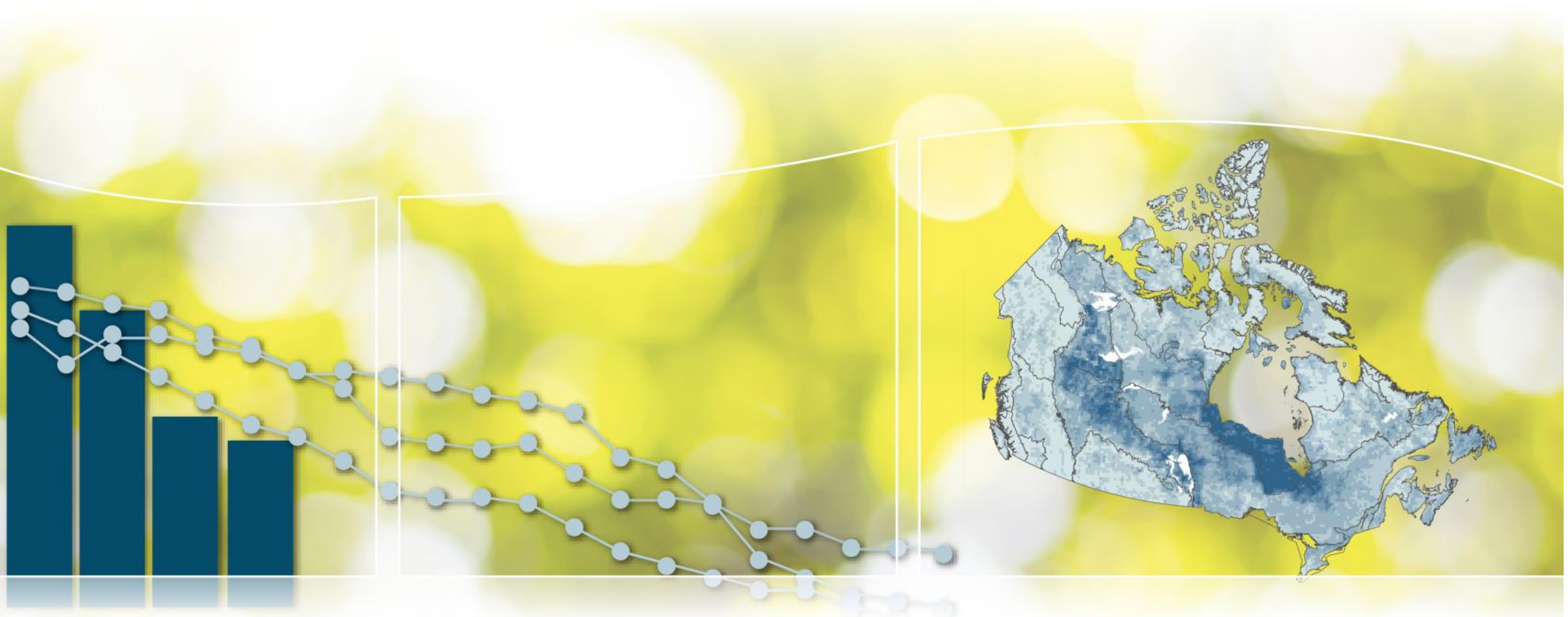
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

Air health trends



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Canadian Environmental Sustainability Indicators

Air health trends

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Air health trends

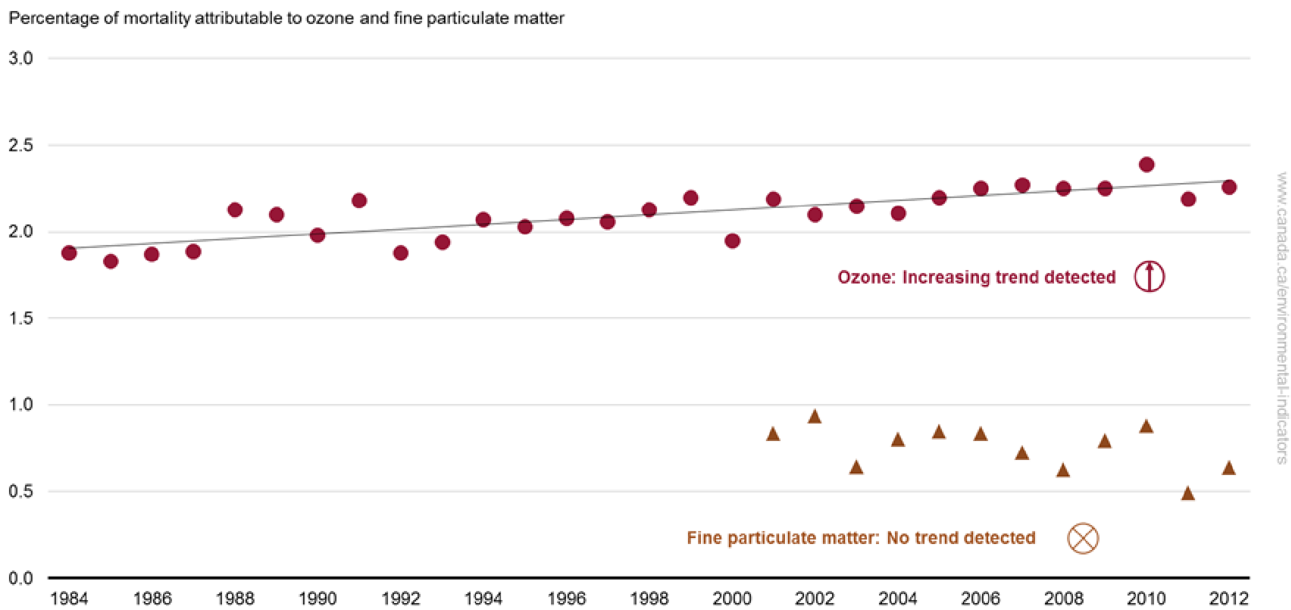
Canadians are regularly exposed to air pollution from buildings, vehicles and industries. This can affect our health and lead to work absences, hospital visits and death. The Air health trends indicators measure the proportion of deaths that can be attributed to 2 major air pollutants: ground-level ozone (O_3) and fine particulate matter ($PM_{2.5}$).[1]

