



Correlates of U.S. Young adults' awareness of alcohol use as a behavioral risk factor for cancer

Lauren Long^a, Mahmood A. Alalwan^b, Brittney Keller-Hamilton^a, Michael D. Slater^c, Darren Mays^{a,*}

^a Department of Internal Medicine, Wexner Medical Center, Center for Tobacco Research, The Ohio State University Comprehensive Cancer Center, 3650 Olentangy River Road, Suite 410/420, Columbus, OH 43214, United States

^b Division of Epidemiology, College of Public Health, The Ohio State University, Columbus, OH 43210, United States

^c School of Communication, The Ohio State University College of Arts and Sciences, Columbus OH 43210, United States

ARTICLE INFO

Keywords:

Alcohol
Tobacco
Cancer risk
Young adults

ABSTRACT

Although alcohol increases the risk of cancer, awareness of alcohol-related cancer risks is low. Alcohol use is prevalent among young adults, and understanding factors associated with awareness and perceptions of alcohol-related cancer risks in this group is critical for cancer prevention efforts. We examined the demographic, tobacco, and alcohol related correlates of young adults' awareness and perceptions of alcohol as a behavioral risk factor for cancer. We completed a secondary analysis of data collected in February 2020 in the U.S. from 1,328 young adults (ages 18–30) who completed a cross-sectional online survey. Participants reported (1) awareness of alcohol as a risk factor for cancer and (2) perceived risks of serious disease such as cancer. We analyzed demographic characteristics, alcohol use, and tobacco use associated with these outcome variables using multivariable regression. Overall, 18.5% of participants believed that alcohol does not increase cancer risk. Perceived cancer risk associated with alcohol use was moderate (M 3.2, SD 1.6, 1–7 scale). In multivariable analysis, awareness of risk was significantly higher among those with higher socioeconomic status. Perceived risk was significantly greater among those with higher socioeconomic status, higher alcohol consumption, and a history of tobacco use. These findings indicate research is warranted to better understand awareness of alcohol as a behavioral risk factor for cancer and associated beliefs in subgroups of young adults to help guide the development of interventions to raise awareness of the risks of cancer associated with alcohol use.

1. Introduction

Alcohol has been classified as a Group 1 carcinogen (the highest level of risk) by the International Agency for Research on Cancer since 1988 (Scheideler and Klein, 2018). Overall, alcohol use is estimated to account for 5.5% of cancer cases annually worldwide (LoConte et al., 2018; Praud et al., 2016). Although alcohol use increases the risk of many types of cancer including female breast, colorectal, liver, larynx, esophageal squamous cell carcinoma, oral cavity and pharynx (LoConte et al., 2018; Bagnardi et al., 2015), public awareness of the cancer risks associated with alcohol use remains low in the United States (Scheideler and Klein, 2018; Wiseman and Klein, 2019). Data from the American Institute for Cancer Research (AICR) Cancer Risk Awareness survey shows that awareness of alcohol use as a risk factor for cancer among U.S. adults increased from 33% in 2004 to 45% in 2019, but from 2013

(38%) to 2019 (45%) awareness has remained stable and relatively low overall (Scheideler and Klein, 2018; American Institute for Cancer Research, 2019). This stands in stark contrast to awareness of other cancer risk factors – for example, in the 2019 AICR Cancer Risk Awareness Survey, nearly 90% of Americans identified tobacco use as a behavioral risk factor for cancer (American Institute for Cancer Research, 2019).

Low awareness of alcohol as a risk factor for cancer possibly stems from a number of different factors, such as widespread social acceptability of alcohol consumption, other cancer-related beliefs (e.g., cancer fatalism, or the belief that everything causes cancer), and beliefs about the health benefits of alcohol (Scheideler and Klein, 2018; Wiseman and Klein, 2019; Hames, 2012). For example, many hold the belief that red wine consumption has cardio-protective effects (Scheideler and Klein, 2018), even though the supporting evidence behind these beliefs has

* Corresponding author.

E-mail addresses: mays.72@osu.edu, darren.mays@osumc.edu (D. Mays).

