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Change in alcohol consumption during the Covid-19 pandemic and associations with mental health and financial hardship: results from a survey of Wisconsin patients with cancer

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Abstract

Purpose Alcohol consumption increases health risks for patients with cancer. The Covid-19 pandemic may have affected drinking habits for these individuals. We surveyed patients with cancer to examine whether changes in drinking habits were related to mental health or financial effects of the pandemic.

Methods From October 2020 to April 2021, adult patients (age 18–80 years at diagnosis) treated for cancer in southcentral Wisconsin were invited to complete a survey. Age-adjusted percentages for history of anxiety or depression, emotional distress, and financial impacts of Covid-19 overall and by change in alcohol consumption (non-drinker, stable, decreased, or increased) were obtained via logistic regression.

Results In total, 1,875 patients were included in the analysis (median age 64, range 19–87 years), including 9% who increased and 23% who decreased drinking. Compared to stable drinkers (32% of sample), a higher proportion of participants who increased drinking alcohol also reported anxiety or depression (45% vs. 26%), moderate to severe emotional distress (61% vs. 37%) and viewing Covid-19 as a threat to their community (67% vs. 55%). Decreased (vs. stable) drinking was associated with higher prevalence of depression or anxiety diagnosis, emotional distress, and negative financial impacts of the pandemic. Compared to non-drinkers (36% of sample), participants who increased drinking were more likely to report emotional distress (61% vs. 48%).

Conclusions Patients with cancer from Wisconsin who changed their alcohol consumption during the Covid-19 pandemic were more likely to report poor mental health including anxiety, depression, and emotional distress than persons whose alcohol consumption was stable.

Implications for cancer survivors Clinicians working with cancer survivors should be aware of the link between poor mental health and increased alcohol consumption and be prepared to offer guidance or referrals to counseling, as needed.

Keywords Covid-19 · Alcohol · Cancer · Mental health · Depression · Anxiety

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Introduction

After the start of the Coronavirus 2019 (Covid-19) pandemic in February 2020, governments around the world implemented non-pharmaceutical interventions such as stay-at-home orders, the closure of schools and non-essential businesses, mask use, and quarantines to mitigate the spread of severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) and reduce the burden of illness on hospitals. Research studies subsequently reported that social isolation, emotional distress, anxiety, and lost income related to the pandemic may have affected patterns of alcohol consumption in individuals subjected to lockdowns [1]. Survey studies, in particular, indicated that approximately 10–40% of respondents self-reported increasing their alcohol consumption since the onset of the pandemic [2–11]. Notably, increased pandemic-related alcohol consumption has serious implications for public health including for patients with cancer, as higher alcohol consumption is linked to negative effects on cancer prognosis and impaired therapeutic efficacy [12, 13].

While previous research has shown that increased alcohol consumption during the Covid-19 pandemic was related to multiple psychosocial factors including depression, anxiety, and emotional distress [1, 3, 9, 11, 14–21], data are limited from individuals diagnosed with cancer, a clinical population for whom increased drinking warrants particular concern. In the United States (US), there are approximately 17 million individuals living with a cancer diagnosis [22], and heavy alcohol consumption by patients with cancer is related to higher risk for relapse, distant metastasis, and mortality [12, 13]. Heavy alcohol consumption also increases susceptibility to severe SARS CoV-2 infection [23, 24].

Little information is available regarding how patterns of alcohol consumption changed during the Covid-19 pandemic for patients with cancer, and what psychosocial factors were related to increased alcohol use in this high-risk population. Although the Covid-19 pandemic and accompanying mitigation interventions have since receded, identifying psychosocial factors related to increased alcohol consumption during a global pandemic may be useful to inform future public health interventions and to identify groups at risk for problematic drinking. To address this gap, we analyzed cross-sectional data from a survey of adult patients with cancer from Wisconsin, a state with high heavy and binge alcohol consumption [25]. This survey was completed during the Covid-19 pandemic and was designed to investigate the effect of the pandemic on the health of patients with cancer in Wisconsin. We hypothesized that self-reported increased alcohol consumption during the pandemic would be related to emotional distress, history of anxiety or depression, and negative financial effects of the Covid-19 pandemic.

Materials and methods

Study sample

This research study was approved by the University of Wisconsin Health Science Institutional Review Board. Eligible participants were adults (18–80 years at cancer diagnosis) who received healthcare for cancer diagnosis or treatment at a University of Wisconsin Carbone Cancer Center (UWCCC) clinic between November 1, 2019 and June 30, 2020 and had a valid residential address. Identified through a search of electronic health records, patients were eligible regardless of cancer type, treatment history, tumor stage, and time since first diagnosis. In total, 2,961 patients were invited to participate in the study; 984 patients refused participation and 24 responded that they were too ill to participate. Surveys were completed from October 2020 to April 2021, and were returned by 1,953 participants, comprising 66% of the eligible sample. For this analysis, participants who met any of the following criteria were excluded: only diagnosed with non-melanoma skin cancer (N = 11), skipped the question asking if they had ever been diagnosed with cancer (N = 7), skipped the question asking how their alcohol consumption had changed due to the pandemic (N = 56), or did not report their age at survey completion (N = 5). A total of 1,875 surveys were included in the final analysis. All participants provided informed, written consent, and all research activities conformed to the Declaration of Helsinki.

Survey design and assessment of alcohol consumption

The survey questionnaire included 80 questions covering the following sections: (A) Cancer Diagnosis and Treatment, (B) Covid-19, (C) Impact of Covid-19 on Health and Healthcare, (D) General Health Status, (E) Lifestyle and Health Behaviors, (F) Other Impacts of COVID-19, and (G) Demographics. In section E (Lifestyle and Health Behaviors), participants were asked to provide the number of (1) glasses of wine or wine coolers (size of a regular can of soda), (2) glasses, bottles, or cans of beer (size of a regular can of soda), and (3) drinks of hard liquor (1.5-ounce shots) they usually consume each week. They were also asked to self-report change in alcohol consumption since the onset of the Covid-19 pandemic, with the following options: "A lot more", "A little more", "About the same", "A little lower", "Much lower", and "I don't drink alcohol now, and I didn't drink alcohol before Covid-19". For the analysis,

self-reported increased alcohol consumption since the onset of Covid-19 pandemic was defined as "a little more" or "a lot more", while decreased alcohol consumption included "a little lower" and "a lot lower". Participants were also asked to describe their primary motivation(s) for change in alcohol consumption, with options including "concerns related to Covid-19", "concerns related to cancer", and "other". Participants who reported "other" were asked to describe their primary motivation, with responses manually grouped into the following categories: "other concerns related to health", "lockdown restrictions", "sadness, stress, depression, or anxiety", "boredom, more time at home", "concerns about politics or current events", or "do not care for alcohol, or lower tolerance".