Key results

Although substantial efforts have been made to improve air quality in Canada over the last few decades, the indicators suggest that outdoor air pollution continues to be an important public health issue in Canada.

- On average, for those years for which estimates can be made, approximately 2% of deaths, excluding deaths from injuries, can be attributed to O_3 exposure and 0.8% to $PM_{2.5}$ exposure
- The proportion of deaths that can be attributed to O_3 shows an increasing trend

Figure 1. Mortality attributable to ground-level ozone (1984 to 2012) and fine particulate matter (2001 to 2012), Canada



Data for Figure 1

Note: Mortalities attributable to exposure to ground-level ozone or fine particulate matter are estimates of the proportion of deaths attributable to these pollutants.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

[1] The Air health trends indicators are different from the Air Quality Health Index. The Air health trends indicators are national annual indicators, while the Air Quality Health Index is location-specific and updated many times a day. For more information on the AQHI, visit the Environment and Climate Change Canada Air Quality Health Index website.

The estimates of deaths due to O_3 exposure were about 2% overall, increasing slightly from 1984 to 2012. This is despite the fact that in the Air quality indicators we see a slight decline in peak level O_3 and no trend in average levels from 2002 to 2016. The discrepancy occurs because mortality due to pollution is estimated using daily results rather than an annual average or peak. Therefore, the results are sensitive to multiple high levels that may occur over a given year.

The estimates of deaths attributable to $PM_{2.5}$ exposure are available for a shorter period (2001 to 2012). They are quite variable (a high of 0.9% in 2002 and a low of 0.5% in 2011), and no trend can be detected.

The national Air health trends indicators provide a view of the public health impacts attributable to short-term exposure to outdoor air pollution in the form of O_3 and $PM_{2.5}$. The current indicators relate mortality to the air pollution concentrations on the same day only; they do not include the health impacts of long-term exposure to these air pollutants.

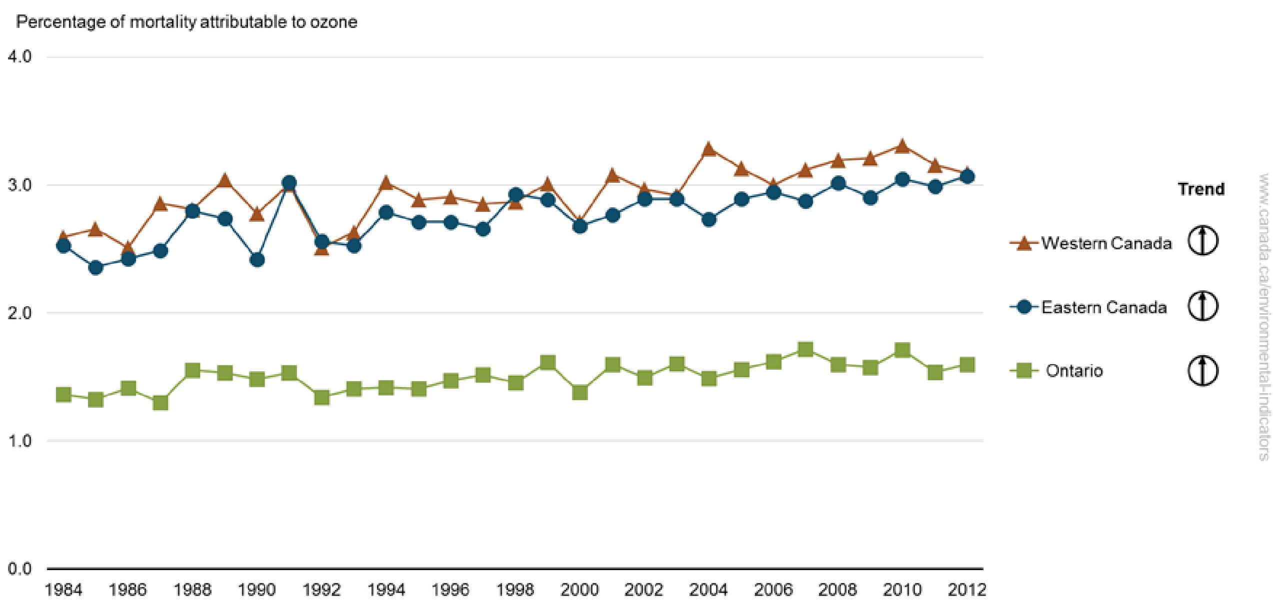
Deaths from all causes except injuries are the result of a variety of risk factors. Aside from pollution exposure, other risk factors include age, sex, race, obesity, smoking history, education, marital status, diet, medicine usage, alcohol consumption, occupational exposures, and pre-existing health conditions. The indicators estimate deaths related solely to the risk from short-term exposure to air pollution.