<https://doi.org/10.1016/j.pmedr.2022.101765>

Received 2 November 2021; Received in revised form 7 March 2022; Accepted 13 March 2022

Available online 15 March 2022

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been shown to be biased (LoConte et al., 2018; Klein et al., 2020). Consequently, much of the public possibly overestimates the health benefits of alcohol consumption on cardiovascular health (LoConte et al., 2018), and this may affect their beliefs about alcohol as a cancer risk factor as well. Although the research on U.S. adults' beliefs about alcohol as a risk factor for cancer remains limited overall, the existing evidence suggests that beliefs about health benefits of alcohol, cancer fatalism, and the normative acceptability of alcohol use possibly impact beliefs about alcohol cancer risks and may help guide the content of communication messages conveying alcohol and cancer risks as a strategy to increase awareness. However, communicating such messages also requires understanding to whom such messages should be directed. In particular, identifying demographic and behavioral variables associated with awareness of alcohol as a cancer risk factor and related beliefs is important to identify those who should be priority populations for informational interventions.

In 2017, the American Society of Clinical Oncology issued a position statement highlighting the need for public education about the cancer risks of alcohol consumption and research to inform awareness interventions (LoConte et al., 2018). The National Cancer Institute (NCI) has also highlighted the need for research addressing alcohol use as a behavioral risk factor for cancer and research on strategies to increase awareness, with an emphasis on research addressing co-use of alcohol and tobacco in youth and young adults (National Cancer Institute, 2020). Young adults are a priority population for this research area for several reasons. First, substance use behaviors become established during this developmental period (Villanti et al., 2019), making young adulthood a critical period for prevention efforts. Second, young adults are heavily exposed to alcohol marketing (Borzekowski et al., 2015; Center on Alcohol Marketing and Youth, 2006), and marketing exposure is associated with alcohol use (Jernigan et al., 2017; Finan et al., 2020). Third, although the research is limited, the available evidence indicates awareness of the cancer risks associated with alcohol use is low among young adults (Scheideler and Klein, 2018; Merten et al., 2017; Burak and Boone, 2008; Khushalani et al., 2020; Robb et al., 2009). Finally, alcohol use also commonly co-occurs with other cancer risk behaviors among young adults, including tobacco use (Cohn et al., 2015; Gubner et al., 2016). This pattern is especially concerning because alcohol and tobacco co-use further increases cancer risk (Prabhu et al., 2014; Marrero et al., 2005; Talamini et al., 2010; Mello et al., 2019; Hashibe et al., 2009; Corrao et al., 2004; Peters et al., 2006), and it highlights the need to better understand associations among tobacco use, alcohol use, and awareness of alcohol as a behavioral risk factor for cancer.

The goal of this study was to advance our understanding of young adults' awareness and beliefs about alcohol use as a behavioral risk factor for cancer by examining demographic and behavioral correlates of these outcomes. As noted above, this is an important initial step to understand demographic and behavioral factors associated with awareness to inform future research in this area and the development of interventions designed to increase awareness of alcohol as a risk factor for cancer (e.g., communication messaging) among young adults.

2. Methods

2.1. Participants & procedures

This is a secondary analysis of data collected for a study of tobacco related messaging. We recruited 1,328 young adult (ages 18–30) participants in February of 2020 through Qualtrics Online Sample, which provides access to online opt-in consumer panels for research studies and has been used in similar, prior studies (Banerjee et al., 2016; Guillery et al., 2016; Farris et al., 2018; Cataldo, 2016). Qualtrics Online Sample provides a non-representative national research panel of U.S. adults to participate in research surveys. Specific subgroups of participants can be targeted with survey invitations depending on eligibility and sampling needs for individual studies. Qualtrics uses rigorous data

quality measures in data collection and panel maintenance, including monitoring response patterns (e.g., straight line reporting, completion times) and digital fingerprinting and de-duplication to verify unique responses. For this study, Qualtrics invited potentially eligible participants to complete an anonymous online survey. Those interested proceeded to a brief eligibility screener and eligible persons were immediately taken to the online survey.

The parent study recruited a sample that included approximately equal numbers of young adult cigarette smokers and non-smokers using recruitment quotas. To accomplish this, at eligibility screening, we assessed age and smoking status using valid items. Cigarette smokers were those who reported smoking at least 100 lifetime cigarettes and now smoke every day or some days (Cornelius et al., 2020). We enrolled participants on a rolling basis until the recruitment quotas for cigarette smokers and non-smokers were filled. Participants completing all study procedures received a small monetary reward from Qualtrics. The host institutions' review boards approved all study procedures.

