Ontario
Cancer Care Ontario
Action Cancer Ontario

Cancer Risk Factors in Ontario

Alcohol – appendix A, B, C, D

APPENDIX A: DATA SOURCES

CANADIAN COMMUNITY HEALTH SURVEY (CCHS), ONTARIO SHARE FILES

The Canadian Community Health Survey (CCHS) is a population-based cross-sectional survey conducted by Statistics Canada that collects information on health status, healthcare utilization and determinants of health for the Canadian population aged 12 years and older living in private dwellings. Individuals living on First Nations reserves and other Aboriginal settlements, institutional residents, full-time members of the Canadian Forces and residents of certain remote regions are excluded from the CCHS. It is representative of 98% of the Canadian population aged 12+ and produces reliable estimates at the health region level.

The CCHS began in 2000/01 and was initially designed to be administered every two years, sampling approximately 130,000 respondents (39,000 in Ontario) in each cycle. In 2007, this format changed to its current iteration where approximately 65,000 respondents (20,000 in Ontario) are sampled annually.

For this report, CCHS full survey waves 2003 and 2005 and half-survey annual waves 2007 to 2012 were used in most analyses. CCHS cycle 1.1, administered in 2000/01, was used to obtain historic prevalence estimates of alcohol consumption to estimate the burden of cancer in Ontario that could be attributed to alcohol.

ONTARIO CANCER REGISTRY (OCR)

The Ontario Cancer Registry (OCR) is operated by Cancer Care Ontario and registers all newly diagnosed cases of invasive neoplasia, except for basal and squamous cell skin cancers. Electronic records are linked at the person level and then "resolved" into incident cases of cancer using computerized medical logic. Major data sources are:

1. Cancer-related hospital discharge and day surgery records from the Canadian Institute for Health Information
2. Cancer-related pathology reports, received mostly electronically from hospital and community laboratories
3. Consultation and treatment records of patients referred to one of 14 Regional Cancer Centres
4. Death certificates with cancer identified as the underlying cause of death, received from the Ontario Registrar General

The OCR was used to obtain the number of new cancer cases diagnosed in 2010 for the analysis of population attributable fractions (PAF) calculated for alcohol.

APPENDIX B: INDICATOR DEFINITIONS

PERCENTAGE EXCEEDING CANCER PREVENTION RECOMMENDATIONS FOR ALCOHOL CONSUMPTION

Definition: Percentage of Ontario adults aged 19 years and older exceeding the maximum recommended level of alcohol consumption for cancer prevention.

Method of Calculation:

$$\frac{\text{Weighted number of adults aged 19 and over who on average exceed the maximum recommended alcohol consumption for cancer prevention}}{\text{Weighted total population aged 19 and over}} \times 100$$

- The average number of drinks consumed daily was calculated from the total number of drinks consumed in the week prior to the survey interview.*
- The maximum recommended alcohol consumption for men is two drinks per day and for women is one drink per day, as specified by the World Cancer Research Fund and the American Institute for Cancer Research.
- Respondents identified as a refusal, don't know or not stated to the required survey questions were excluded.
- Respondents who answered yes, refusal, don't know or not stated to the pregnancy question were excluded.

Survey Questions:

- When we use the word 'drink' it means:
  - one bottle or can of beer or a glass of draft
  - one glass of wine or a wine cooler
  - one drink or cocktail with one and a half ounces of liquor.
- Thinking back over the past week, did you have a drink of beer, wine, liquor or any other alcoholic beverage?
- Starting with yesterday, how many drinks did you have?†

AVERAGE NUMBER OF DAYS PER WEEK EXCEEDING CANCER PREVENTION RECOMMENDATIONS

Definition: Average number of days per week Ontario adults aged 19 years and older exceed the maximum recommended level of alcohol consumption for cancer prevention, among those who exceeded it based on their average consumption during the past week.