Regional air health trends

Key results

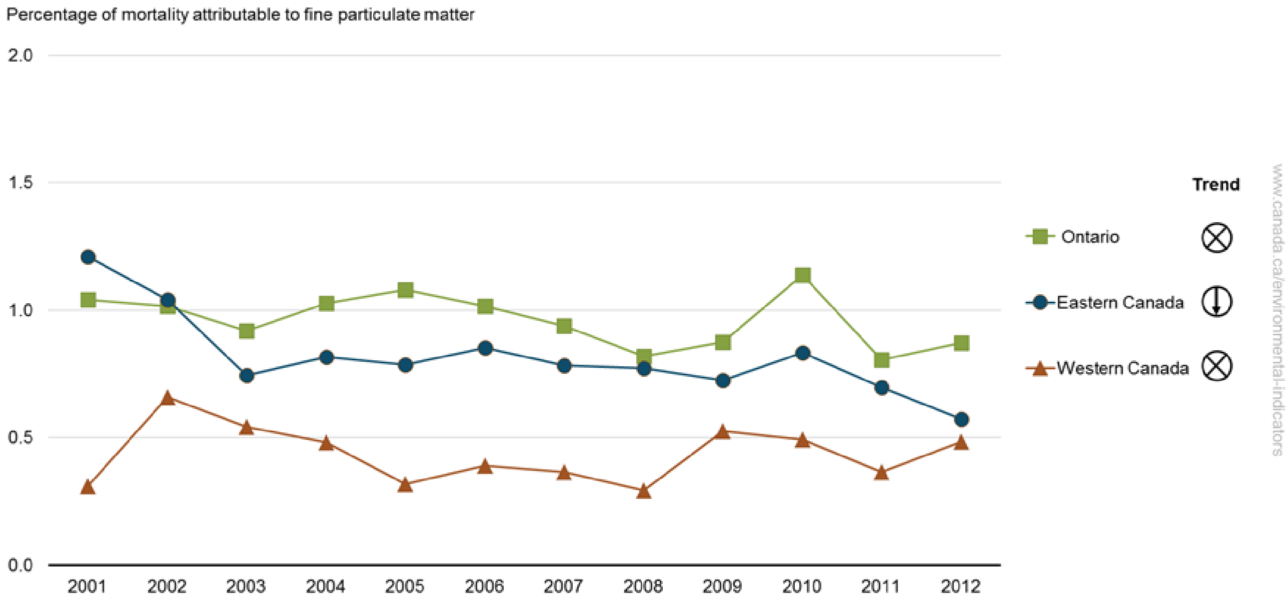
- Deaths attributable to O_3 shows upward trends for all the regions between 1984 and 2012
- No trend was detected for $PM_{2.5}$ between 2001 and 2012, except in Eastern Canada where it shows a downward trend
- Ontario shows lower deaths attributable to O_3, whereas Western Canada shows lower deaths attributable to $PM_{2.5}$

Figure 2. Mortality attributable to ground-level ozone by region, Canada, 1984 to 2012



Data for Figure 2

Figure 3. Mortality attributable to fine particulate matter by region, Canada, 2001 to 2012



Data for Figure 3

Note: The Eastern Canada region is composed of 5 urban areas; Ontario has 13 urban areas and Western Canada has 6 urban areas. For more information, please consult the Methods section. An up arrow means an increasing trend; a down arrow means a decreasing trend; an "X" means no trend. Mortality attributable to ground-level ozone or fine particulate matter exposure are estimates of the proportion of deaths attributable to these pollutants.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

The regional indicators show some disparities among the 3 regions of the country. While all 3 regions show upward trends in deaths attributable to O_3, Eastern Canada is the only region that displays a downward trend in deaths attributable to $PM_{2.5}$. Compared with the other regions, Ontario shows relatively fewer deaths attributable to O_3, but more deaths attributable to $PM_{2.5}$. Western Canada shows fewer deaths attributable to $PM_{2.5}$.

Over the 29 years between 1984 and 2012, in Eastern Canada and Western Canada approximately 3% of deaths[2] can be attributed to ground-level ozone, and in Ontario, 2%.

Between 2001 and 2012, on average, 0.8% of deaths can be attributed to fine particulate matter exposure in Eastern Canada, 1.0% in Ontario and 0.4% in Western Canada.