2.2. Measures

We measured demographic characteristics including age, sex, race, and ethnicity, as well as objective and subjective socioeconomic status (SES) indicators such as education, employment (Cornelius et al., 2020), and subjective financial situation (SFS). SFS is a valid measure of overall SES that has shown to be a stronger predictor of health-related outcomes in young adults than traditional SES measures (Williams et al., 2017). SFS was measured by asking participants: "Considering your own income and the income from any other people who help you, how would you describe your overall financial situation?" Response options included "Don't meet basic expenses," "Just meet basic expenses," "Meet needs with little left," and "Live comfortably." We measured cigarette smoking at eligibility screening (described above) and captured past 30-day use of other combustible tobacco (cigars, little cigars, cigarillos, waterpipe), smokeless tobacco, and electronic cigarettes. We measured past 30 day alcohol use and, among those who reported drinking alcohol in the past 30 days, number of drinks per drinking day. For analyses, we used a recoded variable for average drinks per drinking day where those who had not drunk alcohol in the past 30 days were coded as zero.

We assessed two outcome variables: awareness of alcohol as a risk factor for cancer and perceived risks of cancer and other diseases from drinking alcohol, with a single item each. We measured awareness with an item from the NCI's 2003 Health Information National Trends Survey (HINTS) asking, "Do you think drinking a lot of alcoholic beverages increases a person's chances of getting cancer a lot, a little, or not at all?" For analyses, we compared those reporting a lot or a little (Aware) to those reporting not at all (Not Aware). To measure perceived risk, we asked "What do you think would be your chance of getting a serious disease such as cancer from drinking a lot of alcoholic beverages?" Response options ranged from 1 (no chance) to 7 (certain to happen), and we analyzed this as a continuous variable.

2.3. Statistical analysis

We used descriptive statistics to characterize the sample and bivariate analyses to examine demographic, alcohol, and tobacco-related variables associated with awareness and perceived risk of alcohol use and cancer. Then, we created two multivariable models. For awareness, we used logistic regression to examine correlates of those who were aware (i.e., responded a little or a lot) compared to those who were not aware (i.e., responded not at all) that alcohol is a risk factor for cancer. We also analyzed the awareness outcome using multinomial logistic regression comparing those who responded a little or a lot as separate categories to those who responded not at all. This analytic approach did not produce appreciably different results, so we report results for the binary logistic regression. For perceived risk, we used a linear regression model to examine multivariable correlates. There was minimal missing

data (<1% for any given variable), so we used list-wise deletion of missing data in analyses.

3. Results

3.1. Participant characteristics

In total, 2,717 individuals completed eligibility screening, 209 (9.6%) were ineligible, 1,141 (42.0%) met eligibility criteria but were excluded because recruitment quotas were filled, 39 (1.4%) were removed in data quality checks, and 1,328 (48.9%) were eligible and completed study procedures. By design, the sample included approximately equal proportions of cigarette smokers (49.1%) and non-smokers (50.9%). Overall, 71.9% of participants reported drinking alcohol in the past month; in the sample, the average number of drinks/drinking day was 3.2 (SD 4.7) including non-drinkers and was 4.4 (SD 5.0) excluding non-drinkers. Participants averaged 26.0 (SD 3.1) years of age, 58.9% were female, 58.5% white race, 16.5% Hispanic ethnicity, and 31.4% reported high school education or less. With respect to subjective financial situation, nearly half of participants reported they don't meet basic expenses (8.1%) or just meet basic expenses (35.9%; Table 1). Table 1 shows complete characteristics of the sample.

3.2. Awareness of alcohol as a cancer risk factor

Overall, 18.5% of participants indicated alcohol does not increase the risk of cancer, 54.3% indicated alcohol increases cancer risk a little, and 27.3% indicated alcohol increases cancer risk a lot (Table 1). Bivariate analyses comparing those who were not aware to those who were are shown in Table 2. Those who were not aware were significantly more likely ($p < .05$) to have a high school education or less, and to be unemployed/part time employed. Those who were not aware were less likely to report they meet needs with little left (24.1% vs. 33.1%) and more likely to report that they do not meet basic expenses (12.2% vs. 7.2%; Table 2). Awareness was associated with all tobacco use behaviors assessed, where those who reported tobacco use were significantly more likely to be aware than those who did not report tobacco use (Table 2). People who drank more alcoholic drinks per day were also more likely to be aware of alcohol's cancer risks.