Participants also completed the Cut down, Annoyed, Guilty, and Eye-opener (CAGE) screening tool, a validated set of four yes/no questions to identify potential alcohol abuse [26]. Participants were given one point for each question to which they responded "yes" including whether they ever felt the need to cut down on their drinking (C), whether they felt annoyed when others criticized their drinking (A), whether they felt guilty about their drinking (G), and whether they ever needed a morning "eye-opener" to steady their nerves or treat a hangover (E). A score of two or more points on the CAGE screener is considered clinically significant [26].

Assessment of mental health, financial status, and pessimistic attitudes about Covid-19

In the 'General Health Status' component of the survey, participants were queried regarding whether they had ever been told by a doctor or healthcare professional that they had depression or anxiety. They were also asked to rate the level of distress they had been experiencing in the past week on a scale from 0 (no distress) to 10 (extreme distress), utilizing the National Comprehensive Cancer Network (NCCN) 'distress thermometer' [27]. A score of ≥ 4 was defined as 'moderate to severe distress', as this is an established threshold to identify clinically significant emotional distress in patients with cancer [28]. Regarding 'Other Impacts of Covid-19', participants were further asked to report whether the Covid-19 pandemic had impacted them financially and whether they had lost job-related income as a result, on a scale from 1 ("Not true of me at all") to 7 ("Very true of me") [29]. A response of ≥ 5 out of 7 was taken to indicate strong agreement. Pessimistic attitudes concerning the Covid-19 pandemic were assessed utilizing a five level Likert scale from "Strongly agree" to "Strongly disagree", with participants asked to rate their agreement with the following questions: "Covid-19 is a threat to my community", and "Covid-19 is a threat to my household" [29].

Statistical analysis

Participant demographic characteristics, including age, race, ethnicity, education, income, and most recent cancer type, were tabulated by change in alcohol consumption, with adjustment for age at survey completion.

Logistic regression analysis was utilized to investigate the prevalence of anxiety or depression, emotional distress, negative financial effects of the Covid-19 pandemic, lost job income from the pandemic, and pessimistic attitudes about SARS CoV-2 infection by self-reported change in alcohol consumption since the onset of the pandemic ("No drinking", "Stable drinking", "Decreased drinking", or "Increased drinking"). For the 'Increased' and 'Decreased' drinking categories, data are presented as the percentage difference for each variable of interest relative to the reference category, with 95% confidence interval. Separate models were run utilizing stable drinkers and non-drinkers as the reference category. All models were adjusted for age at survey completion (18–39, 40–59, 60–69, or 70–80 years). Associations are reported for the full sample, as well as stratified by sex and age (<60 years, ≥ 60 years). All analyses were completed with SAS version 9.4 (*SAS Inc., Cary, NC*).

Results

Characteristics of 1,875 participants who completed the survey (median age [range]: 64 [19–87] years at survey completion) are displayed in Table 1. The sample was predominantly female (57%), White (94%), non-Hispanic (98%), with 78% completing at least some college education. There were 598 participants who reported stable alcohol use since the onset of the Covid-19 pandemic (32%), 436 who reported decreased consumption (23%), 171 with increased consumption (9%), and 670 who reported not drinking alcohol before or during the pandemic (36%).

Respondents who increased their alcohol consumption were more likely to be less than 60 years old, female, with a graduate degree and income ≥$100,000/year. Participants who were non-drinkers or who decreased their alcohol consumption were more likely to be currently receiving chemotherapy at the clinic. 34% of the sample reported a diagnosis of depression or anxiety, while 43% reported moderate to severe distress in the previous week, and 21% reported strong agreement that they had experienced negative financial effects of the Covid-19 pandemic (Supplementary Table S1). 15% of participants indicated strong agreement that they had lost job income because of the pandemic. Compared to male respondents, a higher proportion of female respondents reported depression or anxiety, moderate to severe distress, or negative financial impacts of the

Table 1 Demographic characteristics of 1,875 patients with cancer according to reported change in alcohol consumption since the onset of the Covid-19 pandemic[a]

Characteristic	Drinking level compared to pre-Covid-19				
	Full sample (N = 1,875)	Non-drinker (N = 670)	Stable drinkers (N = 598)	Decreased drinking (N = 436)	Increased drinking (N = 171)
Age at survey completion (years)					
18–39	99 (5%)	28 (4%)	26 (4%)	29 (7%)	16 (9%)
40–59	539 (29%)	178 (27%)	178 (30%)	119 (27%)	64 (37%)
60–69	698 (37%)	250 (37%)	219 (37%)	169 (39%)	60 (35%)
≥ 70	539 (29%)	214 (32%)	175 (29%)	119 (27%)	31 (18%)
Sex[b]					
Male	800 (43%)	260 (39%)	275 (46%)	201 (46%)	64 (39%)
Female	1066 (57%)	406 (61%)	320 (54%)	234 (54%)	106 (61%)
Race and ethnicity[b]					
White[c]	1718 (94%)	591 (92%)	558 (95%)	410 (95%)	159 (96%)
Black/African American[c]	27 (1%)	12 (2%)	7 (1%)	5 (1%)	3 (2%)
Asian/Pacific Islander[c]	22 (1%)	11 (2%)	7 (1%)	3 (1%)	1 (0%)
Hispanic (any race)	29 (2%)	15 (2%)	8 (1%)	4 (1%)	2 (1%)
Other or multiracial[c]	27 (1%)	10 (2%)	7 (1%)	8 (2%)	2 (1%)
Education[b]					
High school/GED or less	406 (22%)	185 (27%)	114 (19%)	94 (22%)	13 (8%)
Some college or associate's degree	611 (33%)	227 (35%)	184 (31%)	153 (35%)	47 (27%)
Bachelor's degree	431 (23%)	114 (17%)	159 (27%)	106 (24%)	52 (30%)
Graduate or professional degree	414 (22%)	138 (21%)	136 (23%)	82 (19%)	58 (35%)
Annual household income[b]					
<$20,000	112 (7%)	62 (12%)	17 (3%)	26 (7%)	7 (5%)
$20,000-$49,999	339 (22%)	145 (28%)	94 (18%)	80 (22%)	20 (14%)
$50,000-$99,999	580 (38%)	190 (37%)	203 (40%)	132 (36%)	55 (36%)
≥$100,000	515 (33%)	124 (24%)	192 (38%)	129 (35%)	70 (45%)
Most recent cancer diagnosis[b]					
Breast	361 (20%)	123 (19%)	145 (25%)	95 (23%)	56 (33%)
Hematological cancers[d]	77 (4%)	23 (4%)	97 (16%)	90 (21%)	27 (15%)
Female reproductive cancers[e]	103 (6%)	44 (7%)	86 (15%)	45 (11%)	27 (15%)
Prostate	242 (13%)	77 (11%)	97 (16%)	45 (10%)	23 (17%)
Lung	258 (14%)	100 (15%)	26 (4%)	29 (7%)	4 (3%)
Colorectal	355 (19%)	141 (22%)	29 (5%)	19 (5%)	6 (3%)
Other[f]	438 (24%)	142 (22%)	111 (19%)	100 (24%)	27 (15%)
Time since most recent diagnosis[b]					
<1 year	341 (20%)	126 (21%)	94 (17%)	96 (24%)	25 (15%)
1 year	895 (52%)	304 (50%)	293 (52%)	214 (54%)	84 (52%)
2 years	301 (17%)	103 (17%)	114 (21%)	52 (13%)	32 (19%)
≥3 years	186 (11%)	74 (12%)	57 (10%)	31 (8%)	24 (14%)
Current cancer treatment[b]					
Medication or chemotherapy at home	464 (25%)	166 (25%)	142 (24%)	117 (27%)	39 (22%)
Chemotherapy by IV at clinic	255 (14%)	107 (16%)	53 (9%)	81 (18%)	14 (8%)
Radiation	108 (6%)	38 (6%)	29 (5%)	33 (7%)	8 (5%)
Recovering from surgery	124 (7%)	40 (6%)	37 (6%)	35 (8%)	12 (7%)
Other	38 (2%)	22 (3%)	4 (1%)	9 (2%)	3 (2%)
None	943 (50%)	324 (48%)	332 (56%)	195 (45%)	92 (53%)
Change in physical activity since onset of pandemic[b]					
Decreased	1098 (59%)	415 (62%)	302 (51%)	272 (63%)	109 (64%)
Stable or increased	766 (41%)	250 (38%)	295 (49%)	160 (37%)	61 (36%)