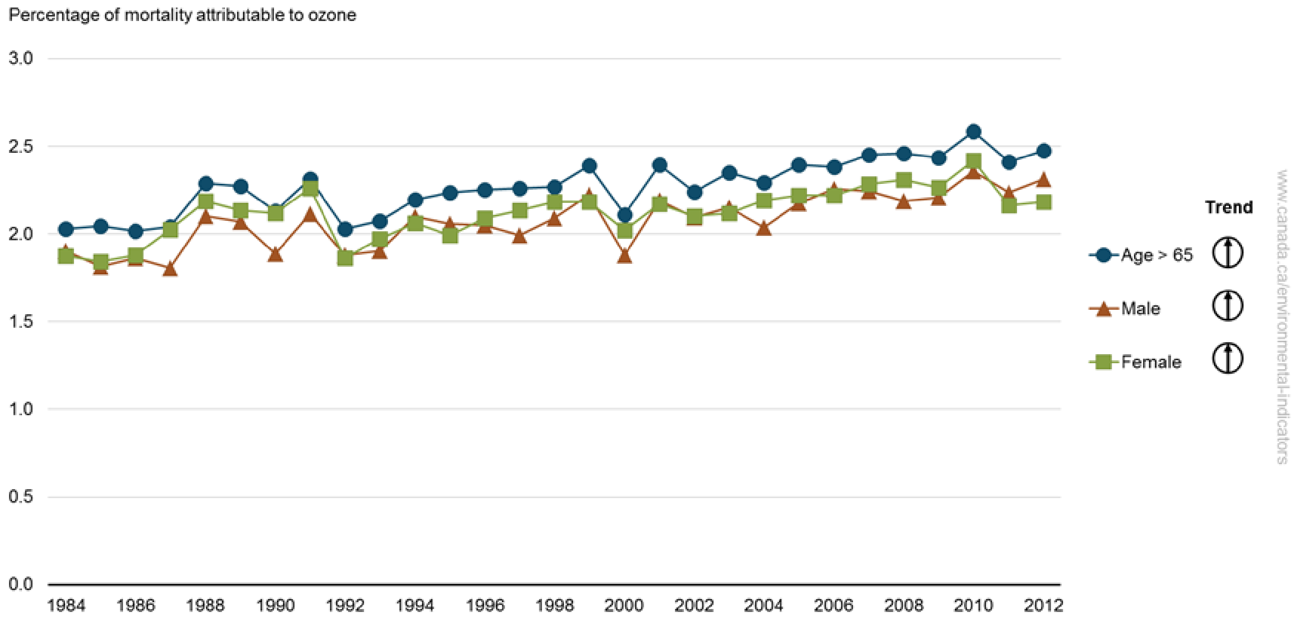
Air health trends by age and sex

Key results

- People aged 65 years and older show an upward trend in deaths attributable to O_3 and a downward trend for $PM_{2.5}$
- Both males and females show increasing trends in deaths attributable to O_3, while females show a decreasing trend for $PM_{2.5}$

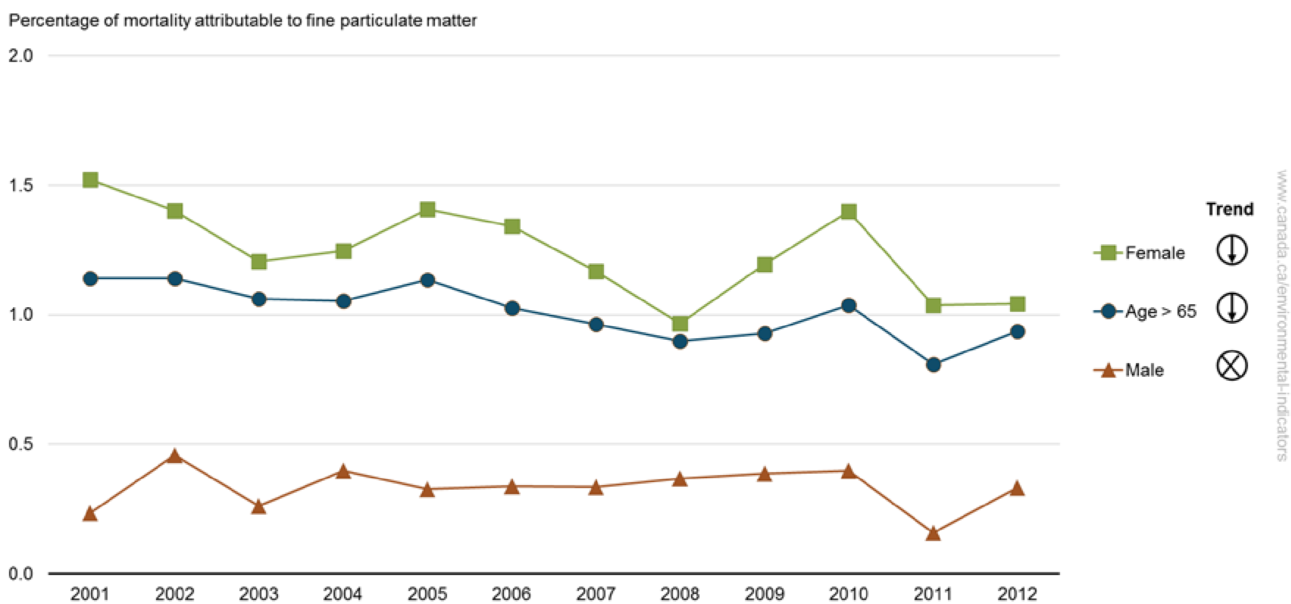
[2] Excluding deaths from injuries.