Results of the multivariable analysis are shown in Table 3. Those with a college degree or higher (vs. those with less education) had greater odds of being aware of alcohol as a risk factor for cancer (Odds Ratio [OR] = 1.56, 95% Confidence Interval [CI] = 1.13, 2.15). Those who reported meeting needs with little left had greater odds of being aware of alcohol's cancer risk than those who live comfortably (OR 1.65, 95% CI 1.11, 2.47).

3.3. Perceived risk of diseases such as cancer from alcohol use

The average perceived risk for diseases such as cancer due to alcohol use was moderate (M 3.2, SD 1.6, 1–7 scale). Perceived risk was significantly ($p < .05$) greater among males, those who were employed full time, those with a household income >\$35,000 annually, and those with higher subjective financial situation (Table 2). Perceived risk was associated with all tobacco use behaviors assessed where those who reported tobacco use reported significantly higher perceived risk of a serious disease such as cancer than those who did not report tobacco use (Table 2).

Results of the multivariable analysis are shown in Table 3. Compared with those who live comfortably, those who reported they just meet basic expenses ($B = -0.25$, 95% CI = $-0.49, -0.01$) or don't meet basic expenses ($B = -0.39$, 95% CI = $-0.76, -0.02$) reported lower perceived risk. Perceived risk was significantly higher among cigarette smokers, other combustible tobacco users, and smokeless tobacco users compared with those who did not use these tobacco products (Table 3). Greater average drinks per drinking day was modestly but significantly

Table 1
Sample characteristics (n = 1328).

	% (n)	M (SD)
Age		26.0 (3.1)
Sex		
Male	41.1% (546)	
Female	58.9% (782)	
Race		
Black/African American	15.1% (206)	
White	68.5% (909)	
Other Non-white	16.4% (219)	
Ethnicity		
Hispanic	16.5% (219)	
Non-Hispanic	83.5% (1109)	
Highest Education		
High School or Less	31.4% (417)	
College Degree or Higher	68.6% (911)	
Employment		
Unemployed/Part Time Employed	47.5% (631)	
Full-Time Employed	52.5% (697)	
Annual Income		
\$35,000 or less	44.4% (590)	
>\$35,000	55.6% (738)	
Subjective Financial Situation		
Don't Meet Basic Expenses	8.1% (104)	
Just Meet Basic Expenses	35.9% (476)	
Meet Needs With Little Left	31.5% (418)	
Live Comfortably	24.4% (324)	
Current Cigarette Smoker		
Yes	49.1% (652)	
No	50.9% (676)	
Other Combustible Tobacco User		
Yes	48.6% (645)	
No	51.4% (683)	
Smokeless Tobacco User		
Yes	14.1% (187)	
No	85.9% (1141)	
E-Cigarette User		
Yes	37.1% (493)	
No	62.9% (835)	
Current Alcohol Use		
Yes	71.9% (955)	
No	28.1% (373)	
Average Drinks/Drinking Day (Including Non-Drinkers)		3.2 (4.7)
Average Drinks/Drinking Day (Excluding Non-Drinkers)		4.4 (5.0)
Awareness of Alcohol as a Cancer Risk Factor		1.9 (0.7)
No Risk At All	18.5% (245)	
A Little Risk	54.3% (729)	
A Lot of Risk	27.3% (362)	
Perceived Cancer Risk of Alcohol		3.2 (1.6)

associated with greater perceived risk ($B = 0.06$, 95% CI = 0.04, 0.08).

4. Discussion

This study examined the demographic, alcohol, and tobacco related correlates of young adults' awareness of alcohol as a risk factor for cancer and perceived risks of developing a serious disease such as cancer due to alcohol use. The findings indicate the majority of participants endorsed some level of awareness of alcohol as a risk factor for cancer, and awareness is independently associated with socioeconomic characteristics of higher education and subjective financial situation of meeting needs with little left. We also found the average perceived risk of developing a serious disease such as cancer due to alcohol use was moderate overall. Perceived risk was lower among those reporting a lower subjective financial situation, non-tobacco users, and lower alcohol consumption.