Method of Calculation:

Weighted average number of days per week exceeding the maximum recommended alcohol consumption for cancer prevention by adults aged 19 and over who exceeded the recommendations based on their average consumption during the past week

- The maximum recommended alcohol consumption for men is two drinks per day and for women is one drink per day, as specified by the World Cancer Research Fund and the American Institute for Cancer Research.
- Respondents identified as a refusal, don't know or not stated to the required survey questions were excluded.
- Respondents who answered yes, refusal, don't know or not stated to the pregnancy question were excluded.

Survey Questions:

- Thinking back over the past week, did you have a drink of beer, wine, liquor or any other alcoholic beverage?
- Starting with yesterday, how many drinks did you have?†

PERCENTAGE EXCEEDING CANCER PREVENTION RECOMMENDATIONS FOR ALCOHOL CONSUMPTION AND CURRENTLY SMOKING

Definition: Percentage of Ontario adults aged 19 years and older exceeding the maximum recommended level of alcohol consumption for cancer prevention who report smoking cigarettes daily or occasionally.

Method of Calculation:

$$\frac{\text{Weighted number of adults aged 19 and over who on average exceed the maximum recommended alcohol consumption for cancer prevention and smoke cigarettes daily or occasionally}}{\text{Weighted total population aged 19 and over}} \times 100$$

- The maximum recommended alcohol consumption for men is two drinks per day and for women is one drink per day, as specified by the World Cancer Research Fund and the American Institute for Cancer Research.
- Respondents identified as a refusal, don't know or not stated to the required survey questions were excluded.
- Respondents who answered yes, refusal, don't know or not stated to the pregnancy question were excluded.

Survey Questions:

- Thinking back over the past week, did you have a drink of beer, wine, liquor or any other alcoholic beverage?
- Starting with yesterday, how many drinks did you have?†
- At the present time, do you smoke cigarettes daily, occasionally or not at all?

PERCENTAGE NOT DRINKING ALCOHOL DURING PAST 12 MONTHS

Definition: Percentage of Ontario adults aged 19 years and older who reported not having an alcoholic drink in the past 12 months.

*A limitation of this method of calculation is that the World Cancer Research Fund/American Institute for Cancer Research recommendations for alcohol consumption provide daily, but not weekly, limits. If this indicator looked at exceedance of the recommendations on any single day during the week prior to the survey interview, the percentage of the population exceeding the recommendations would be roughly twice as high.

†Question repeated for each day of past week

Method of Calculation:

$$\frac{\text{Weighted number of adults aged 19 and over who did not drink during past 12 months}}{\text{Weighted total population aged 19 and over}} \times 100$$

- Respondents identified as a refusal, don't know or not stated to the required survey questions were excluded.
- Respondents who answered yes, refusal, don't know or not stated to the pregnancy question were excluded.

Survey Questions:

- During the past 12 months, have you had a drink of beer, wine, liquor or any other alcoholic beverage?

MEDIAN NUMBER OF DRINKS CONSUMED WEEKLY

Definition: Median number of drinks consumed per week among adults aged 19 years and older who reported having an alcoholic drink in the past 12 months.

Method of Calculation:

Weighted median number of drinks per week among adults aged 19 and over who had an alcoholic drink during the past 12 months

- Respondents identified as a refusal, don't know or not stated to the required survey questions were excluded.
- Respondents who answered yes, refusal, don't know or not stated to the pregnancy question were excluded.

Survey Questions:

- Thinking back over the past week, did you have a drink of beer, wine, liquor or any other alcoholic beverage?
- Starting with yesterday, how many drinks did you have?*

DEFINITION OF CANCER TYPES ASSOCIATED WITH ALCOHOL CONSUMPTION

CANCER TYPE	ICD-O-3 SITE CODE†,‡
Oral cavity and pharynx	C00-C14
Esophagus	C15
Colorectal	C18-C20, C26.0
Liver	C22
Larynx	C32
Female breast	C50

†ICD-O-3 refers to the Third Edition of the International Classification of Diseases for Oncology (2000). ICD-O-3 site/histology codes were based on the Surveillance, Epidemiology, and End Results (SEER) site recode definition. See http://seer.cancer.gov/siterecode/icdo3_d01272003/.
‡All histology codes excluding 9590–9989, 9050–9055, and 9140