Figure 4. Mortality attributable to ground-level ozone by age and sex, Canada, 1984 to 2012



Data for Figure 4

Figure 5. Mortality attributable to fine particulate matter by age and sex, Canada, 2001 to 2012



Data for Figure 5

Note: An up arrow means an increasing trend; a down arrow means a decreasing trend; an ""X"" means no trend. Mortality attributable to ground-level ozone or fine particulate matter exposure are estimates of the proportion of deaths attributable to these pollutants.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

The indicators for O_3 and $PM_{2.5}$ do not show substantial differences in mortality attributable to air pollutants for people aged 65 years or older when compared with the general population. Approximately 2% and 1% of deaths can be attributed to O_3 and $PM_{2.5}$, respectively, for people aged 65 years or older.

Approximately 2% of deaths can be attributed to O_3 for both males and females. On the other hand, for males and females, 0.3% and 1.2% of deaths, respectively, could be attributed to fine particulate matter. There is no known explanation for sex differences in deaths due to air pollution.

About the indicators

What the indicators measure

The Air health trends indicators were developed as a tool to monitor trends in public health impacts in Canada attributable to short-term exposure to 2 important outdoor air pollutants: O_3 and $PM_{2.5}$. Specifically, the indicators estimate and track the percentage of all deaths, excluding those from injuries, that can be attributed to exposure to O_3 (monitored in 24 cities) and $PM_{2.5}$ (monitored in 22 cities).

Why these indicators are important

Exposure to air pollution can lead to chronic lung disease, heart attacks, strokes and mortality. These adverse health effects contribute to economic costs through lost productivity and additional visits to doctors' offices and hospitals. They also influence overall well-being when individuals and families must deal with illness and death.

Related indicators

The Air quality indicators track ambient concentrations of $PM_{2.5}$, O_3, sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and volatile organic compounds (VOCs) at the national and regional levels and at local monitoring stations.

Canada's Air pollutant emissions indicators track emissions from human-related sources of 6 key air pollutants: sulphur oxides (SO_X), nitrogen oxides (NO_X), VOCs, ammonia (NH_3), carbon monoxide (CO), and $PM_{2.5}$.

Safe and healthy communities

These indicators support the measurement of progress towards the following 2016–2019 Federal Sustainable Development Strategy long-term goal: All Canadians live in clean, sustainable communities that contribute to their health and well-being.

Data sources and methods

Data sources

The number of deaths, excluding deaths from injuries, were based on the daily non-accidental mortality data obtained from the national Vital Statistics - Death Database (CVSD) maintained by Statistics Canada.

The daily O_3 and $PM_{2.5}$ concentration data were obtained from the National Air Pollution Surveillance Program operated by Environment and Climate Change Canada.

Daily mean temperature data were obtained from the National Climate Data and Information Archive of Environment and Climate Change Canada.

More information

To estimate the mortality attributable to air pollution, 2 main datasets were used: daily mortality and air pollution concentrations. Additional data were also used to adjust the mortality estimates to account for confounding factors that could influence the relationship between air pollution exposure and mortality:

- calendar time, to account for seasonal and long-term variations in mortality rates
- daily temperature, to take into consideration the short-term effect of weather on daily mortality rates
- days of the week, to account for mortality that varies day by day according to our daily life structure

Data covered a 29-year period (1984 to 2012) for O_3 and a 12-year period (2001 to 2012) for $PM_{2.5}$.

Selection of urban areas

The geographical extent of urban areas was defined using census divisions. Urban areas were selected based on data availability and completeness. To be selected, the urban area required mortality and air pollution concentrations data available for at least 50% of the days (more than 182 days) in each year. The indicators include 24 urban areas for O_3 and 22 urban areas for $PM_{2.5}$.

Mortality data

Statistics Canada extracted the mortality data from the Death Database for the specified urban areas. Data were included only when the census division of residence was the same as the census division of death occurrence, and the deaths were from internal causes (that is, excluding external causes such as injuries).[3]

Air pollution concentrations

The air pollutants of interest are O_3 and $PM_{2.5}$, which are strongly linked to adverse health effects in Canada, including mortality.[4] The same metrics as those used by the Canadian Council of Ministers of the Environment were applied to ozone (daily 8-hour maximum) and $PM_{2.5}$ (daily 24-hour average) on an annual basis. For each monitoring station, the daily average concentration was calculated only if at least 18 out of 24 hourly concentrations (75%) for that day were available. Otherwise, it was recorded as missing. For each urban area, daily average concentrations were in turn averaged over monitoring stations if there were 2 or more stations located in that census division.

[3] International Classification of Diseases - ICD-9 codes < 800 and ICD-10 codes A00-R00.

