



# Assessment of Age and Sex Differences in Risk of 1-Year Mortality After Emergency Department Visits Caused by Alcohol Use

Daniel T. Myran, MD, MPH; Emily Rhodes, MSc; Haris Imsirovic, MSc; Shannon M. Fernando, MD, MSc; Manish M. Sood, MD, MSc; Peter Tanuseputro, MD, MHSc

## Introduction

In the past 2 decades, alcohol-related emergency department (ED) visits have increased in Canada and the US.<sup>1,2</sup> Previous work has reported that the risk of death is increased among older adults with frequent ED visits related to alcohol.<sup>3</sup> However, to our knowledge, data are lacking on the clinical importance of ED visits due to alcohol in young adults or individuals with infrequent or singular visits due to alcohol. We evaluated the probability of death in the year after 1 or more alcohol-related ED visits and the differences by age and sex.

## Methods

This repeated cross-sectional study identified all ED visits due to alcohol and deaths from any cause for individuals aged 15 to 59 years in Ontario, Canada, between January 2003 and December 2017 using linked health administrative data through ICES. This study was approved by the privacy and legal offices of ICES and followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

We compared the risk of all-cause mortality over 365 days between the general population and individuals with an incident ED visit due to alcohol. Individuals were classified as having a total (including incident visit) of 1, 2, or 3 or more ED visits due to alcohol in the year after the initial visit. Each individual could contribute 1 year of follow-up, which began after their first point of eligibility (eMethods in the Supplement). Poisson models were used to calculate incidence rate ratios (IRRs) with 95% CIs for the risk of death in individuals with ED visits due to alcohol relative to the general population. We ran separate models stratified by age and sex. Data were analyzed from July 2021 through September 2021 using SAS, version 9.4 (SAS Institute).

## Results

A total of 10 197 601 individuals were included (5 119 663 [50.2%] female; mean [SD] age, 36.29 [15.50] years), of which 295 011 individuals (2.9% of all individuals in the study; 184 855 [62.7%] male; mean [SD] age, 32.7 [13.5] years) had 1 or more ED visits due to alcohol (Table). The percent of death within 1 year of 1 or more ED visits due to alcohol (2.0% [5840 of 295 001]) was 4 times greater (IRR, 4.1; 95% CI, 4.0-4.2) than the annual percent of death of individuals in the general population (0.5% [48 574 of 9 902 590]). Older adults, men, and a greater frequency of alcohol-related ED visits were associated with the greatest absolute increases in risk of death. The percent of 1-year mortality was 12.1% (335 of 2774) for men aged 45 to 59 years with 3 or more ED visits due to alcohol and 0.2% (121 of 59 375) for women aged 15 to 29 years with 1 alcohol-related ED visit. Younger age, women, and greater frequency of ED visits due to alcohol were associated with the greatest relative increases in risk of death (Figure).

Of the individuals with 1 or more ED visits due to alcohol, 265 398 (90%) had a single ED visit within 1 year. Furthermore, 4310 (73.8%) deaths occurred among individuals with a single alcohol-related ED visit.

## + Supplemental content

Author affiliations and article information are listed at the end of this article.

**Open Access.** This is an open access article distributed under the terms of the CC-BY License.

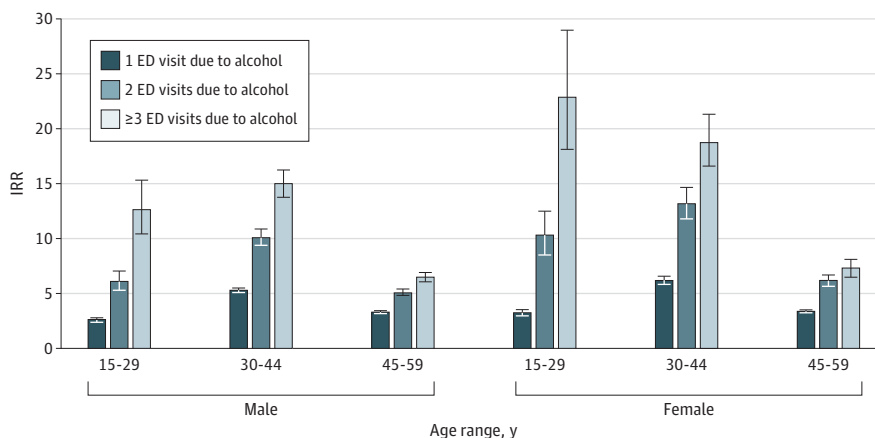
**Table. All-Cause Mortality in Year After 1 or More ED Visits Due to Alcohol Compared With General Population by Sex and Age**

