Alcohol Use Among Patients With Cancer and Survivors in the United States, 2000–2017

Nina N. Sanford, MD^a; David J. Sher, MD^a; Xiaohan Xu, MS^{b,c}; Chul Ahn, PhD^{d,e}; Anthony V. D'Amico, MD, PhD^f; Ayal A. Aizer, MD^f; and Brandon A. Mahal, MD^g

ABSTRACT

Background: Alcohol use is an established risk factor for several malignancies and is associated with adverse oncologic outcomes among individuals diagnosed with cancer. The prevalence and patterns of alcohol use among cancer survivors are poorly described.

Methods: We used the National Health Interview Survey from 2000 to 2017 to examine alcohol drinking prevalence and patterns among adults reporting a cancer diagnosis. Multivariable logistic regression was used to define the association between demographic and socioeconomic variables and odds of self-reporting as a current drinker, exceeding moderate drinking limits, and engaging in binge drinking. The association between specific cancer type and odds of drinking were assessed. **Results:** Among 34,080 survey participants with a known cancer diagnosis, 56.5% self-reported as current drinkers, including 34.9% who exceeded moderate drinking limits and 21.0% who engaged in binge drinking. Younger age, smoking history, and more recent survey period were associated with higher odds of current, exceeding moderate, and binge drinking ($P < .001$ for all, except $P = .008$ for excess drinking). Similar associations persisted when the cohort was limited to 20,828 cancer survivors diagnosed ≥ 5 years before survey administration. Diagnoses of melanoma and cervical, head and neck, and testicular cancers were associated with higher odds of binge drinking ($P < .05$ for all) compared with other cancer diagnoses. **Conclusions:** Most cancer survivors self-report as current alcohol drinkers, including a subset who seem to engage in excessive drinking behaviors. Given that alcohol intake has implications for cancer prevention and is a potentially modifiable risk factor for cancer-specific outcomes, the high prevalence of alcohol use among cancer survivors highlights the need for public health strategies aimed at the reduction of alcohol consumption.

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^aDepartment of Radiation Oncology, and ^bDivision of Biostatistics, Department of Clinical Sciences, University of Texas Southwestern Medical Center, Dallas, Texas; ^cDepartment of Statistical Science, Southern Methodist University, Dallas, Texas; ^dDepartment of Clinical Sciences, and ^eHarold C. Simmons Comprehensive Cancer Center, University of Texas Southwestern Medical Center, Dallas, Texas; and ^fDepartment of Radiation Oncology, Dana-Farber/Brigham and Women's Hospital, and ^gMcGraw/Patterson Center for Population Sciences, Dana-Farber Cancer Institute, Boston, Massachusetts.

Background

Alcohol use has been identified as a risk factor for several malignancies, including cancers of the head and neck, esophagus, colorectum, liver, and breast.^{1–3} Epidemiologic studies have shown that higher alcohol consumption over longer time intervals increases an individual's risk for cancer, and some studies have suggested that even low levels of drinking seem to be associated with the development of certain cancer types.^{4,5} In addition to the link between alcohol use and cancer risk, emerging evidence suggests that alcohol is associated with worse oncologic outcomes among patients already diagnosed with cancer.^{6–10}

As a result, the association between alcohol use and cancer has received increased recent attention. Using global estimates of patients with cancer and deaths from the WHO, one study estimated that 5.8% of cancer deaths were attributable to alcohol use in 2012, up from 3.6% in 2002.¹¹ Major cancer organizations are explicitly focusing efforts to promote public health, research, and policy-related work directed toward obtaining a better understanding of the relationship between alcohol use and cancer, including the need to characterize drinking patterns among individuals diagnosed with cancer.¹²

No contemporary comprehensive investigations of drinking behaviors among adult cancer survivors have been conducted in the United States. Therefore, we used a contemporary nationwide database to characterize alcohol consumption behaviors among US cancer survivors.

Methods

Data Source

The National Health Interview Survey (NHIS) is a cross-sectional household survey of noninstitutionalized civilian adults living in the United States that assesses a wide range of health status and utilization measures.¹³

See JNCCN.org for supplemental online content.

First administered in 1957, the NHIS uses a multistage probability design to ensure broad geographic representation. Sample weights are provided for each individual, permitting inferences on national prevalence. Harmonized data were obtained through the Integrated Health Interview Series.¹⁴

Population

The study population included adults (aged ≥ 18 years) sampled in 2000 through 2017 reporting a diagnosis of cancer. Participants were queried regarding their cancer history via the question: “Have you ever been told you had cancer?” Among participants who answered yes, the type of cancer was recorded. Those who reported a diagnosis of nonmelanoma skin cancer or skin cancer type unknown were excluded. Participants were also queried regarding current alcohol use and were asked to classify themselves as lifetime abstainers (<12 drinks in life), former drinkers (no drinks in the past year), or current drinkers (≥ 1 drinks in the past year). Individuals who were current drinkers were further asked the average number of drinks consumed on days they drank and how many days during the past year they had consumed ≥ 5 drinks.

Additional sociodemographic variables included were age, sex, annual family income, race, ethnicity, marital status, smoking status, insurance status, highest education level, and self-reported health status.

Quantification of Alcohol Intake

Study participants were categorized as current drinkers, former drinkers, or lifetime abstainers (never drinkers). Among those who were current drinkers, exceeding moderate drinking level was defined as having >1 drink per day for women and >2 drinks per day for men, per CDC guidelines.¹⁵

Guidelines issued by the CDC and the National Institute on Alcohol Abuse and Alcoholism define binge drinking as the consumption of alcohol that raises the blood alcohol concentration (BAC) to $\geq 0.08\%$, and specify that this pattern of drinking usually corresponds to ≥ 5 drinks on a single occasion for men or ≥ 4 drinks on a single occasion for women, generally within approximately 2 hours.¹⁶ For the purposes of this study, individuals including both men and women were classified as having participated in binge drinking if they had consumed ≥ 5 drinks during at least 1 day over the past year. No information regarding BAC or time interval of drinking was available in our database.

The NHIS is overseen by the National Center for Health Statistics Research Ethics Review Board. Survey participants provided verbal informed consent. The University of Texas Southwestern Medical Center deemed the study exempt given the use of public deidentified data.

Statistical Analysis

Baseline Characteristics

Baseline characteristics, including demographic and socioeconomic variables, were reported for the entire cohort ($N=34,080$) and for the subgroup of cancer survivors diagnosed ≥ 5 years before survey administration ($n=20,828$).