[4] Health Canada (2017) Health impacts of air pollution in Canada.

Methods

Results are expressed as the proportion of mortality attributable to exposure to the air pollutants. This is estimated by multiplying the annual air pollutant concentrations by the factor "annual mortality risk" multiplied by 100.

The annual mortality risk factor is a rate giving the likely increase in daily mortality associated with a unit increase in that air pollutant concentration for a given year. For each year, the annual mortality risks of O_3 (1984 to 2012) and of $PM_{2.5}$ (2001 to 2012) were calculated for each urban area and adjusted for seasonal variation, weather and day of the week. A national annual mortality risk was then calculated by combining the annual mortality risks from each of the urban areas using a hierarchical model.

More information

The annual mortality risks at national and regional levels are estimated using statistical models. Change over time can be detected by the differences in those annual mortality risks. It is assumed for each year that there is a single distribution of true risks for all urban areas across Canada and that this distribution can be characterized by a single risk model with national mean and variance among urban areas. Urban areas in the same region share the same risk distribution.

Statistical modelling for urban area-specific risk

The annual mortality risk from O_3 and $PM_{2.5}$ exposure for each urban area was estimated using a generalized Poisson model. Daily counts of mortality were assumed to depend on:

- air pollution and the day of the week in a linear manner
- time and temperature in a non-linear manner

For urban area-specific risk estimates, $\hat{\beta}_{ij}$ with urban area location i and calendar year j, a generalized additive over-dispersed Poisson regression model was applied to the daily mortality counts, Y_{ij}. For this model we assumed that:

Equation 1.

$$\log(E[Y_{ij}(t)]) = \beta_{ij} x_{ij}(t) + f_{1ij}(t;\theta_1) + f_{2ij}(temp_0(t);\theta_2) + \sum_{l=1}^{6} g_{lij}(dow(t))$$

where:

t is the calendar time indicating day 1, 2,…, N

$Y_{ij}(t)$, $temp_0(t)$, and $dow(t)$ denote, on the day *t*, the daily mortality counts, the temperature, and the day of the week, respectively

f_{1ij} and f_{2ij} are non-linear smoothing functions

g_{lij} is a linear function for l=1,2,…,6 indicating the intraweek daily interval

$x_{ij}(t)$ represents the concentrations of O_3 or $PM_{2.5}$ on the day *t*

β_{ij} is the parameter of interest to be estimated indicating the adverse health effect of O_3 or $PM_{2.5}$ on mortality

Aggregating to a national model

For each year *j*, the national annual mortality risk is estimated by pooling the annual mortality risks by urban area in Equation 1. A random effects model was applied using a Bayesian approach, due to the small number of urban areas available (24 for O_3 and 22 for $PM_{2.5}$). To enable tracking of not only spatial variations but also temporal variations, a 2-stage Bayesian hierarchical approach was adopted to model national risk.

The estimated risks in Equation 1 were modelled as follows:

Equation 2.

$$\hat{\beta}_{ij} \mid \beta_{ij} \sim N(\beta_{ij}, \hat{v}_{ij})$$

where:

$\hat{\beta}_{ij}$ is the estimated urban area risk obtained by Equation 1

$\hat{v}_{ij}$ is the estimated conditional sampling variance, $\text{var}(\hat{\beta}_{ij} \mid \beta_{ij})$

The unknown true risks for urban area (β_{ij}) were modelled as a normal distribution, with the mean as the annual pooled national risk (μ_j), and variance ($\sigma_j^{\ 2}$) indicating the variation among the urban areas.

Equation 3.

$$\beta_{ij} \mid \mu_j, \sigma_j^{\ 2} \sim N(\mu_j, \sigma_j^{\ 2})$$

Both the national annual mortality risk and variance among urban areas vary over time. The sampling uncertainty in the estimated annual mortality risk depends on the sample size of mortality risks by urban area, but the variance of the unknown true annual mortality risks is independent of this sample size.

For the prior distribution[5] for the true mean annual mortality risk (μ_j), a normal distribution $N(0,\ 10000)$ with large variance was chosen for the purpose of objectivity, meaning not favouring one value over another. Also, the normal distribution is conjugated and so offers some computational advantages over other potential prior distributions.

Trends

To detect trends in the annual mortality risk factors, a SEN's linear trend test and a Mann-Kendall test were applied. If no trend was detected, a random effects model was applied to the annual mortality risk factors to remove unnecessary random variations, which returns adjusted annual mortality risk factors. Following the tests for trends, the estimated mortality attributable to air pollution was calculated as follows:

[5] A prior distribution is a probability distribution representing uncertain quantity before some evidence is taken into account.

Equation 4.

$$\text{estimated mortality attributable to air pollution} = c * r * 100$$

where:

c = annual air pollutant concentrations

r = annual mortality risk

Urban areas considered

The total population of the 24 urban areas has increased slightly from 49% to 52% of the total Canadian population during the 29-year study period (for ozone) between 1984 and 2012; their total mortality counts are consistently 47% to 48% of that for the rest of the Canadian population.