*Question repeated for each day of past week

APPENDIX C: ANALYTIC METHODS

ALCOHOL-RELATED PREVALENCE ESTIMATES

- Most estimates were age-standardized to the age distribution of the 2006 Canadian population using the age groups from the Canadian Community Health Survey (CCHS) person-level sampling strategy: 19–29, 30–44, 45–64 and 65+. The exceptions were age-specific estimates and estimates for the average number of days exceeding the cancer prevention recommendations and median drink consumption, for which unadjusted estimates were provided.
- Bootstrapping techniques were used to obtain variance estimates and 95% confidence intervals of all estimates.[1]
- Time periods varied according to the availability of CCHS content for a given indicator or population:

  2000/01: Used in the population attributable fraction analyses to provide the greatest lag time between alcohol exposure and cancer outcome.

  2012: Used for most analyses because it is the most current CCHS data available when writing this report.

  2003–2012: Used to examine time trends; estimates from the 2000/01 CCHS cycle were excluded because a change in the administration of the survey beginning in 2003 affected some alcohol consumption estimates.[2]

  2010–2012 combined: Pooled data used to increase the survey sample to a size that is acceptable for the release of indicators stratified by geographic regions and socio-demographic characteristics without introducing a high degree of sampling variability.

  2008–2012 combined: Pooled data used to increase the survey sample to a size that is acceptable for the release of indicators stratified by off-reserve Aboriginal identity without introducing a high degree of sampling variability.

- Socio-demographic characteristics were analyzed for adults aged 30+ to restrict the sample to those who have likely completed their education and reached their adult socio-demographic status. These factors were defined as follows:

  Urban/rural residence: Respondents living within any census metropolitan area (CMA) or census agglomeration (CA) were considered "urban residents" and those living outside of any CMA or CA were classified as "rural residents."

  Income quintile: Sorts respondents' derived household income into quintiles based on the ratio of household income to the low-income cut-off (LICO) for the household size and community. Starting in 2011, Statistics Canada imputed all missing household incomes to account for the one-third of missing responses to the income question.

  Education: Highest level of education attained by the respondent, according to three categories: less than secondary school graduation, secondary school graduation or some post-secondary education, and post-secondary graduation.

  Immigration status: Distinguishes immigrants, according to time since immigration, from the Canadian-born population based on three categories: Canadian-born, immigrant > 10 years in Canada and immigrant ≤ 10 years in Canada. The years since immigration refers to the first time the respondent arrived in Canada (excluding holidays) to live as a landed immigrant, by claiming refugee status, with a work permit or with a study permit.

- Analyses by Aboriginal identity (off-reserve), conducted for adults aged 19+, distinguish respondents who self-identify as Aboriginal (First Nations, Métis or Inuk/Inuit) and were born in Canada, the United States or Germany, from those who do not identify themselves as Aboriginal or were not born in the specified countries, based on CCHS derived variable socio-demographic characteristics for Aboriginal identity (SDCDABT). Aboriginal (off-reserve) respondents were further subdivided based on self-identification with any of First Nations, Métis or Inuk/Inuit groups. Self-identified off-reserve First Nations (Status and Non-Status Indians) were categorized as First Nations if they had not also identified as Métis, while those identifying as Métis at any time were categorized as Métis.
- Estimates for Local Health Integration Networks (LHINs) were analyzed using survey weights that were calibrated to the LHIN geographic boundaries, which do not correspond to the standard population weights at the public health unit (PHU) level.
- Statistically significant differences in risk factor prevalence between a given LHIN or PHU and Ontario and between categories of a given socio-demographic factor were tested by comparing the absolute difference between the two estimates with the square root of the sum of the margin of error (i.e., the upper 95% confidence limit minus the estimate) squared for each estimate being compared. If the difference between the estimates was greater than the square root of the sum of the squares of the two margins of error then the estimates were considered significantly different (approximately $p < 0.05$).
  - Socio-demographic factors were compared against the following reference variables: urban areas for analyses by urban/rural residence, income quintile 5 (Q5) for analyses by income quintile, post-secondary graduate for analyses by education status and Canadian-born for analyses by immigration status.
- Limitations to analyses that used CCHS data include:
  - The relatively short time period available to examine time trends in prevalence estimates.
  - The use of self-report data, where socially undesirable behaviours, such as heavy alcohol consumption, are likely to be under-reported by respondents. While self-report data are known to underestimate alcohol consumption when compared with sales data, population survey data allow for analyses to be conducted at a fine geographic level (e.g., by PHU as presented in this report).
  - The limitations of the survey questions regarding alcohol use. For example, questions about the quantity of alcohol consumed were restricted to the week before the survey was administered, which may not be representative of typical consumption. Beginning in 2007, there were no questions about respondents' consumption before the year