Alcohol Consumption Among Participants Diagnosed With Cancer

The primary endpoint of interest in this study was current alcohol consumption. For each of the drinking levels—never drinker (vs current/former drinker), former drinker (vs never/current drinker), current drinker (vs former/never drinker), exceeding moderate drinking (yes vs no among current drinkers), and binge drinking (yes vs no among current drinkers)—multivariable logistic regression defined the adjusted odds ratio of meeting the criteria for the specified level of alcohol consumption (yes vs no) by demographic and socioeconomic variables, including age, sex, annual family income, race, ethnicity, marital status, smoking status, highest education level, insurance status, self-reported health status, and survey period. Time since cancer diagnosis was also included in the multivariable model to ascertain whether drinking patterns differed among participants recently diagnosed with cancer and potentially undergoing active treatment versus cancer survivors with a more remote oncologic history.

As a sensitivity analysis, we repeated the multivariable models, restricting the cohort to participants diagnosed with cancer ≥ 5 years before survey administration. These models included the same variables noted earlier, with the exception of time since cancer diagnosis.

Finally, we restricted the cohort to cancer survivors aged ≤ 50 years to assess trends in drinking patterns for younger cancer survivors, again using the same variables, with the exception of age.

Alcohol Consumption by Cancer Type

The odds of self-reporting current drinking, exceeding moderate drinking levels, and binge drinking by cancer type (ie, lung cancer vs all other cancers) were assessed using univariable logistic regression models. This analysis was conducted in a univariable fashion to ascertain which cancer sites included patient populations more likely to engage in drinking. Because the definitions of exceeding moderate drinking differed for women versus men, analyses regarding the odds of exceeding moderate drinking for sex-specific cancers (breast, cervix, uterus, prostate, and testicular) were restricted to only one sex. Similar to the earlier section on alcohol

consumption among participants diagnosed with cancer, as a sensitivity analysis, patients diagnosed <5 years before survey administration were excluded from the analysis to mitigate the impact of the acute effects of diagnosis and treatment on alcohol consumption and to exclude those with poor disease prognoses.

Sample weighting stratified by year was used for all analyses to produce nationally representative estimates. Statistical testing was 2-sided, with $\alpha=0.05$. Analyses were performed using Stata/SE 15.1 (StataCorp LLP) or R version 3.0.2 (R Foundation for Statistical Computing).

Results

Baseline Characteristics

In 2000 through 2017, a total of 34,080 participants reported having a cancer history, including 20,828 reporting a cancer diagnosis ≥ 5 years before survey administration. In the overall cohort, median age was 67 years (interquartile range [IQR], 55–76 years), with most participants being female (59.5%) and white (89.1%). More than half of participants were former (37.8%) or current (16.7%) smokers and reported their health status as good (32.8%) or very good (25.2%). The baseline characteristics of cancer survivors diagnosed ≥ 5 years before survey administration were similar to those of the main cohort (Table 1).

Alcohol Consumption by Clinical and Sociodemographic Characteristics

In the primary cohort, 56.5% of cancer survivors self-reported as current drinkers (Table 1). Factors associated with higher odds of current drinking were male sex, better self-reported health status, younger age, white race, non-Hispanic ethnicity, higher income, higher education, current or former smoking status, and later survey period ($P<.05$ for all, except for very good health status vs excellent, $P=.2$; Table 2).

Exceeding moderate drinking levels (classified as >1 drink for women and >2 drinks for men)¹⁵ was reported in 34.9% of current drinkers and was more common among female ($P<.001$) and Alaska Native/American Indian study participants ($P=.05$), and in those with annual family income $>\$100,000$ ($P=.05$) (Table 2).

Among cancer survivors, 21.0% of current drinkers also reported engaging in binge drinking. Variables associated with binge drinking included male sex, better health status, younger age, Alaska Native/American Indian race, higher income, former or current smoking status, and later survey period ($P<.001$ for all with the exception of $P=.04$ for Alaska Native/American Indian participants; Table 2).

Notably, alcohol drinking at all levels was more common among younger participants. For example, among those aged 18 to 34 years, 73.5% were current

drinkers, including 35.5% who met the criteria for binge drinking. In contrast, 43.8% of cancer survivors aged ≥ 75 years were current drinkers, including 2.6% who engaged in binge drinking (Figure 1).

Furthermore, drinking alcohol, and particularly engaging in binge drinking, was more prevalent among those who were current smokers. For example, 8.0% versus 23.6% of never versus current smokers reported binge drinking, respectively (Figure 2). The odds of current drinking, exceeding moderate drinking levels, and binge drinking all increased with later survey period ($P<.001$ for all except exceeding moderate drinking, $P=.008$; supplemental eFigure 1, available with this article at JNCCN.org). There was no association between the interval since cancer diagnosis and the odds of alcohol consumption ($P>.05$ for all). In contrast to levels of current drinking, cancer survivors who were women, were never smokers, had worse self-reported health status, and were older were more likely to self-report as former and never drinkers (Table 2).

Among 20,828 participants reporting a cancer diagnosis ≥ 5 years before survey administration, 57.1% were current drinkers, including 35.1% exceeding moderate drinking limits and 20.1% engaging in binge drinking. Within this subgroup, similar variables were associated with the odds of alcohol consumption at all levels, including age at diagnosis and smoking status ($P<.001$ for all, except for age group 35–44 years vs 18–34 years) (supplemental eTable 1). Later survey period was associated with increased odds of current drinking ($P<.001$) and binge drinking ($P<.001$) but not of exceeding moderate drinking levels ($P=.84$).

Among 6,313 cancer survivors aged ≤ 50 years, the odds of binge drinking increased over time, but not the odds of current drinking or exceeding moderate drinking without binge drinking (supplemental eTable 2).

