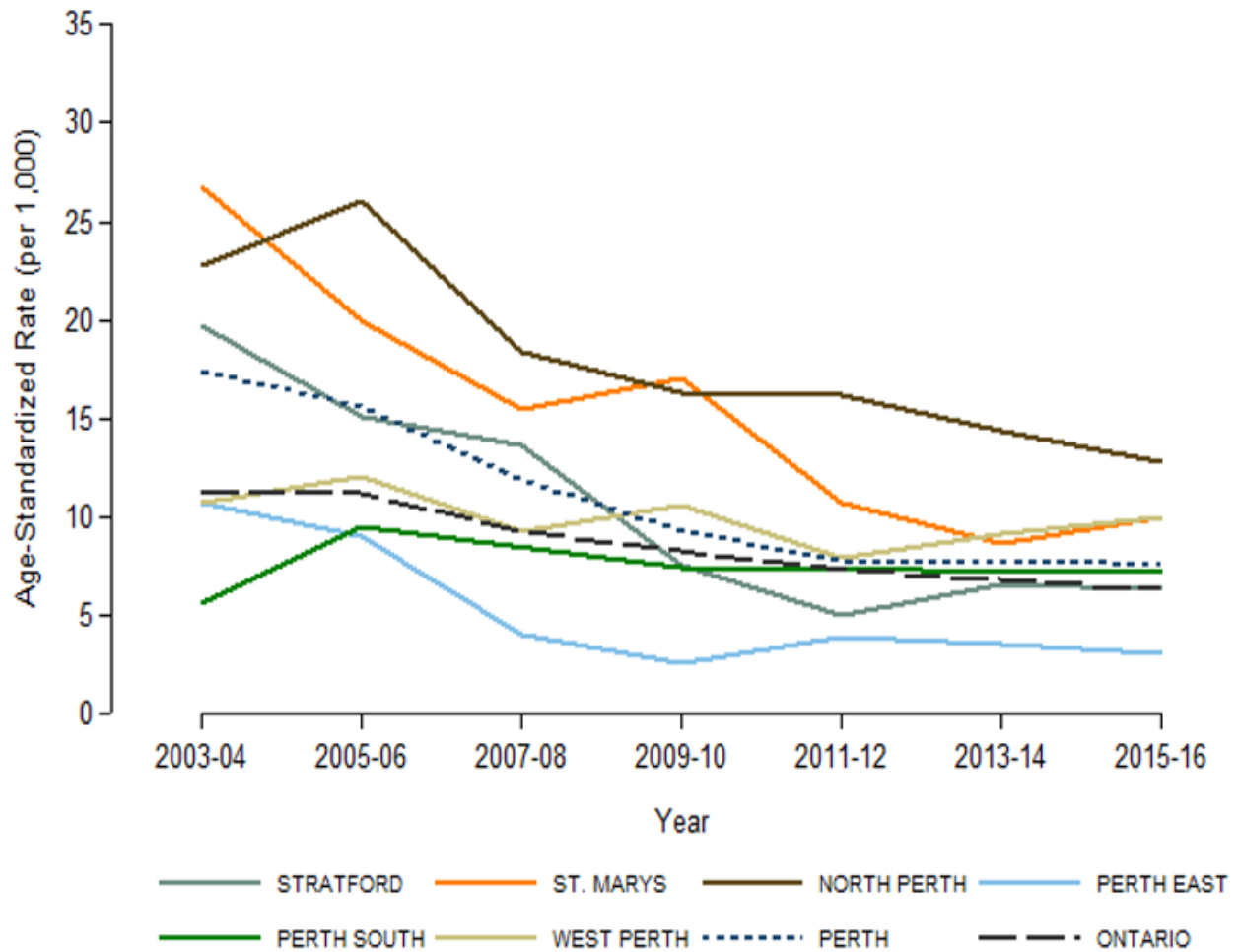
Figure 25: Age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital by males of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI). Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital decreased over time for males from Perth County, its municipalities (including St. Marys), and Ontario (Figure 25).