prior to the survey. Finally, the validity of survey responses may be limited by the accuracy of respondents' recall and their interpretation of the question wording "a drink of beer, wine, liquor or any other alcoholic beverage."

- The presentation of prevalence estimates that were adjusted for age only and did not adjust for other important factors (e.g., socio-economic status) that may contribute to differences in prevalence estimates between groups.

POPULATION ATTRIBUTABLE FRACTIONS (PAF) FOR ALCOHOL CONSUMPTION

- Population attributable fraction (PAF) for alcohol consumption was calculated as follows:

$$PAF = \frac{\Sigma (p_x \times ERR_x)}{1 + \Sigma (p_x \times ERR_x)}$$

where p_x is the proportion of the population in consumption category x and ERR_x is the excess relative risk ($RR_x - 1$) in consumption category x

- The ERR of alcohol consumption for each category x was calculated as follows:

$$ERR_x = \exp (R_g \times G_x) - 1$$

where R_g is the increase in risk per gram of alcohol intake and G_x is the quantity of alcohol consumed (grams per day) in consumption category x

- The proportion of the population in each consumption category was derived from the 2000/01 cycle, the earliest year for which data on alcohol consumption could be easily extracted. The age groups used to generate age-specific proportion estimates were 19–29, 30–44, 45–64 and 65+, consistent with the age group sampling strategy of the CCHS.
- Consumption categories were derived from the CCHS based on the following questions (see Technical Appendix for details):

1. Thinking back over the past week, did you have a drink of beer, wine, liquor or any other alcoholic beverage? If yes, how many drinks did you have on each day?
2. During the past 12 months, how often did you drink alcoholic beverages?
3. Have you ever had a drink? If yes, did you ever regularly drink more than 12 drinks a week? (Respondents were only asked this question if they reported not drinking during the past 12 months.)

The estimated proportions of males and females in the different consumption categories are shown in Table C1 (for proportions by age group, see Technical Appendix, Table 1).

TABLE C1. ESTIMATED PROPORTION OF THE POPULATION AGED 19+ IN ALCOHOL CONSUMPTION CATEGORIES, BY SEX, 2000/01

CATEGORY DESCRIPTION (CATEGORY NUMBER)		PROPORTION (%)	
		MALES	FEMALES
Drank during the past week an average of	up to 1 drink a day (1)	35.6	33.8
	more than 1 and up to 2 drinks a day (2)	11.9	5.1
	more than 2 and up to 3 drinks a day (3)	4.8	1.1
	more than 3 and up to 4 drinks a day (4)	2.0	0.2
	more than 4 drinks a day (5)	1.9	0.2
Did not drink during the past week, but reported drinking during the past year	less than once a month (6)	10.8	19.2
	once a month (7)	5.2	5.9
	2–3 times a month (8)	5.0	5.3
	once a week (9)	3.9	2.8
	2–3 times a week (10)	1.8	1.2
	4–6 times a week (11)	0.3	0.1
	every day (12)	0.4	0.1
Did not drink during the past year, but has had at least one drink in their lifetime and	used to regularly drink more than 12 drinks a week (13)	3.2	0.9
	did not regularly drink more than 12 drinks a week (14)	7.1	13.1
Did not drink during the past year	and has never had a drink (15)	5.9	11.0