Alcohol Consumption by Cancer Type

Among participants diagnosed with cancer, those with cervical or testicular cancer were more likely to report drinking at all levels (Figure 3). In contrast, having a diagnosis of breast cancer was associated with lower odds of drinking at all levels. Among the 84 patients with male breast cancer, 48 (57.1%) were current drinkers. Of those 84 patients who were currently drinking, 25 (52.1%) exceeded moderate drinking levels and 11 (22.9%) met the criteria for binge drinking (data not shown). Notably, patients with a history of head and neck cancer and/or melanoma, along with those diagnosed with cervical or testicular cancer, were also more likely to report binge drinking compared with those with other cancers. Similar trends were observed when the cohort

Table 1. Baseline Patient Characteristics

Characteristic	Cancer History (Diagnosis at Any Time, N=34,080)		Cancer History (Diagnosis ≥5 Years Before Survey, n=20,828)	
	Raw Number	Raw %/ Weighted % ^a	Raw Number	Raw %/ Weighted %
Drinking status				
Never drinker	7,069	20.7/19.2	4,324	20.8/19.3
Former drinker	8,630	25.3/24.3	5,121	24.6/23.6
Current drinker	18,381	53.9/56.5	11,383	54.6/57.1
Exceeding moderate drinking	6,491	35.3/34.9	4,025	35.3/35.1
Binge drinking	3,713	20.4/21.0	2,193	19.5/20.1
Age, median (IQR), y	67	(55–76)	67	(56–77)
Age				
18–34 y	1,761	5.2/5.6	900	4.3/4.8
35–44 y	2,328	6.8/7.5	1,421	6.8/7.6
45–54 y	4,216	12.4/14.0	2,484	11.9/13.5
55–64 y	6,933	20.3/21.7	4,137	19.9/21.4
65–74 y	8,750	25.7/24.6	5,230	25.1/24.1
≥75 y	10,092	29.6/26.6	6,656	32.0/28.6
Sex				
Male	12,731	37.4/40.5	7,059	33.9/36.6
Female	21,349	62.6/59.5	13,769	66.1/63.4
Annual family income ^b (USD)				
\$0–\$34,999	15,012	48.8/39.6	9,215	48.7/39.6
\$35,000–\$74,999	8,675	28.2/30.7	5,319	28.1/30.8
\$75,000–\$99,999	1,922	6.2/7.9	1,190	6.3/7.8
≥\$100,000	3,127	10.2/14.3	1,935	10.2/14.6
Not ascertained/unknown	2,622	6.7/7.4	1,270	6.7/7.4
Race ^c				
White	29,288	86.1/89.1	18,045	86.7/89.4
Black	3,565	10.5/7.8	2,068	10.0/7.5
Alaska Native/American Indian	294	0.9/0.8	165	0.8/0.6
Asian	751	2.2/2.1	448	2.2/2.2
Multiple/Unknown	182	0.3/0.3	102	0.5/0.4
Ethnicity ^c				
Non-Spanish/Hispanic/Latino	31,600	92.7/94.3	19,458	93.4/94.8
Spanish/Hispanic/Latino	2,480	7.3/5.7	1,369	6.6/5.2
Marital status ^d				
Not married	18,675	54.8/41.4	11,612	55.8/42.2
Married	15,346	45.2/58.6	9,180	44.2/57.8
Smoking status ^d				
Never	15,570	45.7/45.6	9,526	46.3/46.4
Former	12,655	37.2/37.8	7,542	36.2/36.3
Current	5,822	17.1/16.7	3,645	17.5/17.4
Insurance status ^d				
Insurance	32,125	94.4/94.3	19,520	93.8/93.7
No insurance	1,918	5.6/5.7	1,287	6.2/6.3

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Table 1. Baseline Patient Characteristics (cont.)

Characteristic	Cancer History (Diagnosis at Any Time, N=34,080)		Cancer History (Diagnosis ≥5 Years Before Survey, n=20,828)	
	Raw Number	Raw %/ Weighted % ^a	Raw Number	Raw %/ Weighted %
Education				
None–grade 4	462	1.4/1.1	246	1.2/1.0
Grade 5–12	15,372	45.1/44.0	9,346	44.9/43.8
1–4 y college	14,698	43.1/43.9	9,048	43.4/44.1
≥5 y college	3,378	9.9/10.5	2,100	10.1/10.6
Unknown	170	0.5/0.5	88	0.4/0.5
Self-reported health status ^d				
Excellent	4,075	12.0/12.8	2,742	13.2/14.2
Very good	8,328	24.5/25.2	5,349	25.7/26.6
Good	11,229	33.0/32.8	6,883	33.1/32.4
Fair	7,204	21.2/20.2	4,148	19.9/19.1
Poor	3,197	9.4/9.0	1,685	8.1/7.7
Survey period				
2000–2004	8,313	24.4/22.0	4,803	23.1/20.7
2005–2009	7,516	22.1/26.5	4,560	21.9/26.4
2010–2014	10,976	32.2/30.6	6,831	32.8/31.0
2015–2017	7,275	21.4/21.0	4,634	22.3/21.9
Interval since diagnosis				
0–5 y	13,446	39.5/40.3	N/A	
6–10 y	6,883	20.2/20.5	N/A	
11–15 y	3,663	10.8/10.6	N/A	
≥16 y	10,088	29.6/28.6	N/A	
Cancer type				
Breast	8,418	24.7/23.2	5,394	25.9/24.9
Prostate	5,182	15.2/15.9	2,902	13.9/14.8
Cervical	3,308	9.7/9.6	2,522	12.1/12.0
Colorectal	3,283	9.6/9.9	1,835	8.8/8.9
Melanoma	3,100	9.1/8.7	1,790	8.6/8.7
Uterine	2,298	6.7/6.2	1,659	8.0/7.8
Lung	1,454	4.3/4.1	546	2.6/2.4
Bladder	1,157	3.4/3.8	614	2.9/3.6
Head and neck	794	2.3/2.3	454	2.2/2.0
Central nervous system	347	1.0/0.9	181	0.9/1.0
Testicular	338	1.0/1.0	253	1.2/1.1
Liver	320	0.9/1.2	98	0.5/0.6

Abbreviations: IQR, interquartile range; NHIS, National Health Information Survey.

^aSample weighting stratified by year was used for all analyses to produce nationally representative estimates. Percentages may not add up to 100% due to rounding.

^bRaw column numbers for income levels do not add up to the total participant number. Between 2000–2006, survey participants were given an income option of “≥\$75,000” and “≥\$20,000.” The 2,722 participants who chose one of these options are not included in the table because of ambiguous income levels.

^cRace and ethnicity were self-reported as captured by the NHIS. Participants were asked whether they identified with one or more of the following racial groups: white, black/African American, Alaskan Native or American Indian, Chinese, Filipino, Asian Indian, or other Asian. Those reporting Chinese, Filipino, Asian Indian, or other Asian race were grouped as “Asian.” Participants with multiple races or the primary race not releasable were grouped as “Unknown/Multiple.” Participants were also asked whether they identified with one or more of the following ethnicities: not Hispanic/Spanish origin, Mexican, Mexican American, Puerto Rican, Cuban/Cuban American, Dominican (Republic), Central or South American, other Latin American (type not specific), other Spanish, or multiple Hispanic. Those reporting any of these ethnicities with the exception of not Hispanic/Spanish origin were categorized as “Spanish-Hispanic-Latino.”