Table 1. Canadian urban areas used for the Air health trends indicators

Urban areas	Ground-level ozone	Fine particulate matter
Halifax	X	X
Saint John	X	X
Quebec city	X	X
Montreal	X	X
Ottawa	X	X
Durham	X	X
York	X	X
Toronto	X	X
Peel	X	X
Halton	X	X
Hamilton	X	X
Niagara	X	X
Waterloo	X	X
Windsor	X	X
Sarnia	X	X
London	X	X
Sudbury	X	n/a
Sault Ste. Marie	X	X
Winnipeg	X	X
Regina	X	X
Saskatoon	X	n/a
Calgary	X	X
Edmonton	X	X
Vancouver	X	X

Note: n/a = not available.

Regional

The indicators' urban areas are classified into 3 regions based on geographical location:

- Eastern Canada (Halifax, Saint John, Quebec City, Montreal and Ottawa)
- Ontario (Durham, York, Toronto, Peel, Halton, Hamilton, Niagara, Waterloo, Windsor, Sarnia, London, Sudbury, and Sault Ste. Marie)
- Western Canada (Winnipeg, Regina, Saskatoon, Calgary, Edmonton, and Vancouver)

While the Eastern and Western Canada regions each consist of multiple provinces, the Ontario region covers a single province. Due to the unbalanced number of urban areas included, not all regions have comparable statistical reliability.

Recent changes

The study period has changed from 1990-2010 to 1984-2012 for ozone and from 2001-2010 to 2001-2012 for fine particulate matter. This extended study period provides more statistical power of detection of trends in annual mortality risk.

The health outcome of interest has changed from heart- and lung-related causes of death to non-accidental causes, which includes the heart and lung causes. This broader health outcome provides for a more general impact of air pollutants on the human body (that is, not limited to heart or lung).

The study period of interest has changed from "warm season," that is, between April and September, to year-round (from January to December). This extended period provides for a more general impact of air pollutants, not limited to a specific 6-month period. With climate change, the warm season in Canada varies over time in terms of temperature, and thus investigation over the whole year is more reliable for the detection of annual trends, which is the main goal of the indicators.

Caveats and limitations

The Air health trends indicators are undergoing continued development. The indicators are assessed in communities for which the required data were available. The indicators do not include assessments of the potential reasons behind changes in mortality attributable to air pollutant exposure.

More information

Short-term versus long-term exposure

The current indicators relate mortality to the air pollution concentrations on the same day only, and thus they do not reflect the total impact associated with these pollutants' concentrations over multiple days. While the indicators estimate acute risk from short-term exposure to air pollution, there is also risk from long-term exposure.

The Air health trends indicators model estimates adverse health effects of exposure on a single day. However, the adverse effect manifests over a period that differs from one member of the population to another, due to different health status and thus different timing of reaction to exposure. Some people become sick immediately, whereas it may take days or even weeks for other people to feel the effects.

Typical models assume that the time delay between exposure and health effect will not be longer than 2 to 3 months: it is too far removed for the exposure to have any reasonable connection to mortality. For the model used here, it was established that even 2 to 3 months strains plausibility, therefore we isolated the association down to a 0-day-to-14-day period following exposure and eliminated the rest from consideration.

Trends

To help detect a trend, the indicators are based on a dynamic model (rather than a static model), which shows more annual variations mainly due to the smaller number of days used for the indicators. A static model returns just one risk factor for all years combined, and thus no trend can be detected. A dynamic model, on the other hand, uses annual data (365 or 366 days) and thus can detect annual changes or trends. Unless a trend in the annual mortality risk factors is identified based on statistical test methods such as the parametric regression model and the non-parametric SEN's test, those annual risks can be interpreted as having the same value over the time period. For example, for ozone there are 29 annual mortality risks calculated for each year in the time series. If no significant trend is found, then no difference is assumed – meaning that the risk is the same over all years considered.

Weather effects

To account for weather effects, it might have been useful to add information on relative humidity and dew point temperature to the mean temperature data. However, among the 24 urban areas, 8 had no appropriate relative humidity or dew point temperature data for 10 to 21 years within the study period. In addition, when tested, no significant effects of relative humidity and dew point temperature were evident using only those urban areas that had data available for both of these variables. Therefore, it was decided not to include relative humidity and dew point temperature as covariates in the model.

Resources

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Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Mortality attributable to ground-level ozone (1984 to 2012) and fine particulate matter (2001 to 2012), Canada

Year	Mortality attributable to ozone (percentage)	Mortality attributable to fine particulate matter (percentage)
1984	1.88	n/a
1985	1.83	n/a
1986	1.87	n/a
1987	1.89	n/a
1988	2.13	n/a
1989	2.10	n/a
1990	1.98	n/a
1991	2.18	n/a
1992	1.88	n/a
1993	1.94	n/a
1994	2.07	n/a
1995	2.03	n/a
1996	2.08	n/a
1997	2.06	n/a
1998	2.13	n/a
1999	2.20	n/a
2000	1.95	n/a
2001	2.19	0.84
2002	2.10	0.94
2003	2.15	0.64
2004	2.11	0.80
2005	2.20	0.85
2006	2.25	0.84
2007	2.27	0.73
2008	2.25	0.63
2009	2.25	0.79
2010	2.39	0.88
2011	2.19	0.49
2012	2.26	0.64

