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RESEARCH BRIEF

Reducing Alcohol Use to Prevent Cancer Deaths: Estimated Effects Among U.S. Adults

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Introduction: The Dietary Guidelines for Americans, 2020–2025 recommends non-drinking or no more than 2 drinks for men or 1 drink for women in a day. However, even at lower levels, alcohol use increases the risk for certain cancers. This study estimated mean annual alcohol-attributable cancer deaths and the number of cancer deaths that could potentially be prevented if all U.S. adults who drank in excess of the Dietary Guidelines had instead consumed alcohol to correspond with typical consumption of those who drink within the recommended limits.

Methods: Among U.S. residents aged ≥20 years, mean annual alcohol-attributable cancer deaths during 2020–2021 that could have been prevented with hypothetical reductions in alcohol use were estimated. Mean daily alcohol consumption prevalence estimates from the 2020–2021 Behavioral Risk Factor Surveillance System, adjusted to per capita alcohol sales to address underreporting of drinking, were applied to relative risks to calculate population-attributable fractions for cancers that can occur from drinking alcohol. Analyses were conducted during February–April 2023.

Results: In the U.S., an estimated 20,216 cancer deaths were alcohol-attributable/year during 2020–2021 (men: 14,562 [72.0%]; women: 5,654 [28.0%]). Approximately 16,800 deaths (83% of alcohol-attributable cancer deaths, 2.8% of all cancer deaths) could have been prevented/year if adults who drank alcohol in excess of the Dietary Guidelines had instead reduced their consumption to ≤2 drinks/day for men or ≤1 drink/day for women. Approximately 650 additional deaths could have been prevented annually if men consumed 1 drink/day, instead of 2.

Conclusions: Implementing evidence-based alcohol policies (e.g., increasing alcohol taxes, regulating alcohol outlet density) to decrease drinking could reduce alcohol-attributable cancers, complementing clinical interventions.

INTRODUCTION

In the U.S., cancer is the second leading cause of death[1] and alcohol is the third leading modifiable cancer risk factor.[2] To reduce the risk of alcohol-related harms, the Dietary Guidelines for Americans, 2020–2025 (referred to as Dietary Guidelines) recommends non-drinking or consuming no more than 2 drinks for men, or 1 drink for women, on drinking days.[3] The Dietary Guidelines indicate that cancer risk also increases at even lower alcohol use levels, consistent with recent World Health Organization (WHO) and Canadian guidance.[4,5] This study estimated the number of alcohol-attributable cancer deaths in the U.S., and the cancer deaths that potentially could be prevented if adults who drink alcohol in excess of the Dietary

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Guidelines had instead drank within the Dietary Guidelines recommended limits.

METHODS

Mean annual national cancer mortality data from 2020−2021 were from the National Vital Statistics System. Deaths from cancer types in the Centers for Disease Control and Prevention (CDC) Alcohol-Related Disease Impact (ARDI) application (breast, colorectal, esophageal, laryngeal, liver, oral cavity and pharyngeal, pancreatic, prostate, and stomach)[6] were identified among people aged ≥20 years using International Classification of Disease-10 codes (Appendix Table 1), based on the underlying cause of death.

A population alcohol-attributable fraction (PAF) formula was used to estimate cancer deaths attributable to alcohol use, by gender: $PAF_{any} = \frac{\sum_{i=1}^{3} Pi(RRi-1)}{1+\sum_{i=1}^{3} Pi(RRi-1)}$. *Pi* is the alcohol use prevalence at low, medium, or high mean daily levels.[7] Gender-specific weighted mean alcohol prevalence levels were calculated using the 2020−2021 Behavioral Risk Factor Surveillance System (BRFSS). Gender refers to self-reported survey responses. Since self-reported alcohol use underestimates population-level drinking, prevalence estimates were adjusted to 73% of per capita alcohol sales[8] (methods are described elsewhere,[7] and consistent with ARDI[9]). *RRi* is the categorical relative risk (RR) corresponding to the alcohol consumption distribution median of each drinking level, by cancer site, based on Bagnardi et al.[10] PAFs are in Appendix Table 1. Using ARDI, the number of site-specific cancer deaths was multiplied by site-specific PAFs, by gender, to calculate mean annual alcohol-attributable cancer deaths.