- Risk estimates for each cancer type associated with alcohol consumption (increase in risk per gram of alcohol intake; Table C2) were obtained from Parkin's study of cancers attributable to alcohol consumption,[3] which, in turn, were derived from several meta-analyses and large epidemiologic studies.[4-9]

TABLE C2. INCREASE IN RISK OF CANCER ASSOCIATED WITH 1 GRAM OF ALCOHOL PER DAY[3]

CANCER TYPE	INCREASE IN RISK PER GRAM OF ALCOHOL PER DAY
Oral cavity and pharynx[4]	0.0185
Esophagus[4]	0.0129
Colorectal[5-8]	0.0080
Liver[4]	0.0059
Larynx[4]	0.0136
Breast[9]	0.0071

- The exposure level, or quantity of alcohol consumed, was calculated for each consumption category (see Technical Appendix for details). Briefly, consumption categories 1 through 5, in Table C1 above, were assigned the median number of drinks per day consumed in each category, categories 6 through 12 were assigned a quantity based on similar respondents who reported drinking during the past week, and categories 13 and 14 were assigned a quantity based on their estimated volume of consumption before the past year. The number of drinks assigned to each category was multiplied by 13.6 g, the amount of alcohol in a standard alcoholic drink, to obtain the quantity of alcohol consumed in grams.
- To evaluate the potential impact of using underestimates of alcohol exposure to calculate the alcohol-attributable fractions, they were recalculated using survey data adjusted according to the coverage rate, or the degree to which survey data account for the amount of alcohol sold (see Technical Appendix for details). Briefly, the average volume of alcohol consumed in Ontario, as captured by the 2000/01 CCHS, was calculated. This was compared with recorded consumption (per capita consumption in Ontario based on sales data, averaged for 2000 and 2001) and unrecorded consumption (calculated as 19.5% of total consumption based on an Ontario study).[10] The coverage rate of the 2000/01 CCHS was calculated to be 30% of recorded and unrecorded per capita consumption, which was used to adjust exposure level for each consumption category following methods used by Shield et al.[11] The quantity of alcohol consumed assigned to each consumption category was multiplied by 80% of the inverse of the coverage rate, upon the assumption that 20% of the estimated total volume was not consumed due to wastage and spillage and to account for undercoverage in the studies used to determine the risk estimates.
- For each cancer type associated with alcohol consumption, the PAF was calculated for each sex and age group combination, using cancer-specific risk estimates and sex- and age-specific estimates for the proportion of the population and quantity of alcohol consumed in each consumption category. Sex- and age-specific PAFs were summed for each cancer type and sex to obtain an overall PAF for that particular cancer.
- Cancers diagnosed in 2010 were examined, allowing for a latent period of 10 years between the time of exposure to alcohol and the time of cancer diagnosis. Based on this 10-year latency, the age groups used for extracting cancer incidence data were 29–39, 40–54, 55–74 and 75+.
- This method of calculating PAF for alcohol consumption adopts several assumptions that may result in somewhat conservative estimates:
  - For each respondent, past-week consumption is representative of their typical consumption.
  - Current consumption reflects past consumption. (Such an assumption is commonly made in PAF calculations, for which longer-term consumption information is usually unavailable.)
  - Survey respondents who reported consuming alcohol in the past 12 months, but did not report drinking during the past week, regularly drink the same amount of alcohol as those who did.
  - Former drinkers have the same magnitude of increased cancer risk as current drinkers.
  - A latent period of 10 years between exposure to alcohol and an increased risk of cancer is appropriate.
  - The increase in cancer risk per gram of alcohol intake is linear on a logarithmic scale.