Similar to prior studies (Scheideler and Klein, 2018), we found that tobacco use was not independently associated with awareness of alcohol

Table 2
Bivariate Associations with Awareness and Perceived Risk of Alcohol Use and Cancer.

	Awareness % (N) or M (SD)			Perceived Risk M (SD) or r	
	Not Aware	Aware	P		P
Age*	26.2 (3.0)	26.0 (3.1)	0.346	-0.00	0.950
Sex			0.696		0.005
Male	40.0 (98)	41.4 (448)		3.3 (1.7)	
Female	60.0 (147)	58.6 (635)		3.1 (1.6)	
Race			0.579		0.062
Black/African American	17.1 (42)	14.6 (158)		3.4 (1.8)	
White	67.4 (165)	68.7 (144)		3.1 (1.6)	
Other Non-white	15.5 (38)	16.7 (181)		3.1 (1.6)	
Ethnicity			0.303		0.693
Hispanic	14.3 (35)	17.0 (184)		3.1 (1.7)	
Non-Hispanic	85.7 (210)	83.0 (899)		3.2 (1.6)	
Highest Education			<0.001		0.201
High School or Less	40.4 (99)	29.4 (318)		3.1 (1.7)	
College Degree or Higher	59.6 (146)	70.6 (765)		3.2 (1.6)	
Employment			0.009		0.001
Unemployed/Part Time Employed	55.1 (135)	45.8 (496)		3.0 (1.6)	
Full-Time Employed	44.9 (11)	54.2 (587)		3.3 (1.7)	
Annual Income			0.061		0.001
\$35,000 or less	49.8 (122)	43.2 (468)		3.0 (1.6)	
>\$35,000	50.2 (123)	56.8 (615)		3.3 (1.7)	
Subjective Financial Situation			0.009		0.003
Don't Meet Basic Expenses	12.2 (30)	7.2 (78)		2.8 (1.8)	
Just Meet Basic Expenses	36.3 (89)	35.8 (387)		3.1 (1.5)	
Meet Needs With Little Left	24.5 (60)	33.1 (358)		3.2 (1.6)	
Live Comfortably	26.9 (66)	23.9 (258)		3.4 (1.8)	
Current Cigarette Smoker			0.110		<0.001
Yes	44.5 (109)	50.1 (543)		3.5 (1.6)	
No	55.5 (136)	49.9 (540)		2.8 (1.6)	
Other Combustible Tobacco User			0.005		<0.001
Yes	40.4 (99)	50.4 (546)		3.6 (1.7)	
No	59.6 (146)	49.6 (537)		2.8 (1.5)	
Smokeless Tobacco User			0.003		<0.001
Yes	8.2 (20)	15.4 (167)		3.9 (1.7)	
No	91.8 (225)	84.6 (916)		3.0 (1.6)	
E-Cigarette User			0.002		<0.001
Yes	28.6 (70)	39.1 (423)		3.6 (1.7)	
No	71.4 (175)	60.9 (660)		2.9 (1.6)	
Average Drinks/Drinking Day*	2.5 (4.3)	3.3 (4.8)	0.016	0.28	<0.001

Note: For age and average drinks/drinking day, values displayed are *M (SD)* for awareness and Pearson's correlation coefficient (*r*) for perceived risks. These variables are denoted with * in the table.

Table 3
Multivariable analysis of awareness and perceived risk of alcohol use and cancer.