Table 1 (continued)

Characteristic	Drinking level compared to pre-Covid-19				
	Full sample (N = 1,875)	Non-drinker (N = 670)	Stable drinkers (N = 598)	Decreased drinking (N = 436)	Increased drinking (N = 171)
Current alcoholic drink consumption					
Mean number of drinks per week (range)	0.4 (0–10)	0 (0-0.2)	0.7 (0–10.0)	0.4 (0-4.1)	1.3 (0–6.0)

[a] Data presented as N (%), standardized for age.

[b] Covariates contain missing data (9-329 observations)

[c] Non-Hispanic only

[d] Hematologic cancer include leukemia and lymphoma.

[e] Female reproductive cancers include vulvar, vaginal, cervical, endometrial, uterine, ovarian, and fallopian.

[f] Other cancer types with less than 50 survey responses including kidney, melanoma, and others.

Covid-19 pandemic (Supplementary Table S1). Likewise, a higher proportion of younger adults (age < 60) reported poor mental health and negative financial impacts of the pandemic compared to older adults (Supplementary Table S2).

For participants who decreased their drinking, the primary self-reported motivations for change were concerns about cancer (54% [95% CI: 49–60%]), other health or medication concerns (9% [7–13%]), and fewer opportunities for social drinking due to lockdown restrictions (8% [5–14%]) (Fig. 1). For participants who increased their drinking, the primary motivations were boredom or more time at home due to lockdown restrictions (30% [23–39%]), concerns related to Covid-19 (23% [16–30%]), and concerns related to cancer (21% [15–28%]).

Compared to participants with stable alcohol consumption, a higher proportion of respondents who increased their drinking after the pandemic onset reported a depression or anxiety diagnosis (45% [95% CI: 37–43%] vs. 26% [22–30%], respectively) and moderate to severe distress in the previous week (61% [53–68%] vs. 37% [33–42%], respectively), with larger differences for women compared to men and for older adults (age ≥ 60 years) compared to younger adults (distress only) (Table 2, Supplementary Table S3). For older adults only, those who increased their drinking were more likely to report negative financial impacts from the pandemic compared to stable drinkers (22% [15–31%] vs. 11% [9–15%], respectively). Participants who increased their drinking were also more likely to be flagged by the CAGE screening instrument for problematic drinking. For participants who decreased their drinking, a higher percentage of patients reported an anxiety or depression diagnosis compared to stable drinkers (36% [31–42%] vs. 26% [22–30%], respectively), as well as moderate to severe distress in the previous week (48% [43–54%] vs. 37% [33–42%], respectively) (Table 2, Supplementary Table S3), and negative financial effects of the pandemic (24% [20–28%] vs. 16% [13–20%], respectively).

Compared to participants who did not drink before or during the pandemic, a higher proportion of participants who increased their drinking reported moderate to severe distress in the previous week (61% [53–68%] vs. 48% [44–53%], respectively), although this association was only observed for female participants and older adults (Table 3, Supplementary Table S3). No strong associations were observed with non-drinkers as the reference group for depression or anxiety diagnosis, negative financial impacts of Covid-19, or lost job income. Participants who decreased their alcohol consumption were more likely to report lost job income from Covid-19 compared to non-drinkers (17% [13–21%] vs. 12% [9–15%], respectively), while no strong differences were observed for other variables.

The mean number of alcoholic drinks consumed per day was not significantly associated with depression or anxiety diagnosis, moderate to severe distress, negative financial impacts of Covid-19, lost job income from Covid-19, or views of Covid-19 as a threat to a participant's community or household (Supplementary Table S4).

Discussion

In this study of patients with cancer from Wisconsin, both self-reported increased and decreased alcohol consumption during the Covid-19 pandemic were positively associated with a previous diagnosis of depression or anxiety, moderate to severe distress, and pessimistic attitudes about SARS CoV-2 infection compared to participants whose alcohol consumption was stable. This study adds to a body of evidence linking pandemic-related stress to changes in alcohol consumption and demonstrates that these findings may generalize to patients with cancer. Notably, continued susceptibility to Covid-19 infection and mortality for vulnerable populations, including patients with cancer [30], may reinforce feelings of distress and anxiety and potentially promote adverse coping behaviors including increased alcohol consumption [3, 31].