^dColumns for marital status, smoking status, insurance, and self-reported health status do not add up to the total participant number because of 59, 33, 37, and 47 participants with unknown marital status, smoking status, insurance, and self-reported health status, respectively.

Table 2. Multivariable Analysis of Participants (N=34,080)

	Current Drinker									
	Never Drinker		Former Drinker		Not Exceeding Moderate Drinking ^a		Exceeding Moderate Drinking ^b		Binge Drinking ^c	
	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
Age										
18–34 y	Ref		Ref		Ref		Ref		Ref	
35–44y	1.04 (0.81–1.33)	.78	1.53 (1.21–1.94)	.002	0.74 (0.61–0.89)	.007	0.61 (0.49–0.77)	<.001	0.57 (0.46–0.71)	<.001
45–54y	1.19 (0.95–1.50)	.13	1.75 (1.41–2.18)	<.001	0.62 (0.52–0.74)	<.001	0.45 (0.37–0.56)	<.001	0.37 (0.30–0.46)	<.001
55–64 y	1.14 (0.92–1.42)	.92	2.18 (1.77–2.69)	<.001	0.52 (0.44–0.62)	<.001	0.33 (0.29–0.43)	<.001	0.27 (0.22–0.33)	<.001
65–74 y	1.61 (1.30–2.01)	<.001	2.22 (1.80–2.73)	<.001	0.41 (0.35–0.49)	<.001	0.25 (0.20–0.30)	<.001	0.16 (0.13–0.20)	<.001
≥75 y	2.04 (1.64–2.54)	<.001	2.52 (2.04–3.11)	<.001	0.31 (0.26–0.37)	<.001	0.13 (0.10–0.15)	<.001	0.05 (0.04–0.07)	<.001
Sex										
Male	Ref		Ref		Ref		Ref		Ref	
Female	2.08 (1.89–2.28)	<.001	0.87 (0.81–0.94)	<.001	0.71 (0.66–0.76)	<.001	2.09 (1.90–2.31)	<.001	0.40 (0.36–0.45)	<.001
Annual family income (USD)										
\$0–\$34,999	Ref		Ref		Ref		Ref		Ref	
\$35,000–\$74,999	0.70 (0.63–0.77)	<.001	0.85 (0.78–0.92)	<.001	1.45 (1.38–1.57)	<.001	0.97 (0.86–1.09)	.60	1.09 (0.96–1.25)	.19
\$75,000–\$99,999	0.57 (0.47–0.69)	<.001	0.75 (0.64–0.87)	<.001	1.74 (1.52–2.01)	<.001	1.03 (0.85–1.24)	.80	1.26 (1.02–1.55)	.03
≥\$100,000	0.44 (0.37–0.53)	<.001	0.56 (0.48–0.66)	<.001	2.40 (2.11–2.73)	<.001	1.18 (1.00–1.39)	.05	1.42 (1.17–1.71)	<.001
Not ascertained/ unknown	0.89 (0.76–1.03)	.12	0.78 (0.69–0.88)	.001	1.28 (1.14–1.43)	<.001	0.95 (0.79–1.14)	.61	1.01 (0.79–1.30)	.92
Insurance status										
Not insured	Ref		Ref		Ref		Ref		Ref	
Insured	0.98 (0.82–1.17)	.85	0.87 (0.75–1.02)	.08	1.12 (0.98–1.29)	.10	1.05 (0.87–1.26)	.64	0.74 (0.66–0.83)	.51
Race										
White	Ref		Ref		Ref		Ref		Ref	
Black	1.35 (1.20–1.52)	<.001	1.27 (1.15–1.42)	<.001	0.65 (0.58–0.71)	<.001	0.93 (0.79–1.09)	.38	0.64 (0.52–0.79)	<.001
Alaska Native/American Indian	1.00 (0.63–1.58)	1.00	1.84 (1.35–2.50)	<.001	0.57 (0.41–0.79)	<.001	1.62 (1.00–2.62)	.05	1.64 (1.03–2.62)	.04
Asian	3.81 (3.03–4.79)	<.001	0.79 (0.61–1.02)	.07	0.37 (0.29–0.46)	<.001	0.78 (0.54–1.13)	.19	0.43 (0.27–0.69)	<.001
Multiple/Unknown	1.52 (0.80–2.90)	.20	0.73 (0.46–1.18)	.20	1.09 (0.70–1.69)	.70	0.79 (0.43–1.44)	.44	0.41 (0.16–1.07)	.07
Ethnicity										
Non-Spanish/Hispanic/Latino	Ref		Ref		Ref		Ref		Ref	
Spanish/Hispanic/Latino	1.38 (1.21–1.58)	<.001	0.99 (0.86–1.13)	.86	0.78 (0.70–0.88)	<.001	1.22 (1.01–1.49)	.04	1.11 (0.89–1.39)	.35
Marital status										
Not married	Ref		Ref		Ref		Ref		Ref	
Married	1.11 (1.03–1.21)	.01	0.99 (0.92–1.06)	.79	0.96 (0.90–1.02)	.19	0.75 (0.67–0.81)	<.001	0.74 (0.66–0.83)	<.001
Smoking status										
Never	Ref		Ref		Ref		Ref		Ref	
Former	0.24 (0.22–0.26)	<.001	1.61 (1.49–1.73)	<.001	1.74 (1.62–1.86)	<.001	1.74 (1.56–1.92)	<.001	1.69 (1.49–1.92)	<.001
Current	0.24 (0.21–0.27)	<.001	1.37 (1.24–1.52)	<.001	2.13 (1.94–2.34)	<.001	3.01 (2.64–3.42)	<.001	2.73 (2.37–3.15)	<.001

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Table 2. Multivariable Analysis of Participants (N=34,080) (cont.)