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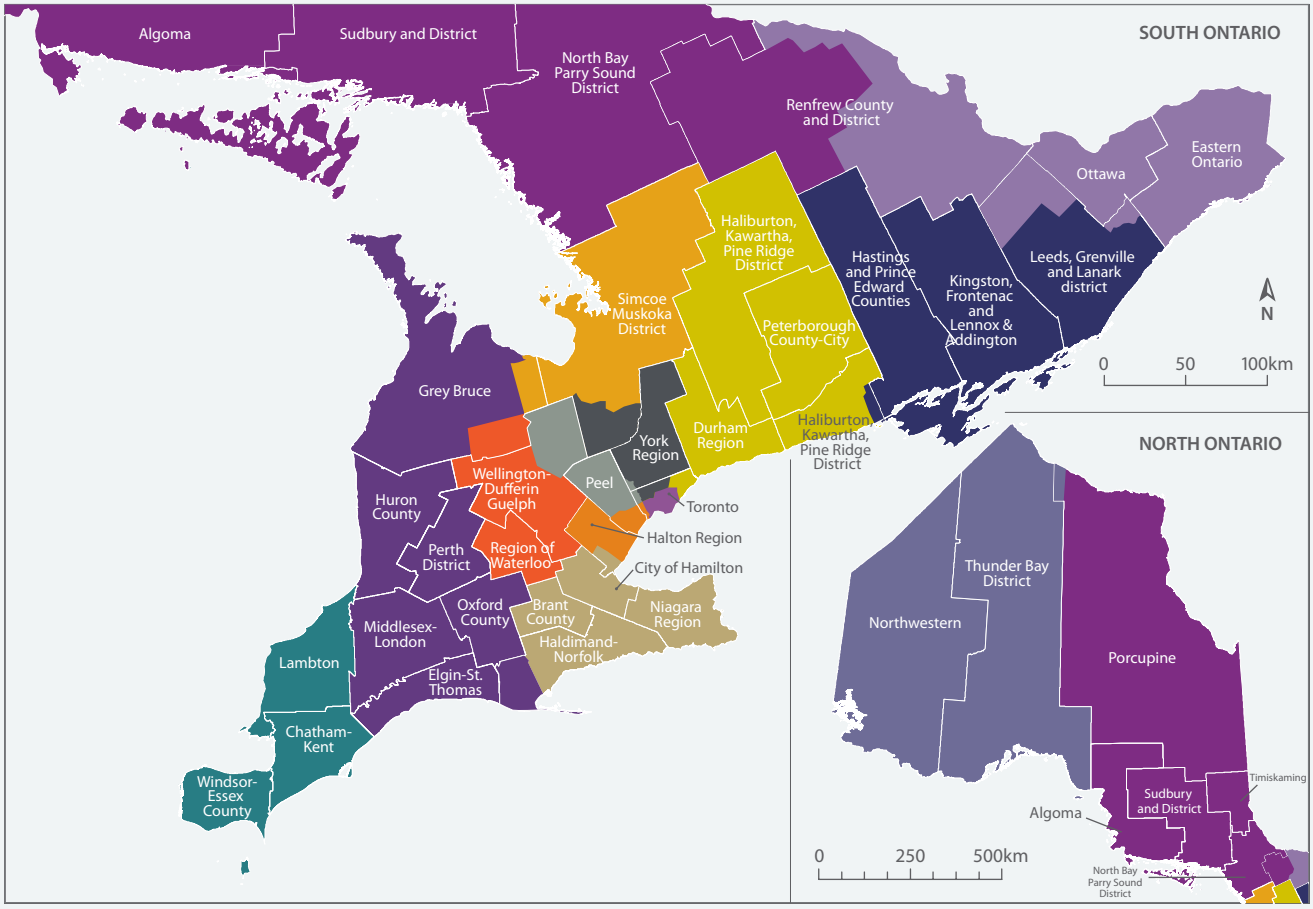
APPENDIX D:
MAP OF ONTARIO'S LOCAL HEALTH INTEGRATION NETWORKS AND PUBLIC HEALTH UNITS



☐ PHU boundary

LHIN regions

- Erie St. Clair
- South West
- Waterloo Wellington
- Hamilton Niagara Haldimand Brant
- Central West
- Mississauga Halton
- Toronto Central
- Central
- Central East
- South East
- Champlain
- North Simcoe Muskoka
- North East
- North West