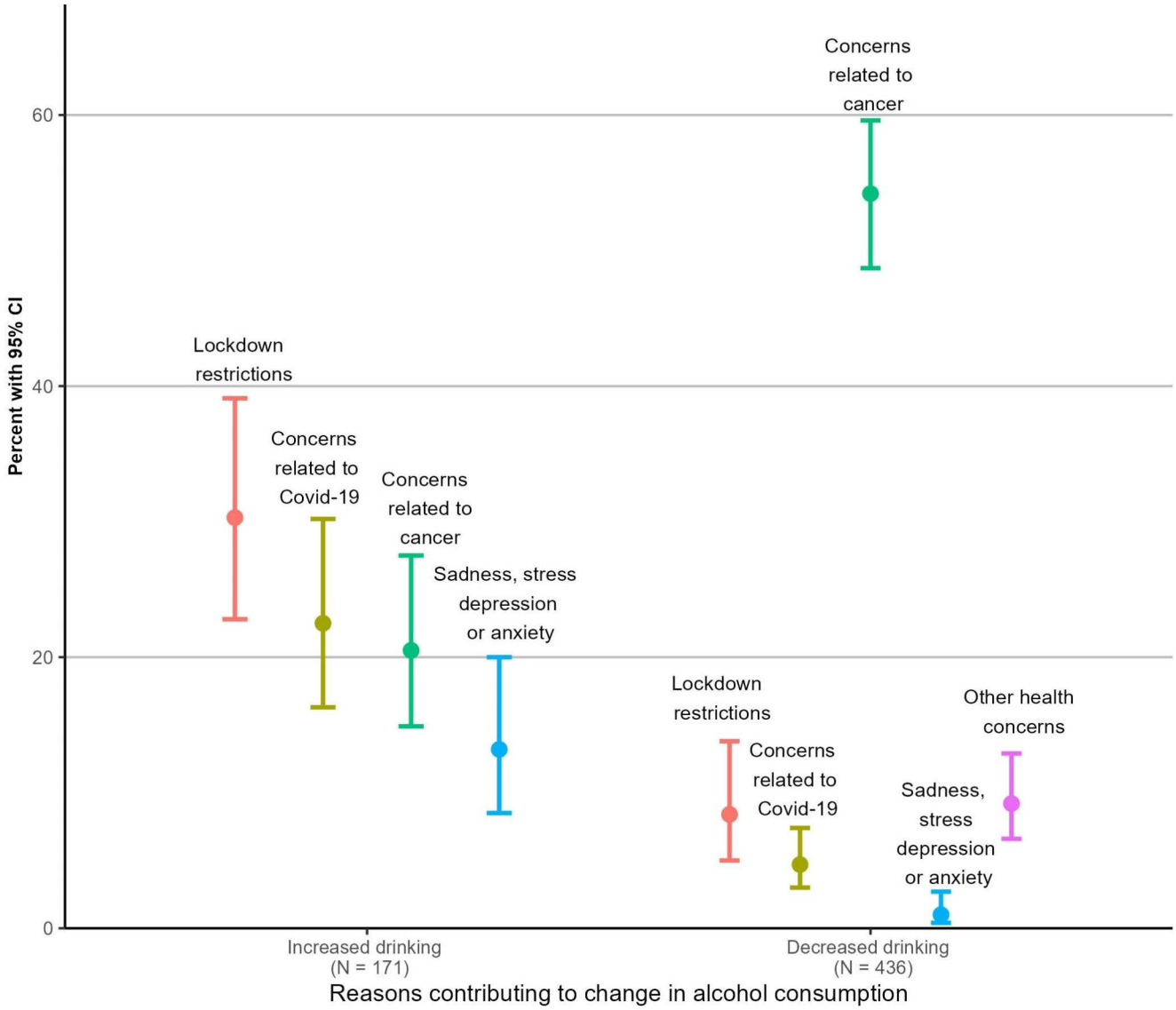

Fig. 1 Self-reported primary motivation for change in alcohol consumption during the Covid-19 pandemic for survey respondents who reported either increased or decreased alcohol consumption since the onset of Covid-19 (N = 607) (Data reported as the percentage with 95% confidence intervals. Categories with less than 25 responses for the full sample are suppressed. The categorization of responses varies according to alcohol consumption)

Previous surveys of US adults demonstrated increased alcohol consumption for approximately 10–40% of respondents during the pandemic [2–5, 7, 10, 19], as well as higher scores on measures of alcohol use disorder [5–8, 32]. These findings are consistent with evidence linking increased alcohol consumption and binge drinking to stressful or catastrophic events, including the September 11th terrorist attacks [33–36], Hurricane Katrina [37, 38], and the 2007–2008 financial crisis [39, 40]. In the present study of patients with cancer, we found that only 9% of surveyed respondents increased their alcohol consumption during the Covid-19 pandemic while 23% decreased their consumption, which was higher than reported in earlier survey studies from the US [3, 4, 41, 42]. It is highly likely that participants were motivated to reduce their drinking because of concerns related to cancer treatment, as nearly 54% of respondents who reported decreased drinking listed this as a primary motivation. Decreased drinking may also have been driven by closure of drinking establishments, fewer opportunities for socialization due to lockdowns, or decreased income due to the pandemic [43]. Consistent with this, decreased drinking was associated with negative financial effects of Covid-19 in our sample.

Table 2 Proportion of surveyed participants who reported poor mental health, negative effects of the Covid-19 pandemic on finances, and perception of SARS CoV-2 as a significant threat to household and community, for participants who self-reported increased or decreased alcohol consumption compared to participants with stable drinking[a]