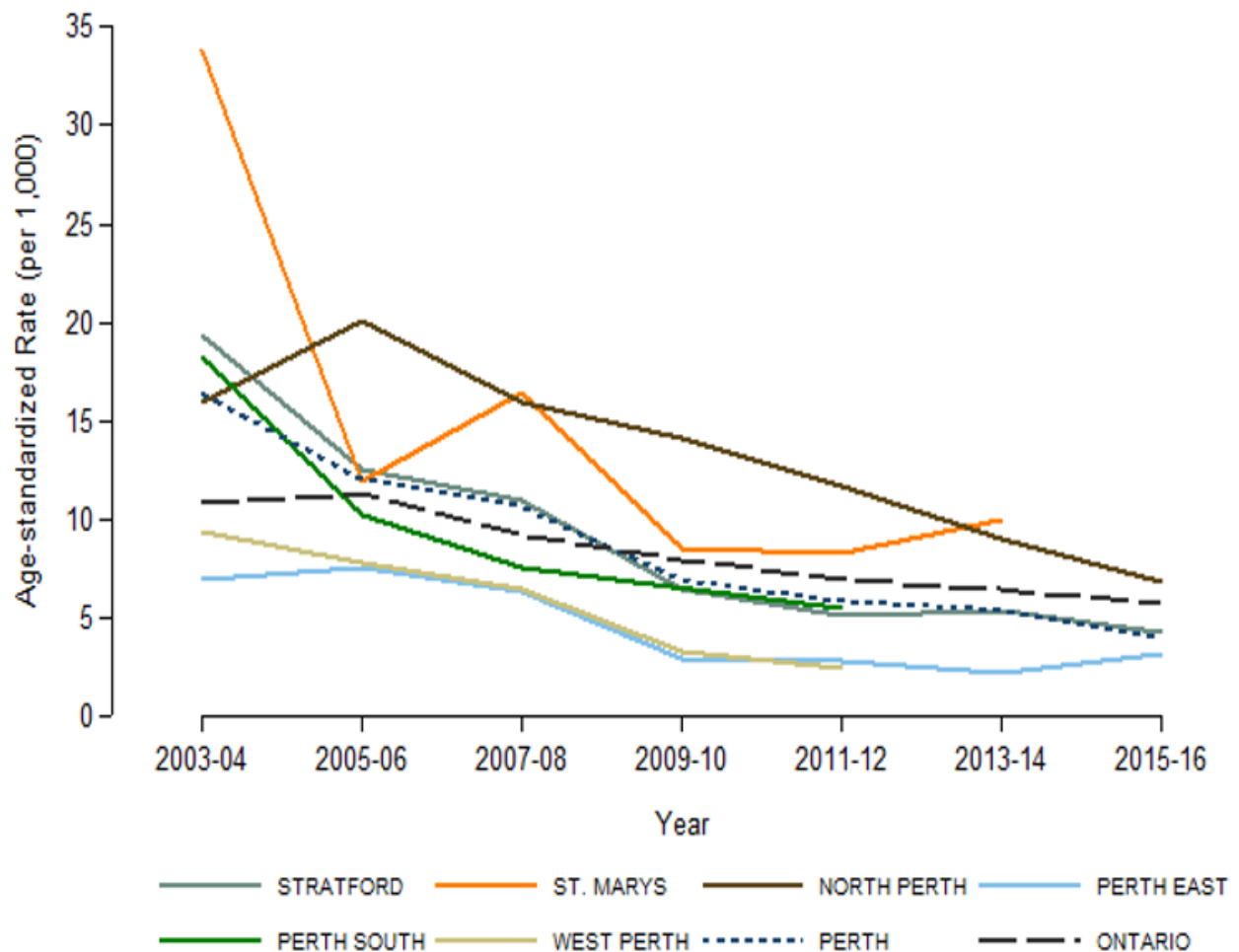
Figure 26: Age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital by females of Perth County and its municipalities and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI). Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma at any Ontario hospital decreased over time for females in Perth County, its municipalities (except for West Perth and Perth South), and Ontario (Figure 26).