Note: n/a = not available. Mortalities attributable to exposure to ground-level ozone or fine particulate matter are estimates of the proportion of deaths attributable to these pollutants.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

Table A.2. Data for Figure 2. Mortality attributable to ground-level ozone by region, Canada, 1984 to 2012

Year	Eastern Canada (percentage)	Ontario (percentage)	Western Canada (percentage)
1984	2.52	1.36	2.59
1985	2.36	1.33	2.66
1986	2.43	1.41	2.51
1987	2.49	1.30	2.86
1988	2.80	1.56	2.81
1989	2.74	1.53	3.04
1990	2.42	1.48	2.78
1991	3.02	1.53	3.00
1992	2.56	1.34	2.51
1993	2.53	1.41	2.63
1994	2.78	1.42	3.02
1995	2.71	1.41	2.88
1996	2.71	1.47	2.91
1997	2.66	1.52	2.85
1998	2.93	1.46	2.87
1999	2.89	1.62	3.01
2000	2.68	1.38	2.71
2001	2.77	1.60	3.08
2002	2.89	1.50	2.96
2003	2.89	1.61	2.92
2004	2.73	1.49	3.28
2005	2.89	1.56	3.13
2006	2.95	1.62	3.00
2007	2.87	1.71	3.12
2008	3.02	1.60	3.19
2009	2.90	1.57	3.21
2010	3.05	1.71	3.31
2011	2.99	1.54	3.16
2012	3.07	1.60	3.09

Note: The Eastern Canada region is composed of 5 urban areas; Ontario has 13 urban areas and Western Canada has 6 urban areas. For more information, please consult the Methods section. Mortality attributable to ground-level ozone exposure is an estimate of the proportion of deaths attributable to the pollutant.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

Table A.3. Data for Figure 3. Mortality attributable to fine particulate matter by region, Canada, 2001 to 2012

Year	Eastern Canada (percentage)	Ontario (percentage)	Western Canada (percentage)
2001	1.21	1.04	0.31
2002	1.04	1.02	0.66
2003	0.75	0.92	0.54
2004	0.82	1.03	0.48
2005	0.79	1.08	0.32
2006	0.85	1.02	0.39
2007	0.78	0.94	0.37
2008	0.77	0.82	0.29
2009	0.72	0.87	0.52
2010	0.83	1.14	0.49
2011	0.70	0.80	0.37
2012	0.57	0.87	0.49

Note: The Eastern Canada region is composed of 5 urban areas; Ontario has 13 urban areas and Western Canada has 6 urban areas. For more information, please consult the Methods section. Mortality attributable to fine particulate matter exposure is an estimate of the proportion of deaths attributable to the pollutant.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

Table A.4. Data for Figure 4. Mortality attributable to ground-level ozone by age and sex, Canada, 1984 to 2012

Year	Age > 65 (percentage)	Female (percentage)	Male (percentage)
1984	2.03	1.87	1.90
1985	2.05	1.84	1.81
1986	2.02	1.88	1.86
1987	2.04	2.02	1.81
1988	2.29	2.19	2.10
1989	2.27	2.13	2.07
1990	2.13	2.12	1.89
1991	2.31	2.26	2.11
1992	2.03	1.86	1.88
1993	2.07	1.97	1.90
1994	2.20	2.06	2.10
1995	2.24	1.99	2.06
1996	2.25	2.09	2.05
1997	2.26	2.13	1.99
1998	2.27	2.19	2.09
1999	2.39	2.18	2.23
2000	2.11	2.02	1.88

Year	Age > 65 (percentage)	Female (percentage)	Male (percentage)
2001	2.39	2.17	2.19
2002	2.24	2.10	2.09
2003	2.35	2.12	2.15
2004	2.29	2.19	2.04
2005	2.39	2.22	2.18
2006	2.38	2.22	2.25
2007	2.45	2.28	2.24
2008	2.46	2.31	2.19
2009	2.44	2.27	2.21
2010	2.58	2.42	2.36
2011	2.41	2.17	2.24
2012	2.48	2.18	2.31

Note: Mortality attributable to ground-level ozone exposure is an estimate of the proportion of deaths attributable to the pollutant.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

Table A.5. Data for Figure 5. Mortality attributable to fine particulate matter by age and sex, Canada, 2001 to 2012

Year	Age > 65 (percentage)	Female (percentage)	Male (percentage)
2001	1.14	1.52	0.23
2002	1.14	1.40	0.46
2003	1.06	1.21	0.26
2004	1.05	1.25	0.40
2005	1.13	1.41	0.33
2006	1.03	1.34	0.34
2007	0.96	1.17	0.33
2008	0.90	0.97	0.37
2009	0.93	1.19	0.39
2010	1.04	1.40	0.40
2011	0.81	1.04	0.16
2012	0.94	1.04	0.33

Note: Mortality attributable to fine particulate matter exposure is an estimate of the proportion of deaths attributable to the pollutant.
Source: Health Canada (2017) Environmental Health Science and Research Bureau, Population Studies Division.

Additional information can be obtained at:

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