Survey Responses	Stable drinking % (95% CI) Reference	Decreased drinking β (95% CI) %Diff. vs. stable drinkers	Increased drinking β (95% CI) %Diff. vs. stable drinkers
Full sample (N = 1,205)			
Depression or anxiety (% yes)	26 (22–30)	+11 (4–17)	+19 (10–27)
Moderate to severe distress in past week (% yes)[b]	37 (33–42)	+11 (5–18)	+24 (15–32)
Covid-19 negatively impacted finances (% yes)[c]	16 (13–20)	+7 (2–12)	+5 (-1-12)
Lost job income from Covid-19 (% yes)[d]	13 (10–16)	+4 (-1-8)	+0 (-5-6)
View Covid-19 as threat to community (% yes)	55 (51–60)	+6 (0–12)	+11 (3–20)
View Covid-19 as threat to household (% yes)	15 (12–18)	-4 (-8-1)	+1 (-5-7)
CAGE screening score ≥ 2 (% yes)	2 (1–3)	+1 (-1-3)	+18 (11–24)
Males (N = 540)			
Depression or anxiety (% yes)	21 (16–27)	+9 (0–18)	+14 (0–27)
Moderate to severe distress in past week (% yes)[b]	34 (27–41)	+14 (5–23)	+12 (-1-26)
Covid-19 negatively impacted finances (% yes)[c]	14 (9–19)	+11 (3–18)	+4 (-6-14)
Lost job income from Covid-19 (% yes)[d]	11 (7–16)	+4 (-2-11)	+2 (-7-11)
View Covid-19 as threat to community (% yes)	53 (45–60)	+5 (-4-14)	+12 (-1-26)
View Covid-19 as threat to household (% yes)	16 (11–21)	-5 (-11-1)	-1 (-11-9)
CAGE screening score ≥ 2 (% yes)	2 (1–5)	0 (-2-3)	+22 (11–33)
Females (N = 660)			
Depression or anxiety (% yes)	30 (25–36)	+11 (3–20)	+19 (8–31)
Moderate to severe distress in past week (% yes)[b]	40 (34–46)	+9 (0–18)	+30 (20–41)
Covid-19 negatively impacted finances (% yes)[c]	19 (15–24)	+5 (-2-12)	+5 (-4-14)
Lost job income from Covid-19 (% yes)[d]	15 (11–20)	+4 (-3-10)	-1 (-8-6)
View Covid-19 as threat to community (% yes)	58 (52–64)	+6 (-2-14)	+9 (-2-20)
View Covid-19 as threat to household (% yes)	14 (10–19)	-2 (-8-3)	+1 (-6-9)
CAGE screening score ≥ 2 (% yes)	2 (1–4)	+1 (-1-4)	+14 (6–22)
Age < 60 (N = 432)			
Depression or anxiety (% yes)	32 (25–40)	+12 (2–23)	+18 (5–31)
Moderate to severe distress in past week (% yes)[b]	46 (38–54)	+9 (-2-19)	+15 (3–28)
Covid-19 negatively impacted finances (% yes)[c]	24 (18–31)	+7 (-2-17)	-2 (-12-9)
Lost job income from Covid-19 (% yes)[d]	17 (12–24)	+6 (-2-14)	-4 (-13-4)
View Covid-19 as threat to community (% yes)	49 (41–57)	+13 (2–23)	+12 (-1-24)
View Covid-19 as threat to household (% yes)	13 (9–20)	-1 (-8-6)	+1 (-8-10)
CAGE screening score ≥ 2 (% yes)	2 (1–5)	+3 (-1-6)	+14 (5–22)
Age ≥ 60 (N = 773)			
Depression or anxiety (% yes)	21 (17–25)	+9 (2–16)	+18 (7–30)
Moderate to severe distress in past week (% yes)[b]	29 (25–34)	+12 (5–20)	+29 (18–41)
Covid-19 negatively impacted finances (% yes)[c]	11 (9–15)	+7 (1–12)	+11 (2–19)
Lost job income from Covid-19 (% yes)[d]	10 (7–13)	+2 (-3-7)	+4 (-3-12)
View Covid-19 as threat to community (% yes)	60 (55–64)	+2 (-5-10)	+12 (2–23)
View Covid-19 as threat to household (% yes)	16 (12–20)	-5 (-10-0)	+1 (-7-10)
CAGE screening score ≥ 2 (% yes)	2 (1–4)	0 (-2-2)	+21 (12–30)

[a] Data presented as percentages with 95% confidence intervals, adjusted for age.

[b] Defined as score ≥ 4 out of 10 on the National Comprehensive Cancer Network Distress Thermometer (see Ref. [29])

[c] Defined as strong agreement (≥ 5 out of 7) with the statement that "Covid-19 has negatively impacted me from a financial point of view".

[d] Defined as strong agreement (≥ 5 out of 7) with the statement that "I have lost job income due to the Covid-19 pandemic".

Abbreviations: CAGE – Need to cut-down on drinking (C), Annoyed when people criticize your drinking (A), Guilty about drinking (G), Eye-opener required to wake up or treat hangover (E)

Table 3 Proportion of surveyed participants who reported poor mental health, negative effects of the Covid-19 pandemic on finances, and perception of SARS CoV-2 as a significant threat to household and community, for participants who self-reported increased or decreased alcohol consumption compared to participants who did not drink before or during Covid-19[a]

Survey Responses	Non-drinkers % (95% CI) Reference	Decreased drinking β (95% CI) %Diff. vs. non-drinkers	Increased drinking β (95% CI) %Diff. vs. non-drinkers
Full sample (N = 1,277)			
Depression or anxiety (% yes)	41 (36–45)	-4 (-11-2)	+4 (-5-13)
Moderate to severe distress in past week (% yes)[b]	48 (44–53)	0 (-6-6)	+12 (4–21)
Covid-19 negatively impacted finances (% yes)[c]	22 (18–26)	+2 (-3-7)	0 (-7-7)
Lost job income from Covid-19 (% yes)[d]	12 (9–15)	+5 (1–9)	+1 (-4-7)
View Covid-19 as threat to community (% yes)	59 (54–63)	+3 (-3-9)	+8 (0–16)
View Covid-19 as threat to household (% yes)	17 (14–21)	-6 (-10–2)	-1 (-8-5)
Males (N = 525)			
Depression or anxiety (% yes)	32 (25–39)	-2 (-12-7)	+3 (-12-17)
Moderate to severe distress in past week (% yes)[b]	47 (40–54)	+1 (-8-10)	-1 (-15-13)
Covid-19 negatively impacted finances (% yes)[c]	20 (15–26)	+4 (-4-12)	-3 (-13-8)
Lost job income from Covid-19 (% yes)[d]	11 (7–16)	+4 (-2-11)	+2 (-7-11)
View Covid-19 as threat to community (% yes)	54 (46–61)	+4 (-5-13)	+11 (-2-25)
View Covid-19 as threat to household (% yes)	18 (13–24)	-7 (-14–1)	-3 (-13-7)
Females (N = 746)			
Depression or anxiety (% yes)	46 (40–51)	-4 (-12-5)	+4 (-7-15)
Moderate to severe distress in past week (% yes)[b]	49 (43–54)	0 (-8-8)	+21 (11–31)
Covid-19 negatively impacted finances (% yes)[c]	23 (18–28)	+1 (-6-8)	+2 (-7-11)
Lost job income from Covid-19 (% yes)[d]	12 (9–16)	+6 (0–12)	+1 (-6-8)
View Covid-19 as threat to community (% yes)	62 (56–67)	+2 (-6-10)	+5 (-5-16)
View Covid-19 as threat to household (% yes)	16 (12–21)	-4 (-10-1)	0 (-8-7)
Age < 60 (N = 434)			
Depression or anxiety (% yes)	47 (39–55)	-2 (-14-9)	+4 (-10-17)
Moderate to severe distress in past week (% yes)[b]	60 (52–67)	-5 (-15-6)	+2 (-11-14)
Covid-19 negatively impacted finances (% yes)[c]	25 (19–33)	+6 (-3-15)	-3 (-14-8)
Lost job income from Covid-19 (% yes)[d]	16 (11–23)	+7 (-1-16)	-3 (-12-5)
View Covid-19 as threat to community (% yes)	59 (51–67)	+3 (-7-13)	+1 (-11-14)
View Covid-19 as threat to household (% yes)	18 (12–25)	-5 (-13-2)	-3 (-13-6)
Age ≥ 60 (N = 843)			
Depression or anxiety (% yes)	35 (30–40)	-5 (-12-2)	+4 (-7-16)
Moderate to severe distress in past week (% yes)[b]	39 (34–43)	+3 (-5-10)	+20 (9–31)
Covid-19 negatively impacted finances (% yes)[c]	18 (15–22)	0 (-6-6)	+4 (-5-13)
Lost job income from Covid-19 (% yes)[d]	9 (7–12)	+3 (-1-8)	+5 (-2-13)
View Covid-19 as threat to community (% yes)	59 (55–64)	+2 (-5-10)	+13 (2–23)
View Covid-19 as threat to household (% yes)	17 (14–21)	-6 (-11–1)	0 (-8-9)