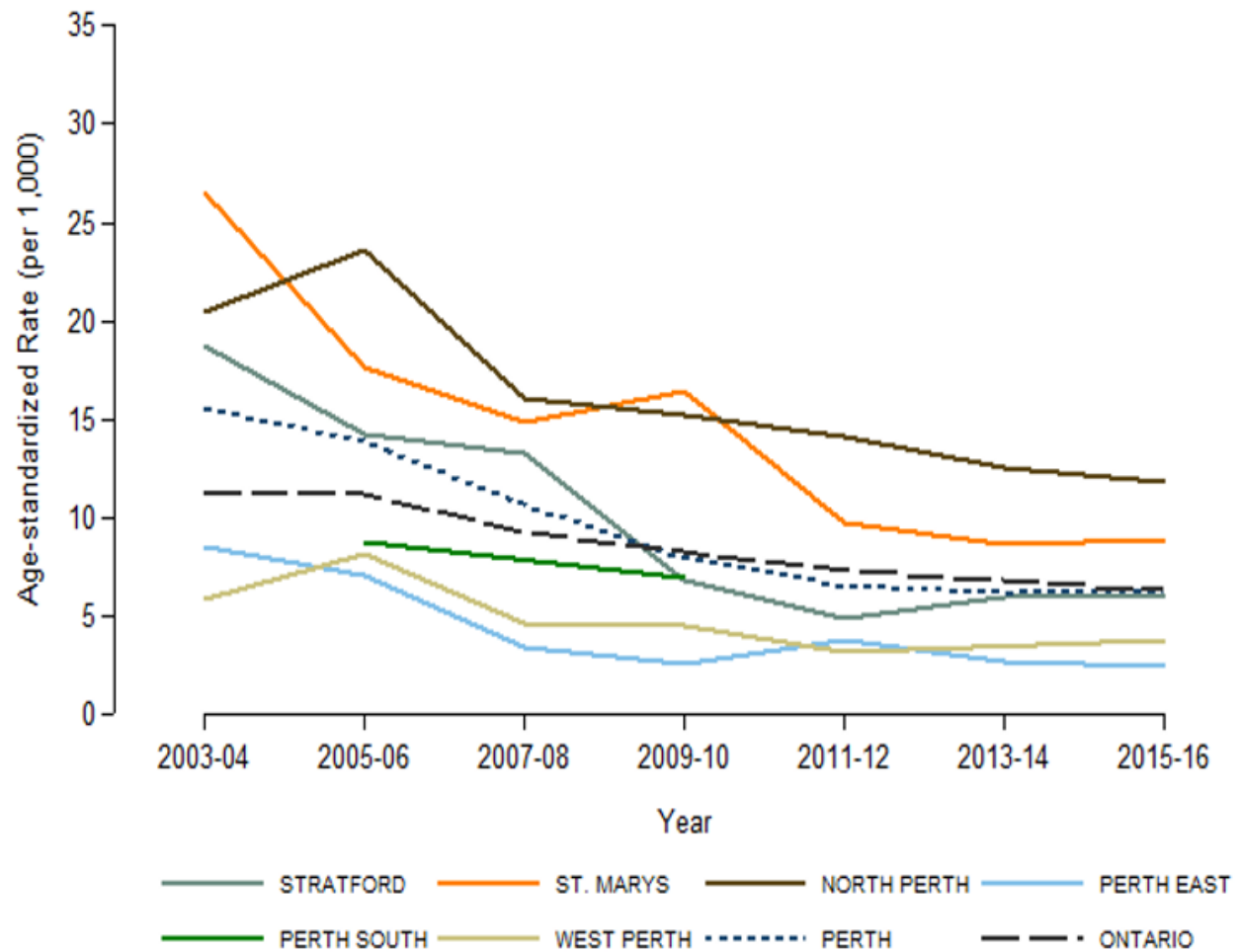
Figure 27: Age-standardized rates (per 1,000) of emergency department visits due to asthma at any Perth County hospital by males of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI). Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma at any Perth County hospital decreased over time for males from Perth County, its municipalities (including St. Marys), and Ontario (Figure 27).

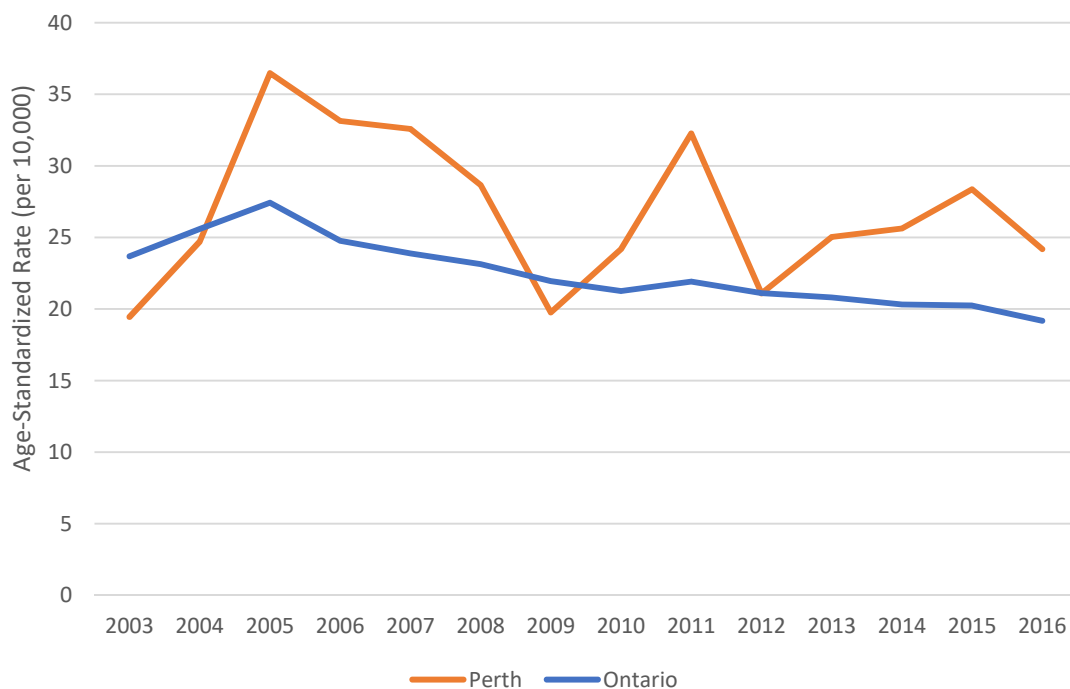
Figure 28: Age-standardized rates (per 1,000) of emergency department visits due to asthma at any Perth County hospital by females of Perth County, its municipalities, and Ontario, 2003-2016