	Current Drinker									
	Never Drinker		Former Drinker		Not Exceeding Moderate Drinking ^a		Exceeding Moderate Drinking ^b		Binge Drinking ^c	
	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
Education										
None—grade 4	Ref		Ref		Ref		Ref		Ref	
Grade 5–12	0.63 (0.46–0.87)	.005	0.93 (0.70–1.24)	.61	2.08 (1.46–2.98)	<.001	1.30 (0.63–2.68)	.47	1.73 (0.70–4.30)	.24
1–4 y college	0.39 (0.28–0.53)	<.001	0.72 (0.54–0.97)	.03	3.50 (2.44–5.02)	<.001	1.04 (0.51–2.15)	.91	1.46 (0.59–3.63)	.41
≥5 y college	0.35 (0.25–0.50)	<.001	0.63 (0.46–0.86)	.004	4.11 (2.83–5.98)	<.001	0.80 (0.38–1.67)	.56	1.11 (0.44–2.80)	.82
Unknown	1.02 (0.61–1.73)	.93	0.91 (0.55–1.51)	.72	1.44 (0.82–2.51)	.20	1.86 (0.69–5.03)	.22	1.91 (0.47–7.76)	.36
Self-reported health status										
Excellent	Ref		Ref		Ref		Ref		Ref	
Very good	0.97 (0.83–1.12)	.67	1.14 (1.00–1.31)	.05	0.93 (0.83–1.04)	.20	0.90 (0.78–1.04)	.14	0.90 (0.76–1.05)	.20
Good	1.20 (1.04–1.38)	.01	1.67 (1.47–1.90)	<.001	0.62 (0.55–0.69)	<.001	0.91 (0.79–1.05)	.19	0.83 (0.70–0.98)	.03
Fair	1.61 (1.38–1.86)	<.001	2.29 (1.91–2.51)	<.001	0.40 (0.35–0.45)	<.001	0.73 (0.62–0.86)	<.001	0.75 (0.62–0.91)	.004
Poor	2.06 (1.74–2.45)	<.001	2.77 (2.38–3.32)	<.001	0.25 (0.22–0.29)	<.001	0.73 (0.58–0.91)	.006	0.69 (0.53–0.91)	.008
Survey period										
2000–2004	Ref		Ref		Ref		Ref		Ref	
2005–2009	0.96 (0.86–1.07)	.45	0.97 (0.89–1.07)	.57	1.07 (0.98–1.17)	.13	1.04 (0.93–1.17)	.49	1.19 (1.02–1.40)	.03
2010–2014	0.81 (0.73–0.90)	<.001	1.01 (0.92–1.11)	.97	1.17 (1.08–1.27)	<.001	1.05 (0.94–1.16)	.41	1.26 (1.09–1.47)	.002
2015–2017	0.78 (0.69–0.88)	<.001	0.96 (0.87–1.07)	.47	1.27 (1.15–1.39)	<.001	1.17 (1.05–1.31)	.006	1.74 (1.48–2.05)	<.001
Time since diagnosis										
0–5 y	Ref		Ref		Ref		Ref		Ref	
6–10 y	0.93 (0.83–1.03)	.15	0.93 (0.85–1.02)	.11	1.12 (1.03–1.22)	.007	0.94 (0.83–1.06)	.32	1.04 (0.90–1.19)	.56
11–15 y	0.97 (0.85–1.11)	.67	1.00 (0.89–1.12)	.98	1.03 (0.93–1.14)	.59	0.96 (0.82–1.11)	.59	0.98 (0.82–1.16)	.78
>15 y	0.98 (0.89–1.08)	.71	1.00 (0.92–1.09)	.96	1.02 (0.94–1.09)	.69	0.97 (0.87–1.09)	.61	0.98 (0.85–1.12)	.72

Abbreviation: aOR, adjusted odds ratio.

^aCurrent drinking without meeting criteria for exceeding moderate drinking or binge drinking.

^bDefined as >1 drink/day for women and >2 drinks/day for men, and includes those who engage in binge drinking.

^cDefined as ≥5 drinks/day during at least 1 day over the past year.

was restricted to cancer survivors diagnosed ≥5 years before survey administration (supplemental eTable 3).

Discussion

In this comprehensive population-based study of alcohol consumption among adult cancer survivors, most participants with a history of cancer (56.5%) self-reported as current drinkers, including 34.9% who exceeded moderate drinking limits and 21.0% who engaged in binge drinking. Younger age, current or former smoking status, and later survey period were associated with greater odds of currently drinking alcohol at all levels. The proportion of participants who self-reported alcohol consumption did not seem to change with an increasing interval since cancer diagnosis. Those with a history of melanoma and/or cervical, head and neck, and/or testicular cancer were more likely to engage in binge drinking, likely a reflection of the

predominant demographic characteristics—particularly younger age—associated with these cancer diagnoses, rather than an intrinsic association between cancer type and alcohol use.

This study shows a high prevalence of alcohol use among cancer survivors and as such has important public health implications. First, mounting data suggest that alcohol use may be a risk factor for cancer and that continued alcohol use after a cancer diagnosis may be associated with worse oncologic outcomes.^{4,5,7,8} Given that alcohol intake is a potentially modifiable risk factor, policies and guidelines should be initiated to encourage the reduction of alcohol drinking among cancer survivors. By highlighting that most cancer survivors engage in drinking and identifying groups at higher risk for excessive drinking behaviors, our findings could serve as an impetus for a greater focus on alcohol screening and reduction as a part of cancer care. Second, this study shows a gradual

Figure 1. Proportion of study participants self-reporting as never, former, and current drinkers (including those who drink without exceeding moderate drinking limits, those who exceed moderate drinking limits, and those who engage in binge drinking) stratified by age category.

Figure 2. Proportion of study participants self-reporting as never, former, and current drinkers (including those who drink without exceeding moderate drinking limits, those who exceed moderate drinking limits, and those who engage in binge drinking) stratified by smoking status.

but persistent trend in increasing alcohol intake among cancer survivors over the past decade, particularly in binge drinking. Given the prognostic role of alcohol in cancer-specific outcomes, the factors contributing to this trend warrant further investigation.

The observed higher likelihood of alcohol intake at all levels among patients who are current smokers merits further discussion. Continued smoking after a cancer diagnosis has been associated with a wide range of adverse outcomes, including increased risks of cancer recurrence, more severe treatment-related toxicity, and development of a second primary cancer.¹⁷ Given the synergism between alcohol intake and smoking on the pathogenesis of several cancer subtypes,^{18,19} continued alcohol intake, particularly in large quantities, may pose a particularly negative health risk for current smokers. Notably, these risks are not limited to cancer-specific outcomes but also include stroke and cardiovascular disease, which smoking and heavy alcohol use, along with prior cancer treatments such as systemic therapy and radiotherapy, have been shown to negatively impact.^{20–22} Therefore, smokers represent a high-risk population that should also be appropriately screened and counseled regarding alcohol use. Furthermore, because drinking has been shown to represent a conduit for smoking^{23–26} (ie, individuals tend to smoke more after consuming alcohol), reducing the incidence of drinking could also potentially lower smoking rates, particularly in instances of co-use.