[a] Data presented as percentages with 95% confidence intervals, adjusted for age.

[b] Defined as score ≥ 4 out of 10 on the National Comprehensive Cancer Network Distress Thermometer (see reference 29).

[c] Defined as strong agreement (≥ 5 out of 7) with the statement that "Covid-19 has negatively impacted me from a financial point of view".

[d] Defined as strong agreement (≥ 5 out of 7) with the statement that "I have lost job income due to the Covid-19 pandemic".

Abbreviations: CAGE – Need to cut-down on drinking (C), Annoyed when people criticize your drinking (A), Guilty about drinking (G), Eye-opener required to wake up or treat hangover (E)

We confirmed previous findings that individuals who increased their alcohol consumption during the pandemic were more likely to have experienced moderate to severe distress, or to have a previous diagnosis of anxiety or depression compared to stable drinkers [3, 9, 11, 15–18, 20, 21, 44]. Our results are consistent with previously published findings of Wisconsin residents, as Pomazal et al. reported that participants from the Survey of the Health of Wisconsin were more likely to increase their alcohol consumption during the Covid-19 pandemic if they had depression or anxiety [45]. We did not find a strong association between increased drinking and negative financial effects of the pandemic,

except for respondents aged 60 or older. In our sample of patients with cancer, increased alcohol consumption was more common in younger participants (i.e. <60 years), which is consistent with other studies from the Covid-19 pandemic [10, 16, 19, 44, 46, 47]. Increased alcohol consumption was also higher for female compared to male participants (10% vs. 8%, respectively), as reported in other Covid-19 pandemic surveys of US residents showing that women were more likely to exceed recommended drinking limits [5], increase their scores on the alcohol use disorder identification test (AUDIT-C) [6], or to increase the number of days with heavy drinking [10]. Higher rates of increased alcohol consumption by female participants in our sample may have been related to higher levels of depression or anxiety and emotional distress compared to male respondents.

Unexpectedly, a history of depression or anxiety and moderate to severe distress were also more common in respondents who *decreased* their alcohol consumption (compared to stable drinkers), suggesting that the relationship between mental health and changes in alcohol consumption during the pandemic may be influenced by other contextual or environmental factors, or that these participants employed other adverse coping mechanisms. These associations may have been influenced by the stress related to cancer diagnosis and treatment, as participants who decreased their drinking were (1) diagnosed with cancer more recently; (2) primarily motivated by concerns related to cancer; and (3) approximately twice as likely to be receiving chemotherapy, compared to stable drinkers. The finding that younger participants were more likely to change their alcohol consumption during the pandemic likely reflects a reaction to multiple compounding and major disruptions since young adults, especially female patients, often carry a greater burden of childcare responsibilities and, during the pandemic, were responsible for adapting to school closures in addition to facing cancer and cancer treatment [48, 49].

The associations between increased alcohol consumption and mental health variables were sensitive to the choice of reference group. For participants who increased their drinking, a higher prevalence of depression or anxiety diagnosis was found relative to stable drinkers, but not compared to participants who abstained from alcohol before and during Covid-19. Likewise, the positive association between increased alcohol consumption and distress was still present but attenuated in comparison to non-drinkers. Like participants who decreased their drinking, alcohol abstainers may have been motivated by concerns related to cancer, as this group was more likely to currently receive chemotherapy compared to stable drinkers. Likewise, alcohol abstainers may have a history of addiction or a more complicated medical history characterized by conditions such as diabetes that contraindicate alcohol consumption [50]. Consequently, the associations between mental health variables and increased alcohol consumption during Covid-19 may not generalize to patients who already abstained from alcohol.

Alcohol may have multiple harmful effects on tumor biology, promoting tumor growth and invasiveness, inhibiting anti-tumor immunity from the innate and adaptive immune systems, and reducing the therapeutic efficacy of chemotherapy and immunotherapy [12]. Importantly, higher alcohol consumption has been linked to poor prognosis across multiple cancer subtypes, including increased risk for recurrence, metastasis, and mortality [12, 13]. In the present sample of patients receiving cancer care in the state of Wisconsin, participants were more than twice as likely to decrease rather than increase their drinking during the Covid-19 pandemic, and this may reflect concerns about cancer or the receipt of chemotherapy. However, patients who report anxiety or depression, or are experiencing moderate to severe distress may be susceptible to increased alcohol consumption and may therefore benefit from counselling or education designed to limit or reduce drinking.

This study has several limitations. Our study included a one-time survey, and causal relationships cannot be inferred. Reverse causation is possible, as excessive alcohol consumption may contribute to depression, while alcohol withdrawal due to cutting back may have increased distress levels in participants used to self-medicating with alcohol. Due to the cross-sectional study design, we were unable to evaluate whether changes in alcohol consumption were transient or persisted throughout the pandemic. Because drinking habits prior to the Covid-19 pandemic were not assessed, we were unable to quantify the longitudinal change in alcohol consumption or identify participants who moved into a different category of alcohol consumption (e.g., from 'light' to 'heavy' drinking), or investigate whether participants with pre-existing alcohol use disorder were more likely to increase their drinking [6, 46, 51]. Because pre-pandemic alcohol consumption was not quantified, participants were asked to describe their change in alcohol consumption (e.g. "a little more" or "a lot more") but clear guidelines for these terms were not provided. Further, because change in alcohol consumption was obtained via retrospective self-report, this primary outcome may be subject to inaccurate recall or intentional underreporting. Our sample was predominantly White and non-Hispanic, reflecting the demographic makeup of the catchment area for the Carbone Cancer Center, and consequently our results may not generalize to more demographically diverse populations. Further, our measures of depression and anxiety depended on self-report rather than a comprehensive clinical assessment.