Source: Ontario Ministry of Health and Long-Term Care, IntelliHealth Ontario. Ambulatory Visit Cube (NACRS, CIHI). Extracted: Nov 3, 2017

- The age-standardized rates (per 1,000) of emergency department visits due to asthma at any Perth County hospital decreased over time for females of Perth County, its municipalities (except for Perth South), and Ontario (Figure 28).

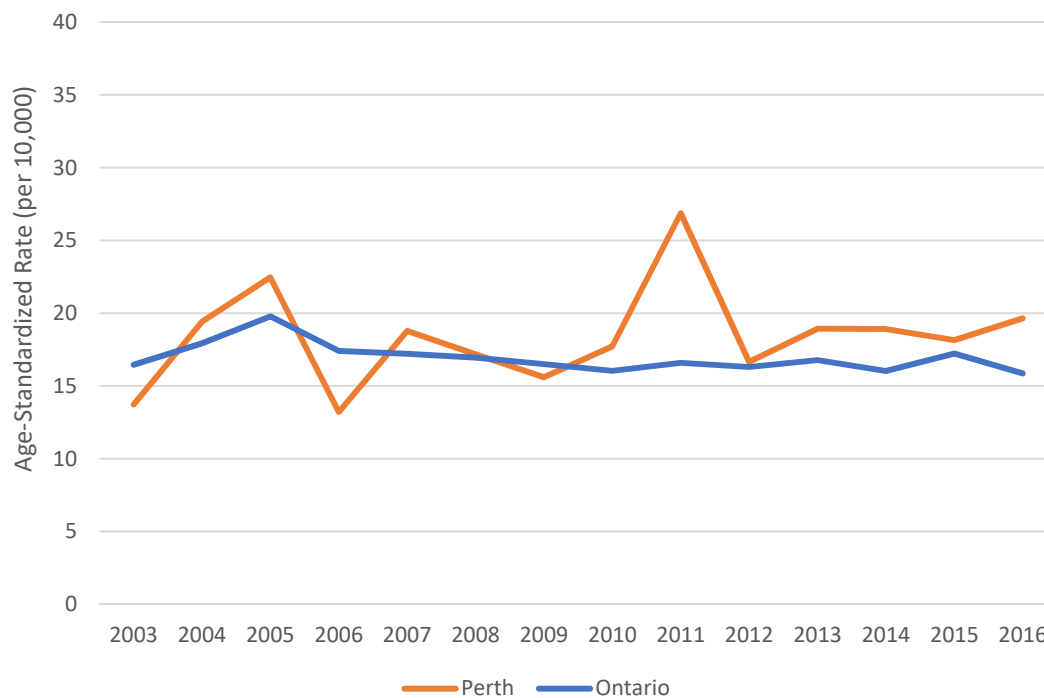
Figure 29: COPD hospitalization: Age-standardized rates (per 10,000) of male residents of Perth County (including Stratford and St. Marys) and Ontario, 2009-2016



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: 5 Apr 2018.

- The age-standardized rates (per 10,000) of hospitalization due to COPD did not change over time among-Perth County males and decreased over time among Ontario males (Figure 29).
- The age-standardized rates (per 10,000) of hospitalization due to COPD among Perth County males was higher over time compared to Ontario males.

Figure 30: COPD hospitalization: Age-standardized rates (per 10,000) of female residents of Perth County (including Stratford and St. Marys) and Ontario, 2009-2016



Source: Public Health Ontario. Snapshots. Ontario Agency for Health Protection and Promotion. Accessed: 5 Apr 2018.

- The age-standardized rates (per 10,000) of hospitalization due to COPD did not change over time among-Perth County females and decreased over time among Ontario females (Figure 30).
- The age-standardized rates (per 10,000) of hospitalization due to COPD among Perth County females was not different compared to Ontario females.