Notably, among cancer survivors, better self-reported health status was associated with higher odds of current drinking at all levels and, conversely, lower odds of being a former drinker. It is possible that individuals with a diagnosis of cancer who self-report poor health status may be those with persistent or recurrent disease who are undergoing active treatment and who have been advised not to drink or do not feel well enough to consume

alcohol. Another interpretation of these findings is that alcohol could improve overall health among cancer survivors, which has been suggested in a recent study.²⁷ It is important to note, however, that the NHIS database is participant-reported and that self-reported health statuses were not verified by objective measures.

Although white race was associated with higher odds of any current drinking among cancer survivors, Alaska Natives/American Indians had the highest odds of exceeding moderate drinking levels and engaging in binge drinking. Research on the general population has also reported higher rates of alcohol abuse among the Alaska Native/American Indian population, although practices vary greatly from tribe to tribe.²⁸ Compared with other racial backgrounds, Alaska Natives/American Indians seem to be at higher risk for alcohol-related consequences, with one study showing a 5.6 times higher age-adjusted alcohol-related death rate.²⁹ The causes of this disparity are likely multifactorial, with notable contributions from systemic factors partly rooted in structural racism, including limited healthcare resources and poor access to housing, education, and nutrition, all of which have been shown to affect health risk and outcomes.^{30,31} As such, the higher rates of excessive drinking behaviors among Alaska Native/American Indian cancer survivors should prompt the establishment of policies and guidelines to improve access to a wide range of resources affecting health outcomes among this population, including housing and education. Oncology providers working in areas with high Alaska Native/American Indian populations should be given appropriate time and resources to engage in culturally sensitive discussions regarding alcohol use.

This study has several notable limitations. First, the thresholds for moderate drinking and binge drinking used herein were those issued for the general population. The risks associated with varying levels of alcohol use

A

Cancer Type	N	Prevalence	OR	LCL	UCL
Breast	8,418	49.2	0.80	0.75	0.85
Prostate	5,182	57.6	1.16	1.08	1.25
Cervical	3,308	63.1	1.49	1.36	1.63
Colorectal	3,283	45.9	0.69	0.63	0.76
Melanoma	3,100	64.6	1.59	1.45	1.75
Uterine	2,298	48.2	0.72	0.65	0.80
Lung	1,454	45.3	0.69	0.61	0.79
Bladder	1,157	54.8	0.99	0.85	1.14
Head and neck	794	52.1	0.88	0.74	1.06
CNS	347	47.3	0.69	0.53	0.90
Testicular	338	76.6	2.70	1.94	3.76
Liver	320	36.3	0.47	0.35	0.63

B

Cancer Type	Prevalence	OR	LCL	UCL
Breast	37.4	0.67	0.60	0.74
Prostate	18.0	0.56	0.49	0.65
Cervical	61.2	2.29	2.02	2.60
Colorectal	28.8	0.80	0.68	0.93
Melanoma	33.2	0.95	0.84	1.08
Uterine	43.6	0.89	0.76	1.04
Lung	31.9	0.84	0.68	1.04
Bladder	22.5	0.58	0.45	0.73
Head and neck	35.6	0.91	0.71	1.17
CNS	36.6	1.15	0.78	1.71
Testicular	31.1	1.58	1.14	2.19
Liver	39.8	0.94	0.59	1.49

C

Cancer Type	Prevalence	OR	LCL	UCL
Breast	12.7	0.50	0.44	0.57
Prostate	17.6	0.75	0.66	0.85
Cervical	29.9	1.71	1.51	1.94
Colorectal	20.4	1.02	0.86	1.20
Melanoma	22.7	1.20	1.05	1.38
Uterine	17.6	0.80	0.65	0.98
Lung	19.8	0.89	0.69	1.15
Bladder	18.9	1.12	0.87	1.43
Head and neck	27.9	1.49	1.14	1.95
CNS	19.8	0.91	0.56	1.49
Testicular	40.6	2.53	1.87	3.41
Liver	23.5	0.96	0.57	1.61

Figure 3. Forest plot for odds and associated 95% CI of self-reporting (A) current drinking, (B) exceeding moderate drinking, and (C) binge drinking. Only cancer types with >300 participants are shown. Each cancer is compared with all other cancer types. Abbreviations: CNS, central nervous system; LCL, lower confidence limit; OR, odds ratio; UCL, upper confidence limit.

may differ depending on underlying conditions, but no such guidelines have been created specifically for patients with cancer. Second, the CDC guidelines used in this study specified binge drinking as achieving a BAC of 0.08% and estimated this level to require 5 drinks in men and 4 drinks in women consumed over the course of ≤ 2 hours. Information regarding the duration of alcohol intake was not available in the database, and therefore individuals reporting drinking ≥ 5 drinks on one occasion may have done so over longer periods, and thus would not have reached the biological threshold for binge drinking. Third, alcohol intake in this survey was self-reported and not verified by any other sources such as family members. However, earlier research has suggested that individuals tend to underreport alcohol use, and that difference between reported and actual alcohol consumption is greatest in heavy drinkers.^{32,33} Therefore, the true prevalence and quantity of alcohol intake, particularly for binge drinking, may be higher than indicated by the NHIS survey. Fourth, study participants could report up to 3 cancer types, and information regarding the number of cancer types that each participant reported was not available. Therefore, the current analysis on the association between cancer type and current drinking likely included patients whose drinking status may have been affected by more than one cancer diagnosis. However, given that there were a total of 34,080 cancer survivors and 36,813 cancer types reported, the number of patients with more than one diagnosis was likely small.

Conclusions

Study findings show that most cancer survivors self-report as current drinkers, including a subset who seem to engage in excessive drinking behaviors. By reporting the demographic and socioeconomic variables associated with alcohol intake, our work begins to identify subgroups toward whom alcohol-based interventions could be targeted, and could serve as a benchmark for assessing changes in drinking behavior in the population of patients with cancer. Nevertheless, given that this represents the first study to assess drinking patterns in cancer survivors, further investigation is needed, including large-scale systems-based research on alcohol use in cancer survivors. For the time being, because oncologists have a responsibility to promote the overall health and well-being of their patients, efforts should be undertaken to accurately assess alcohol intake among cancer survivors and to inform these individuals of the potential harms associated with continued drinking.