Conclusions

In conclusion, in a survey of patients with cancer receiving care in the state of Wisconsin, increased alcohol consumption during the Covid-19 pandemic was positively associated with poor mental health, including history of anxiety and depression and moderate to severe distress. These results corroborate previous findings in healthy, non-cancer populations and highlight the relationship between stressful or traumatic experiences and potentially harmful changes in alcohol consumption. Although pandemic mitigation measures have largely been rescinded, patients with cancer remain at elevated risk for Covid-19 infection and mortality, which may have adverse effects on mental health outcomes including anxiety and distress. Medical providers should be aware that poorer mental health is consistently linked to changes in drinking patterns and should be prepared to screen patients and offer referrals to counseling as well as guidance or resources to address their alcohol consumption.

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Data availability Participants did not consent to data sharing for this project, and consequently data are not available.

Declarations

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. The Health Sciences Institutional Review Board provided approval for this study.

Consent to participate All participants provided written informed consent.

Competing interests The authors declare no competing interests.

References

1. Bantounou MA. A narrative review of the use of alcohol during the Covid-19 pandemic; effects and implications. J Addict Dis. 2023;41(1):30–40.
2. Akré ER, Anderson A, Stojanovski K, Chung KW, VanKim NA, Chae DH, Depression. Anxiety, and Alcohol Use among LGBTQ + people during the COVID-19 pandemic. Am J Public Health. 2021;111(9):1610–9.
3. Avery AR, Tsang S, Seto EYW, Duncan GE. Stress, anxiety, and change in Alcohol Use during the COVID-19 pandemic: findings among adult twin pairs. Front Psychiatry. 2020;11:571084.
4. Bakaloudi DR, Jeyakumar DT, Jayawardena R, Chourdakis M. The impact of COVID-19 lockdown on snacking habits, fast-food and alcohol consumption: a systematic review of the evidence. Clin Nutr. 2022;41(12):3038–45.
5. Barbosa C, Cowell AJ, Dowd WN. Alcohol consumption in response to the COVID-19 pandemic in the United States. J Addict Med. 2021;15(4):341–4.
6. Boschuetz N, Cheng S, Mei L, Loy VM. Changes in alcohol use patterns in the United States during COVID-19 pandemic. WMJ. 2020;119(3):171–6.
7. Hanson JD, Noonan C, Harris A, Oziel K, Sarche M, MacLehose RF, et al. Alcohol consumption during COVID among women with an existing alcohol-use disorder. Int J Environ Res Public Health. 2021;18(18):9460.
8. Killgore WDS, Cloonan SA, Taylor EC, Lucas DA, Dailey NS. Alcohol dependence during COVID-19 lockdowns. Psychiatry Res. 2021;296:113676.
9. Lechner WV, Laurene KR, Patel S, Anderson M, Grega C, Kenne DR. Changes in alcohol use as a function of psychological distress and social support following COVID-19 related University closings. Addict Behav. 2020;110:106527.
10. Pollard MS, Tucker JS, Green HD. Changes in adult Alcohol Use and consequences during the COVID-19 pandemic in the US. JAMA Netw Open. 2020;3(9):e2022942.
11. Palmer EOC, Trender W, Tyacke RJ, Hampshire A, Lingford-Hughes A. Impact of COVID-19 restrictions on alcohol consumption behaviours. BJPsych Open. 2021;7(5):e167.
12. Ratna A, Mandrekar P. Alcohol and Cancer: mechanisms and therapies. Biomolecules. 2017;7(3):61.
13. Meadows GG, Zhang H. Effects of Alcohol on Tumor Growth, Metastasis, Immune Response, and host survival. Alcohol Res. 2015;37(2):311–22.
14. Murthy P, Narasimha VL. Effects of the COVID-19 pandemic and lockdown on Alcohol Use Disorders and Complications. Curr Opin Psychiatry. 2021;34(4):376–85.
15. Fernandez MDS, Vieira IS, Silva NRJ da, Cardoso T, de Bielavski A, Rakovski CH et al. C,. Anxiety symptoms and alcohol abuse during the COVID-19 pandemic: A cross-sectional study with Brazilian dental undergraduate students. J Dent Educ. 2021;85(11):1739–48.
16. Jacob L, Smith L, Armstrong NC, Yakkundi A, Barnett Y, Butler L, et al. Alcohol use and mental health during COVID-19