Using the PAF methodology above, mean annual alcohol-attributable cancer deaths during 2020−2021 were estimated (referred to as "actual estimates"). Then, 2 hypothetical scenarios assessed effects on cancer mortality of reduced adult drinking instead of drinking in excess of the Dietary Guidelines recommended limits. In both scenarios, deaths that could have been prevented if adults had consumed less alcohol were calculated as the difference between the actual alcohol-attributable cancer deaths and scenario-based estimates. Scenario 1 estimated alcohol-attributable cancer deaths if adults' drinking approximated the Dietary Guidelines recommendations. Adults with medium or high mean daily alcohol use levels were shifted to low-levels (>0 to ≤2 drinks/day for men, >0 to ≤1 drink/day for women), in a distribution corresponding to the 2020−2021 BRFSS mean low-volume drinking distribution among adults who drink. Prevalence estimates were based on mean daily consumption; however, the Dietary Guidelines pertain to drinks consumed on drinking days. Since the gender-specific distributions of current low-volume drinking were assumed in the hypothetical scenario, the cancer-specific low-volume RRs were unchanged. In scenario 2, low use assumed >0 to ≤1 drink/day for men instead of 2, approximating the unadopted 2020 Dietary Guidelines Advisory Committee recommendation.[11] RRs were recalculated for scenario 2 because of the different low-level boundary. A standard drink is 14 g of alcohol.[3]

Alcohol consumption prevalence estimates and cancer deaths were calculated using SAS, version 9.4 (SAS Institute Inc). Analyses were conducted during February−April 2023. Secondary analyses of deidentified data were conducted; institutional review board oversight and informed consent were not required as determined by CDC per 45 CFR 46.

RESULTS

During 2020−2021, 36.8% of U.S. men drank low levels of alcohol and 21.3% drank at higher levels, while 29.6% of women drank low levels and 17.8% drank at higher levels (Appendix Table 2).

There were 602,064 mean annual deaths from all cancers during 2020−2021 among people aged ≥20 years (men: 317,224 [52.7%]; women: 284,840 [47.3%]). An estimated 20,216 cancer deaths/year were attributable to alcohol (men: 14,562 [72.0%]; women: 5,654 [28.0%]) (Table 1), or 3.4% of all cancer deaths. By cancer site, among men, the largest number of alcohol-attributable cancer deaths was from liver cancer (4,740 deaths), accounting for 32.6% of men's alcohol-attributable cancer deaths. Among women, the largest number of alcohol-attributable cancer deaths was from breast cancer (3,410 deaths), accounting for 60.3% of women's alcohol-attributable cancer deaths.

Compared to the actual estimates, there could have been 16,803 fewer alcohol-attributable cancer deaths/year (an 83.1% reduction in alcohol-attributable cancer deaths; 2.8% of all cancer deaths), if adults' alcohol use had instead reduced to correspond with those drinking within the Dietary Guidelines (scenario 1, Table 1). If both men and women who drink alcohol had consumed ≤1 drink/day (scenario 2), there could have been 17,461 fewer alcohol-attributable cancer deaths/year than the actual estimates (86.4% reduction), yielding 2,755 mean annual alcohol-attributable cancer deaths (658 fewer deaths than scenario 1).