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Correspondence: Nina N. Sanford, MD, Department of Radiation Oncology, University of Texas Southwestern Medical Center, 2280 Inwood Road, Dallas, TX 75390-9303. Email: Nina.Sanford@UTSouthwestern.edu

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Supplemental online content for:

Alcohol Use Among Patients With Cancer and Survivors in the United States, 2000–2017

Nina N. Sanford, MD; David J. Sher, MD; Xiaohan Xu, MS; Chul Ahn, PhD; Anthony V. D'Amico, MD, PhD; Ayal A. Aizer, MD; and Brandon A. Mahal, MD

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eFigure 1: Adjusted ORs and Absolute Percents for Study Participants Self-Reporting Drinking

eTable 1: Multivariable Analysis of Participants Reporting a Cancer Diagnosis >5 Years Before Survey Administration

eTable 2: Multivariable Analysis by Era of Survey Among Participants Aged ≤50 Years

eTable 3: Multivariable Analysis by Cancer Type of Participants Reporting a Cancer Diagnosis ≥5 Years Before Survey Administration

eFigure 1. Adjusted ORs and absolute percents for study participants self-reporting (A) current drinking, (B) exceeding moderate drinking, and (C) binge drinking, by survey period (ref, 2000–2014).
Abbreviation: OR, odds ratio.

eTable 1. Multivariable Analysis of Participants Reporting a Cancer Diagnosis >5 Years Before Survey Administration (n=20,828)

	Current Drinking ^a		Exceeding Moderate Drinking ^b		Binge Drinking ^c		Former Drinking ^a		Never Drinking	
	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
Age										
18–34 y	Ref		Ref		Ref		Ref		Ref	
35–44 y	0.83 (0.63–1.11)	.21	0.68 (0.49–0.94)	.02	0.65 (0.49–0.87)	.005	1.40 (1.00–1.96)	.05	0.91 (0.64–1.31)	.62
45–54 y	0.63 (0.48–0.82)	.001	0.47 (0.35–0.64)	<.001	0.45 (0.34–0.59)	<.001	1.85 (1.35–2.53)	<.001	1.07 (0.77–1.49)	.69
55–64 y	0.53 (0.41–0.68)	<.001	0.36 (0.27–0.48)	<.001	0.30 (0.23–0.39)	<.001	2.29 (1.70–3.09)	<.001	1.06 (0.77–1.45)	.71
65–74 y	0.39 (0.30–0.51)	<.001	0.25 (0.19–0.34)	<.001	0.17 (0.13–0.23)	<.001	2.47 (1.83–3.34)	<.001	1.52 (1.11–2.08)	.009
≥75 y	0.28 (0.22–0.36)	<.001	0.12 (0.09–0.17)	<.001	0.06 (0.04–0.08)	<.001	3.02 (2.25–4.09)	<.001	1.84 (1.34–2.53)	<.001
Sex										
Male	Ref		Ref		Ref		Ref		Ref	
Female	0.64 (0.58–0.70)	<.001	2.03 (1.78–2.31)	<.001	0.37 (0.32–0.43)	<.001	1.00 (0.92–1.10)	.94	2.01 (1.78–2.28)	<.001
Annual family income (USD)										
\$0–\$34,999	Ref		Ref		Ref		Ref		Ref	
\$35,000–\$74,999	1.51 (1.37–1.68)	<.001	0.88 (0.76–1.03)	.12	1.06 (0.89–1.27)	.50	0.81 (0.72–0.90)	<.001	0.71 (0.62–0.80)	<.001
\$75,000–\$99,999	1.51 (1.26–1.81)	<.001	0.97 (0.76–1.23)	.79	1.19 (0.90–1.57)	.21	0.86 (0.70–1.05)	.15	0.63 (0.49–0.81)	<.001
≥\$100,000	2.49 (2.09–2.95)	<.001	1.12 (0.91–1.39)	.29	1.42 (1.10–1.82)	.006	0.58 (0.47–0.71)	<.001	0.41 (0.32–0.51)	<.001
Not ascertained/ unknown	1.34 (1.14–1.58)	<.001	1.03 (0.80–1.33)	.84	1.13 (0.80–1.60)	.49	0.80 (0.67–0.96)	.02	0.87 (0.72–1.05)	.15
Insurance status										
Not insured	Ref		Ref		Ref		Ref		Ref	
Insured	1.06 (0.88–1.27)	.53	1.11 (0.87–1.42)	.40	1.04 (0.81–1.33)	.76	0.99 (0.81–1.21)	.94	0.98 (0.78–1.22)	.83
Race										
White	Ref		Ref		Ref		Ref		Ref	
Black	0.71 (0.62–0.81)	<.001	0.98 (0.80–1.21)	.88	0.72 (0.56–0.94)	.01	1.24 (1.07–1.42)	.003	1.31 (1.13–1.53)	<.001
Alaska Native/ American Indian	0.74 (0.46–1.20)	.23	1.40 (0.75–2.60)	.29	1.36 (0.71–2.58)	.35	1.35 (0.86–2.11)	.19	1.07 (0.58–1.95)	.84
Asian	0.39 (0.29–0.53)	<.001	0.66 (0.40–1.09)	.11	0.43 (0.23–0.83)	.01	0.77 (0.56–1.06)	.11	3.66 (2.70–4.94)	<.001
Multiple/Unknown	1.13 (0.58–2.19)	.72	0.73 (0.27–1.98)	.54	0.17 (0.03–0.91)	.04	0.72 (0.33–1.58)	.41	1.21 (0.57–2.58)	.61
Ethnicity										
Non-Spanish/ Hispanic/Latino	Ref		Ref		Ref		Ref		Ref	
Spanish/ Hispanic/Latino	0.80 (0.67–0.94)	.008	1.22 (0.92–1.61)	.17	1.07 (0.76–1.49)	.71	0.96 (0.80–1.16)	.69	1.37 (1.14–1.63)	.001
Marital status										
Not married	Ref		Ref		Ref		Ref		Ref	
Married	0.93 (0.85–1.02)	.13	0.81 (0.71–0.93)	.003	0.73 (0.62–0.86)	<.001	0.98 (0.89–1.09)	.76	1.11 (1.00–1.24)	.04
Smoking status										
Never	Ref		Ref		Ref		Ref		Ref	
Former	1.67 (1.52–1.83)	<.001	1.90 (1.66–2.18)	<.001	1.78 (1.50–2.11)	<.001	1.70 (1.54–1.88)	<.001	0.24 (0.21–0.27)	<.001
Current	1.72 (1.52–1.96)	<.001	3.19 (2.69–3.78)	<.001	2.92 (2.42–3.52)	<.001	1.64 (1.43–1.88)	<.001	0.26 (0.22–0.30)	<.001

(continued on next page)

eTable 1. Multivariable Analysis of Participants Reporting a Cancer Diagnosis >5 Years Before Survey Administration (n=20,828) (cont.)