Description of ED visit	Eligible individuals, No.	All deaths, No. (%)	Death rate per 100 000 person-years, No.	Incidence rate ratio (95% CI)
<b>Men, age 15-29 y</b>				
General population <sup>a</sup>	1 605 267	2388 (0.15)	150.1	1 [Reference]
1 ED visit due to alcohol	79 994	264 (0.33)	331.8	2.6 (2.5-2.7)
2 ED visits due to alcohol	3957	34 (0.86)	867.4	5.9 (5.1-6.8)
≥3 ED visits due to alcohol	1066	24 (2.25)	2298.8	12.2 (10.1-14.8)
<b>Men, age 30-44 y</b>				
General population <sup>a</sup>	1 818 509	5298 (0.29)	294.5	1 [Reference]
1 ED visit due to alcohol	40 666	638 (1.57)	1592.0	5.2 (5.0-5.4)
2 ED visits due to alcohol	4234	146 (3.45)	3558.0	9.8 (9.1-10.5)
≥3 ED visits due to alcohol	2372	110 (4.64)	4827.4	14.5 (13.4-15.7)
<b>Men, age 45-59 y</b>				
General population <sup>a</sup>	1 469 307	21 408 (1.46)	1479.0	1 [Reference]
1 ED visit due to alcohol	44 490	2339 (5.26)	5469.9	3.2 (3.2-3.3)
2 ED visits due to alcohol	5302	504 (9.51)	10 222.2	5.0 (4.8-5.2)
≥3 ED visits due to alcohol	2774	335 (12.08)	13 236.7	6.3 (6.0-6.7)
<b>Women, age 15-29 y</b>				
General population <sup>a</sup>	1 671 837	1070 (0.06)	64.5	1 [Reference]
1 ED visit due to alcohol	59 375	121 (0.20)	204.7	3.2 (3.0-3.4)
2 ED visits due to alcohol	2696	11 (0.41)	410.5	10.0 (8.3-12.1)
≥3 ED visits due to alcohol	813	15 (1.85)	1868.1	22.2 (17.5-28.0)
<b>Women, age 30-44 y</b>				
General population <sup>a</sup>	1 839 201	3649 (0.20)	199.9	1 [Reference]
1 ED visit due to alcohol	20 616	218 (1.06)	1068.5	6.1 (5.8-6.4)
2 ED visits due to alcohol	2122	43 (2.03)	2059.3	12.7 (11.4-14.2)
≥3 ED visits due to alcohol	1119	45 (4.02)	4146.9	18.2 (16.0-20.6)
<b>Women, age 45-59 y</b>				
General population <sup>a</sup>	1 498 469	14761 (0.99)	995.0	1 [Reference]
1 ED visit due to alcohol	20 257	730 (3.60)	3702.5	3.3 (3.2-3.4)
2 ED visits due to alcohol	2141	164 (7.66)	8145.4	6.0 (5.6-6.5)
≥3 ED visits due to alcohol	1017	99 (9.73)	10 441.9	7.1 (6.4-7.9)

Abbreviation: ED, emergency department.

<sup>a</sup> All individuals in Ontario of same age and sex who did not experience an ED visit due to alcohol during the study period.

**Figure. Differences in Rates of Death in Year After Emergency Department (ED) Visits Due to Alcohol Compared With the General Ontario Population**



Incidence rate ratio (IRR) for rate of death in year after 1 or more ED visits due to alcohol for males and females in 3 age categories compared with the general Ontario population. Error bars represent 95% CIs.

## Discussion

The findings of this study suggest a substantial elevation in the risk of mortality for individuals after 1 or more ED visits due to alcohol. The findings also suggest that a single ED visit due to alcohol, even in younger individuals, was associated with a substantial elevation in the risk of death and that most deaths were associated with a single visit.