Of the 16,803 alcohol-attributable cancer deaths that could have been prevented if adults had drank less to correspond with the Dietary Guidelines, liver cancer accounted for the greatest number and percentage of

Table 1. Estimated Mean Annual Alcohol-Attributable Cancer Deaths by Population Drinking Scenario[a]

	Actual estimates			Scenario 1 estimates: corresponding with Dietary Guidelines on alcohol recommendations			Scenario 2 estimates: corresponding with Dietary Guidelines Advisory Committee recommendations		
Cancer site	**Overall**	**Men**	**Women**	**Overall**	**Men**	**Women**	**Overall**	**Men**	**Women**
Breast (females only)	3,410	NA	3,410	800	NA	800	800	NA	800
Colorectal	3,615	3,107	508	803	677	126	601	474	126
Esophageal[b]	1,912	1,477	435	631	490	141	508	367	141
Laryngeal	862	775	87	190	169	20	139	119	20
Liver	5,171	4,740	430	69	65	5	26	22	5
Oral cavity and pharyngeal	3,510	2,968	542	732	612	120	549	429	120
Pancreatic[c]	765	542	223	0	0	0	0	0	0
Prostate (males only)	778	778	NA	188	188	NA	132	132	NA
Stomach[c]	194	175	19	0	0	0	0	0	0
Deaths total[d]	20,216	14,562	5,654	3,413	2,201	1,211	2,755	1,543	1,211

[a]For actual estimates, low levels of daily consumption is defined as a mean of >0 to ≤1 drink for women or >0 to ≤2 drinks for men, medium is defined as >1 to ≤2 drinks for women or >2 to ≤4 drinks for men, and high is defined as >2 drinks for women or >4 drinks for men mean daily levels. The actual estimates are based on population-level alcohol use. In scenario 1, the same cut-points defined the alcohol consumption levels; however, adults who were in the medium or high mean alcohol use levels were hypothetically shifted to low levels (i.e., within the Dietary Guidelines recommended limits), in a distribution corresponding to the 2020–2021 mean low-volume drinking distribution among adults. Scenario 2 retained that shift of adults to the low alcohol consumption level; therefore, the prevalence estimates for scenarios 1 and 2 were the same. However, in scenario 2, low use was redefined as >0 to ≤1 drink per day for men, and so death estimates differ in scenarios 1 and 2 because of the corresponding shifts in relative risks of cancer death for men to reflect a new median consumption level in the low mean daily alcohol use prevalence group among men.
[b]Only the proportion of esophageal cancer deaths from squamous cell carcinoma (25.6% for men; 52.7% for women) were included.
[c]Pancreatic and stomach cancer deaths were estimated among people consuming high alcohol levels only because of the epidemiologic evidence on alcohol use and these cancers, consistent with the CDC Alcohol-Related Disease Impact application.[9]
[d]Numbers may not sum to totals due to rounding.
NA, not applicable.