	Current Drinking ^a		Exceeding Moderate Drinking ^b		Binge Drinking ^c		Former Drinking ^a		Never Drinking	
	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
Education										
None–grade 4	Ref		Ref		Ref		Ref		Ref	
Grade 5–12	2.30 (1.34–3.93)	.002	1.38 (0.63–3.03)	.42	2.43 (0.64–9.15)	.19	0.91 (0.58–1.43)	.69	0.65 (0.40–1.06)	.09
1–4 y college	3.71 (2.16–6.36)	<.001	1.10 (0.50–2.41)	.82	2.12 (0.56–7.99)	.27	0.72 (0.46–1.14)	.16	0.41 (0.25–0.67)	<.001
≥5 y college	4.18 (2.40–7.28)	<.001	0.85 (0.38–1.90)	.70	1.54 (0.40–5.91)	.53	0.65 (0.40–1.05)	.08	0.39 (0.23–0.65)	<.001
Unknown	0.94 (0.37–2.35)	.89	1.27 (0.27–6.01)	.76	2.69 (0.26–26.40)	.40	1.57 (0.72–3.44)	.26	0.84 (0.40–1.76)	.64
Self-reported health status										
Excellent	Ref		Ref		Ref		Ref		Ref	
Very good	0.91 (0.78–1.05)	.18	0.99 (0.83–1.18)	.89	0.92 (0.74–1.13)	.41	1.24 (1.05–1.48)	.01	0.94 (0.78–1.13)	.52
Good	0.61 (0.53–0.70)	<.001	0.92 (0.77–1.10)	.38	0.79 (0.64–0.97)	.03	1.77 (1.50–2.10)	<.001	1.19 (1.00–1.42)	.05
Fair	0.37 (0.32–0.43)	<.001	0.71 (0.57–0.88)	.002	0.82 (0.64–1.06)	.14	2.36 (1.98–2.81)	<.001	1.64 (1.36–1.98)	<.001
Poor	0.27 (0.22–0.32)	<.001	0.70 (0.51–0.96)	.03	0.59 (0.40–0.86)	.006	2.84 (2.31–3.51)	<.001	2.02 (1.61–2.52)	<.001
Survey period										
2000–2004	Ref		Ref		Ref		Ref		Ref	
2005–2009	1.00 (0.87–1.13)	.92	0.96 (0.79–1.18)	.73	1.30 (1.02–1.66)	.03	1.10 (0.86–1.27)	.18	0.97 (0.84–1.12)	.67
2010–2014	1.07 (0.94–1.21)	.29	0.94 (0.78–1.13)	.52	1.34 (1.06–1.68)	.01	1.15 (1.00–1.31)	.04	0.82 (0.72–0.94)	.004
2015–2017	1.22 (1.07–1.41)	.003	1.00 (0.82–1.23)	.99	1.82 (1.42–2.32)	<.001	1.02 (0.87–1.18)	.84	0.79 (0.68–0.92)	.002

Abbreviation: aOR, adjusted odds ratio.

^aAmong all survey participants.^bAmong current drinkers. Defined as >1 drink/day for women and >2 drinks/day for men.^cAmong current drinkers. Defined as ≥5 drinks/day during at least 1 day over the past year.**eTable 2. Multivariable Analysis by Era of Survey Among Participants Aged ≤50 Years (n=6,313)**

Survey Period	Current Drinking		Exceeding Moderate Drinking		Binge Drinking	
	aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
2000–2004	Ref		Ref		Ref	
2005–2009	1.12 (0.88–1.36)	.24	0.96 (0.75–1.22)	.74	1.02 (0.81–1.29)	.87
2010–2014	1.20 (0.99–1.46)	.07	0.86 (0.68–1.10)	.23	1.14 (0.90–1.46)	.28
2015–2017	1.07 (0.85–1.36)	.56	0.97 (0.73–1.27)	.81	1.48 (1.12–1.95)	.006

The model was also adjusted for sex, annual family income, race, ethnicity, marital status, smoking status, highest education level, insurance status, and self-reported health status.

Abbreviation: aOR, adjusted odds ratio.

eTable 3. Multivariable Analysis by Cancer Type of Participants Reporting a Cancer Diagnosis ≥ 5 Years Before Survey Administration (n=20,828)

Cancer Type	n	Current Drinking ^a		Exceeding Moderate Drinking ^b		Binge Drinking ^c	
		aOR (95% CI)	P Value	aOR (95% CI)	P Value	aOR (95% CI)	P Value
Breast	5,394	0.76 (0.71–0.83)	<.001	0.61 (0.54–0.69)	<.001	0.47 (0.40–0.55)	<.001
Prostate	2,902	1.11 (1.00–1.22)	.04	0.56 (0.47–0.68)	<.001	0.77 (0.65–0.92)	.005
Cervical	2,522	1.43 (1.28–1.59)	<.001	2.22 (1.92–2.66)	<.001	1.58 (0.65–0.92)	<.001
Colorectal	1,835	0.67 (0.60–0.76)	<.001	0.74 (0.61–0.90)	.002	1.05 (0.84–1.31)	.67
Melanoma	1,790	1.56 (1.38–1.77)	<.001	0.80 (0.68–0.94)	.006	1.10 (0.92–1.32)	.29
Uterine	1,659	0.71 (0.63–0.81)	<.001	0.85 (0.70–1.03)	.09	0.71 (0.55–0.91)	.008
Lung	546	0.74 (0.60–0.91)	.004	0.76 (0.54–1.07)	.12	1.02 (0.67–1.56)	.92
Bladder	614	1.04 (0.85–1.27)	.69	0.65 (0.48–0.90)	.008	1.17 (0.83–1.64)	.38
Head and neck	454	1.00 (0.78–1.27)	.99	0.93 (0.67–1.30)	.69	1.49 (1.03–2.15)	.03
CNS	181	0.81 (0.57–1.16)	.25	1.26 (0.76–2.11)	.37	1.07 (0.56–2.04)	.85
Testicular	253	2.41 (1.66–3.51)	<.001	1.58 (1.07–2.34)	.02	2.69 (1.89–3.82)	<.001
Liver	98	0.38 (0.23–0.64)	<.001	0.59 (0.26–1.34)	.21	0.51 (0.18–1.46)	.21

Abbreviation: aOR, adjusted odds ratio; CNS, central nervous system.

^aAmong all survey participants.

^bAmong current drinkers. Defined as >1 drink/day for women and >2 drinks/day for men.

^cAmong current drinkers. Defined as ≥ 5 drinks/day during at least 1 day over the past year.