A study limitation was the inability to identify the role of alcohol in each death. Whereas a single visit may be dismissed as a unique event, and patients may receive minimal follow-up after discharge from the ED, our data suggest that any ED visit due to alcohol is associated with future adverse events. Increases in delivery of interventions may be warranted because ED visits and deaths due to alcohol have been increasing in North America.<sup>1,2,4</sup> Studies suggest that improving uptake of brief alcohol interventions delivered in the ED and increasing access to medical services for addiction may reduce harm associated with use of alcohol.<sup>5,6</sup>

---

### ARTICLE INFORMATION

**Accepted for Publication:** February 14, 2022.

**Published:** April 4, 2022. doi:10.1001/jamanetworkopen.2022.5499

**Open Access:** This is an open access article distributed under the terms of the [CC-BY License](#). © 2022 Myran DT et al. *JAMA Network Open*.

**Corresponding Author:** Daniel T. Myran, MD, MPH, Clinical Epidemiology Program, Ottawa Hospital Research Institute, 1053 Carling Ave, PO Box 693, Ottawa, ON K1Y4E9, Canada ([dmyra088@uottawa.ca](mailto:dmyra088@uottawa.ca)).

**Author Affiliations:** Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada (Myran, Rhodes, Sood, Tanuseputro); ICES, Ottawa, Ontario, Canada (Imsirovic); Division of Critical Care, Department of Medicine, University of Ottawa, Ottawa, Ontario, Canada (Fernando).

**Author Contributions:** Dr Myran had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Concept and design:* Myran, Rhodes, Tanuseputro.

*Acquisition, analysis, or interpretation of data:* All authors.

*Drafting of the manuscript:* Myran, Rhodes.

*Critical revision of the manuscript for important intellectual content:* All authors.

*Statistical analysis:* Myran, Imsirovic.

*Obtained funding:* Myran, Tanuseputro.

*Administrative, technical, or material support:* Myran, Rhodes.

*Supervision:* Sood, Tanuseputro.

**Conflict of Interest Disclosures:** Dr Sood reported receiving speaker's fees from AstraZeneca outside the submitted work. No other disclosures were reported.

**Funding/Support:** This study was supported by the College of Family Physicians of Canada (CFPC) Janus research grant through the Foundation for Advancing Family Medicine (FAFM) program (Dr Myran); by ICES, which is funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC); by a Canadian Institutes of Health Research (CIHR) and University of Ottawa Department of Family Medicine Fellowship (Dr Myran); and by a PSI Graham Farquharson Knowledge Translation Fellowship (Dr Tanuseputro).

**Role of the Funder/Sponsor:** The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Disclaimer:** Parts of this material are based on data and information compiled and provided by the Canadian Institute for Health Information and Ontario Ministry of Health and Long-Term Care. The analyses, conclusions, opinions, and statements expressed herein are those of the authors and do not reflect those of the funding or data sources; no endorsement is intended or should be inferred.

## REFERENCES

1. Myran DT, Hsu AT, Smith G, Tanuseputro P. Rates of emergency department visits attributable to alcohol use in Ontario from 2003 to 2016: a retrospective population-level study. *CMAJ*. 2019;191(29):E804-E810. doi:10.1503/cmaj.181575
2. White AM, Slater ME, Ng G, Hingson R, Breslow R. Trends in alcohol-related emergency department visits in the United States: results from the nationwide emergency department sample, 2006 to 2014. *Alcohol Clin Exp Res*. 2018;42(2):352-359. doi:10.1111/acer.13559
3. Hulme J, Sheikh H, Xie E, Gatov E, Nagamuthu C, Kurdyak P. Mortality among patients with frequent emergency department use for alcohol-related reasons in Ontario: a population-based cohort study. *CMAJ*. 2020;192(47):E1522-E1531. doi:10.1503/cmaj.191730
4. Spillane S, Shiels MS, Best AF, et al. Trends in alcohol-induced deaths in the United States, 2000-2016. *JAMA Netw Open*. 2020;3(2):e1921451. doi:10.1001/jamanetworkopen.2019.21451
5. Schmidt CS, Schulte B, Seo HN, et al. Meta-analysis on the effectiveness of alcohol screening with brief interventions for patients in emergency care settings. *Addiction*. 2016;111(5):783-794. doi:10.1111/add.13263
6. Corace K, Willows M, Schubert N, et al. Alcohol medical intervention clinic: a rapid access addiction medicine model reduces emergency department visits. *J Addict Med*. 2020;14(2):163-171. doi:10.1097/ADM.0000000000000559

## SUPPLEMENT.

**eMethods.** Case Definitions, Data Sources, and Analytical Methods