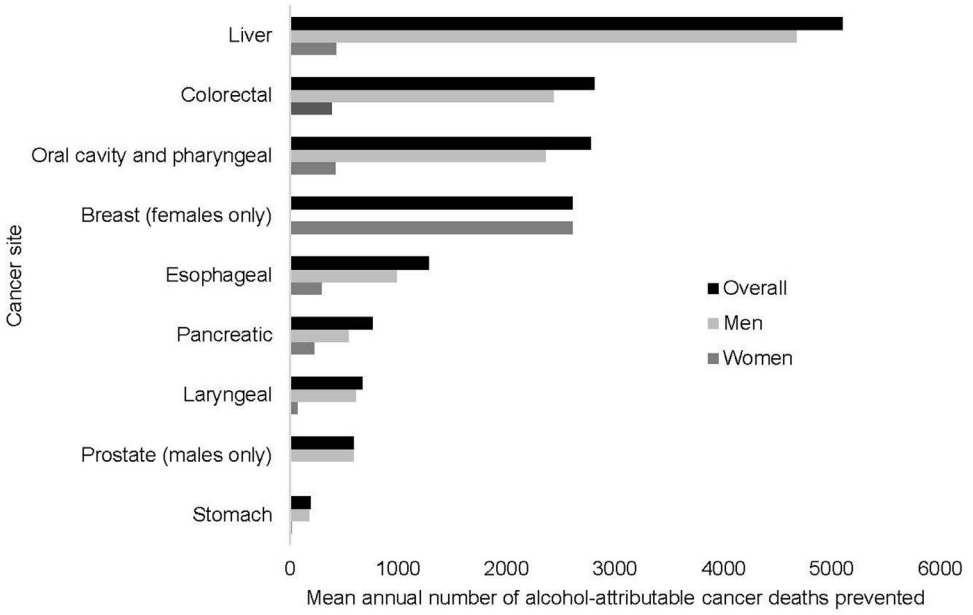

Figure 1. Alcohol-attributable cancer deaths that could have been prevented if adults reduced their drinking[a].
[a]Calculated as the difference between actual estimates of alcohol-attributable cancer deaths and the estimated number of alcohol-attributable cancer deaths that would have occurred if adults reduced their mean daily alcohol use to correspond with the Dietary Guidelines for Americans on alcohol, 2 drinks or less per day for men or 1 drink or less per day for women.

deaths that could have been prevented overall (5,102, 30.4%) and among men (4,675, 37.8%), while the leading preventable deaths among women were from breast cancer (2,610, 58.7%) (Figure 1).

DISCUSSION

This study found that of the estimated 20,000 cancer deaths each year caused by alcohol use during 2020–2021, approximately 16,800 (83%) of them could have been prevented if adults who drank had instead reduced their consumption to ≤2 drinks/day for men, or ≤1 drink/day for women, corresponding to the Dietary Guidelines—preventing 2.8% of U.S. cancer deaths. More than 650 additional deaths could have been prevented each year (totaling an 86% reduction in alcohol-attributable cancer deaths) if men had consumed ≤1 drink/day. However, approximately 2,750 alcohol-attributable cancer deaths/year would have occurred were adult alcohol use limited to 1 drink/day, demonstrating the population-level risk of cancer death associated with any drinking level, as highlighted in WHO's and Canada's guidance.[4,5]

This study estimated that alcohol-attributable cancer deaths accounted for 3.4% of all cancer deaths nationally during 2020–2021. Although methodologies differ slightly, previous studies estimated that alcohol caused 3.5%–4.3% of all cancer deaths.[2,12]

Limitations

This analysis assumed that the distributions of low-level alcohol consumption mirrored current population distributions and that the relative risks did not change in the two scenarios compared to the actual estimates; however, if adults reduced their drinking to low levels, distributions and relative risks might differ from these hypothetical scenarios. Scenario 1 only approximates the Dietary Guidelines as alcohol prevalence estimates were based on mean consumption, whereas the Dietary Guidelines pertain to drinks on drinking days. Lastly, the alcohol prevalence estimates did not include adults who did not drink 30 days prior to the survey; however, some people who formerly drank may have died from alcohol-attributable cancer, referred to as the sick-quitter effect.

CONCLUSIONS

An estimated 83% of the approximately 20,000 alcohol-attributable cancer deaths each year could have been prevented if adults who drank in excess of the Dietary Guidelines had instead consumed alcohol within the Dietary Guidelines recommendations. There is the potential for

preventing additional cancer deaths if men consumed up to 1 drink/day (rather than 2 drinks/day). Alcohol use is an underrecognized cancer risk factor and could be more widely included in comprehensive cancer control plans.[13] Like strategies to address other modifiable cancer risk factors (e.g., tobacco use), evidence-based policies that reduce the availability and affordability of alcohol (e.g., increasing alcohol taxes, reducing alcohol outlet density) can decrease excessive drinking and alcohol-attributable cancers, complementing clinical interventions (e.g., alcohol screening and brief intervention).[14–16]

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CREDIT AUTHOR STATEMENT

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SUPPLEMENTAL MATERIAL

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