lockdown: a cross-sectional study in a sample of UK adults. Drug Alcohol Depend. 2021;219:108488.
17. Rodriguez LM, Litt DM, Stewart SH. Drinking to cope with the pandemic: the unique associations of COVID-19-related perceived threat and psychological distress to drinking behaviors in American men and women. Addict Behav. 2020;110:106532.
18. Stanton R, To QG, Khalesi S, Williams SL, Alley SJ, Thwaite TL, et al. Depression, anxiety and stress during COVID-19: associations with changes in physical activity, sleep, Tobacco and Alcohol Use in Australian adults. Int J Environ Res Public Health. 2020;17(11):4065.
19. Taylor S, Paluszek MM, Rachor GS, McKay D, Asmundson GJG. Substance use and abuse, COVID-19-related distress, and disregard for social distancing: a network analysis. Addict Behav. 2021;114:106754.
20. Tran TD, Hammarberg K, Kirkman M, Nguyen HTM, Fisher J. Alcohol use and mental health status during the first months of COVID-19 pandemic in Australia. J Affect Disord. 2020;277:810–3.
21. Yazdi K, Fuchs-Leitner I, Rosenleitner J, Gerstgrasser NW. Impact of the COVID-19 pandemic on patients with Alcohol Use Disorder and Associated Risk factors for Relapse. Front Psychiatry. 2020;11:620612.
22. SEER [Internet]. [cited 2023 Feb 22]. Cancer of Any Site - Cancer Stat Facts. Available from: https://seer.cancer.gov/statfacts/html/all.html.
23. Huang W, Zhou H, Hodgkinson C, Montero A, Goldman D, Chang SL. Network Meta-Analysis on the mechanisms underlying Alcohol Augmentation of COVID-19 pathologies. Alcohol Clin Exp Res. 2021;45(4):675–88.
24. Abbasi-Oshaghi E, Mirzaei F, Khodadadi I. Alcohol misuse may increase the severity of COVID-19 Infections. Disaster Med Public Health Prep. 2022;16(3):847–8.
25. CDC – 2021 BRFSS Survey Data and Documentation [Internet]. 2023 [cited 2023 Aug 10]. Available from: https://www.cdc.gov/brfss/annual_data/annual_2021.html.
26. Williams N. The CAGE questionnaire. Occup Med (Lond). 2014;64(6):473–4.
27. Riba MB, Donovan KA, Ahmed K, Andersen B, Braun Ii, Breitbart WS, et al. NCCN Guidelines® insights: Distress Management, Version 2.2023. J Natl Compr Canc Netw. 2023;21(5):450–7.
28. Donovan KA, Grassi L, McGinty HL, Jacobsen PB. Validation of the distress thermometer worldwide: state of the science. Psychooncology. 2014;23(3):241–50.
29. Iii LGC, Woodard SR, Zubrod A. Social Psychological Measurements of COVID-19: Coronavirus Perceived Threat, Government Response, Impacts, and Experiences Questionnaires [Internet]. PsyArXiv; 2020 [cited 2023 May 4]. Available from: https://psyarxiv.com/z2x9a/.
30. Liu C, Zhao Y, Okwan-Duodu D, Basho R, Cui X. COVID-19 in cancer patients: risk, clinical features, and management. Cancer Biol Med. 2020;17(3):519–27.
31. Yue Y, Wang S, Smith E, Goyal D, Zhu K, Zhang ZF, et al. Alcohol Consumption and Mental Health during the COVID-19 pandemic. Alcohol Alcohol. 2023;58(3):247–57.
32. Tsai MH, Xirasagar S, de Groen PC. Persisting racial disparities in Colonoscopy Screening of persons with a family history of Colorectal Cancer. J Racial Ethn Health Disparities. 2018;5(4):737–46.
33. Hirst A, Miller-Archie SA, Welch AE, Li J, Brackbill RM. Post-9/11 drug- and alcohol- related hospitalizations among World Trade Center Health Registry enrollees, 2003–2010. Drug Alcohol Depend. 2018;187:55–60.
34. DiMaggio C, Galea S, Li G. Substance use and misuse in the aftermath of Terrorism. A bayesian meta-analysis. Addiction. 2009;104(6):894–904.
35. Welch AE, Caramanica K, Maslow CB, Cone JE, Farfel MR, Keyes KM, et al. Frequent binge drinking five to six years after exposure to 9/11: findings from the World Trade Center Health Registry. Drug Alcohol Depend. 2014;140:1–7.
36. Welch AE, Caramanica Zweig K, McAteer JM, Brackbill RM. Intensity of binge drinking a Decade after the September 11th terror Attacks among exposed individuals. Am J Prev Med. 2017;52(2):192–8.
37. Flory K, Hankin BL, Kloos B, Cheely C, Turecki G. Alcohol and cigarette use and misuse among Hurricane Katrina survivors: psychosocial risk and protective factors. Subst Use Misuse. 2009;44(12):1711–24.
38. Cerdá M, Tracy M, Galea S. A prospective population based study of changes in alcohol use and binge drinking after a mass traumatic event. Drug Alcohol Depend. 2011;115(1–2):1–8.
39. Bor J, Basu S, Coutts A, McKee M, Stuckler D. Alcohol use during the great recession of 2008–2009. Alcohol Alcohol. 2013;48(3):343–8.
40. de Goeij MCM, Bruggink JW, Otten F, Kunst AE. Harmful drinking after job loss: a stronger association during the post-2008 economic crisis? Int J Public Health. 2017;62(5):563–72.
41. Knell G, Robertson MC, Dooley EE, Burford K, Mendez KS. Health Behavior Changes during COVID-19 pandemic and subsequent stay-at-home orders. Int J Environ Res Public Health. 2020;17(17):6268.
42. Sharma P, Ebbert JO, Rosedahl JK, Philpot LM. Changes in substance use among young adults during a Respiratory Disease pandemic. SAGE Open Med. 2020;8:2050312120965321.
43. Rehm J, Kilian C, Ferreira-Borges C, Jernigan D, Monteiro M, Parry CDH, et al. Alcohol use in times of the COVID 19: implications for monitoring and policy. Drug Alcohol Rev. 2020;39(4):301–4.
44. Oksanen A, Savolainen I, Savela N, Oksa R. Psychological stressors Predicting increased drinking during the COVID-19 Crisis: a Longitudinal National Survey Study of workers in Finland. Alcohol Alcohol. 2021;56(3):299–306.
45. Pomazal R, Malecki KMC, McCulley L, Stafford N, Schowalter M, Schultz A. Changes in Alcohol Consumption during the COVID-19 pandemic: evidence from Wisconsin. Int J Environ Res Public Health. 2023;20(7):5301.
46. Bloomfield K, Kilian C, Manthey J, Rehm J, Brummer J, Grittner U. Changes in Alcohol Use in Denmark during the initial months of the COVID-19 pandemic: further evidence of polarization of drinking responses. Eur Addict Res. 2022;28(4):297–308.
47. Vanderbruggen N, Matthys F, Van Laere S, Zeeuws D, Santermans L, Van den Ameele S, et al. Self-reported Alcohol, Tobacco, and Cannabis Use during COVID-19 Lockdown measures: results from a web-based survey. Eur Addict Res. 2020;26(6):309–15.
48. Del Boca D, Oggero N, Profeta P, Rossi M. Women's and men's work, housework and childcare, before and during COVID-19. Rev Econ Househ. 2020;18(4):1001–17.
49. Gulati N, Nanda C, Hora RK. COVID-19 and its impact on mental health as a function of gender, age, and income. Discov Ment Health. 2023;3(1):4.
50. Choi NG, DiNitto DM, Marti CN, Choi BY. Sociodemographic Characteristics and Health Status of Lifetime Abstainers, ex-drinkers, bingers, and Nonbingers among Baby boomers and older adults. Subst Use Misuse. 2016;51(5):637–48.
51. Kilian C, O'Donnell A, Potapova N, López-Pelayo H, Schulte B, Miquel L, et al. Changes in alcohol use during the COVID-19 pandemic in Europe: a meta-analysis of observational studies. Drug Alcohol Rev. 2022;41(4):918–31.

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