	Awareness OR (95% CI)	Perceived Risk B (95% CI)
Age	0.97 (0.92, 1.02)	0.01 (-0.03, 0.03)
Sex		
Male	0.92 (0.68, 1.23)	0.04 (-0.14, 0.21)
Female	Ref.	Ref.
Race		
Black/African American	0.85 (0.56, 1.26)	0.23 (-0.01, 0.49)
White	Ref.	Ref.
Other Non-white	1.01 (0.72, 1.44)	0.11 (-0.12, 0.35)
Ethnicity		
Hispanic	1.09 (0.73, 1.64)	-0.15 (-0.38, 0.08)
Non-Hispanic	Ref.	Ref.
Highest Education		
High School or Less	Ref.	Ref.
College Degree or Higher	1.56 (1.13, 2.15)	0.06 (-0.13, 0.26)
Employment		
Unemployed/Part Time Employed	Ref.	Ref.
Full-Time Employed	1.21(0.88, 1.67)	-0.03 (-0.22, 0.16)
Annual Income		
\$35,000 or less	Ref.	Ref.
>\$35,000	1.03 (0.74, 1.44)	0.08 (-0.11, 0.28)
Subjective Financial Situation		
Don't Meet Basic Expenses	0.93 (0.53, 1.64)	-0.39 (-0.76, -0.02)
Just Meet Basic Expenses	1.32 (0.89, 1.96)	-0.25 (-0.49, -0.01)
Meet Needs With Little Left	1.65 (1.11, 2.47)	-0.14 (-0.37, 0.09)
Live Comfortably	Ref.	Ref.
Current Cigarette Smoker		
Yes	0.96 (0.67, 1.40)	0.24 (0.02, 0.46)
No	Ref.	Ref.
Other Combustible Tobacco User		
Yes	1.21 (0.85, 1.39)	0.35 (0.14, 0.56)
No	Ref.	Ref.
Smokeless Tobacco User		
Yes	1.67 (0.98, 2.51)	0.33 (0.07, 0.60)
No	Ref.	Ref.
E-Cigarette User		
Yes	1.24 (0.85, 1.82)	0.13 (-0.08, 0.36)
No	Ref.	Ref.
Average Drinks/Drinking Day	1.02 (0.98, 1.06)	0.06 (0.04, 0.08)

use as a cancer risk factor. However, we found that perceived risk of developing a serious disease such as cancer due to alcohol consumption was significantly higher among cigarette smokers, other combustible tobacco users, and smokeless tobacco users relative to non-users. This could be because tobacco users have a higher perceived cancer risk in general owing to their behavioral exposure (Honda and Neugut, 2004), and this belief extends to alcohol use. Beliefs about cancer have also been found to be associated with awareness outcomes in similar prior studies. For example, data from the 2017 HINTS survey showed that those who reported stronger beliefs that everything causes cancer (i.e., cancer fatalism) and those who reported cancer information seeking were significantly more likely to be aware that alcohol is a risk factor for cancer (Wiseman and Klein, 2019). In contrast, cancer worry and the belief that there is little you can do to decrease cancer risk were not significantly associated with awareness (Wiseman and Klein, 2019). This suggests our observed associations between tobacco use, alcohol consumption, and higher perceived risk could be influenced by beliefs such as cancer fatalism among those who use tobacco or consume alcohol, making them more likely to endorse the risks. In future studies, it will be important to investigate the intersection of alcohol and tobacco use among young adults, and associations with cancer-related beliefs that may be candidates for preventive intervention.

Notably, measurement differences between our study and prior research may affect how our findings compare to other studies. For

example, our awareness item was from a version of NCI's HINTS survey that did not include a "don't know" response option. Data from the 2017 HINTS survey examining awareness of alcohol as a risk factor for cancer showed that 36% of U.S. adults indicated "don't know" responses, while 38% responded with a definitive "yes" and 25% with "no" (Wiseman and Klein, 2019). In the 2017 HINTS study, younger adults were less likely than older adults to report "don't know," although 26% of adults aged 18–39 chose "don't know" as a response option (Wiseman and Klein, 2019). Therefore, our measure may have overestimated awareness of alcohol as a risk factor for cancer by using forced response options and excluding the "don't know" response option. Despite this difference in measurement, our multivariable analyses similarly showed that there were few associations between demographic and tobacco-related characteristics and awareness of alcohol as a risk factor for cancer consistent with prior analyses (Wiseman and Klein, 2019). However, one notable difference is that our study demonstrated an association between education and awareness. This finding could be due to sample differences (e.g., our study focused on younger adults who may still be completing their education), differences in covariates examined, or differences in the awareness items used (Wiseman and Klein, 2019). Future research to further characterize predictors of awareness and risk perceptions using items with a "don't know" response will be useful to identify optimal measurement approaches.

Our results also showed that awareness and perceived risk varied based on socioeconomic factors. Awareness was lower among those with less education and lower subjective financial situation, and perceived risk was lower among those with a lower subjective financial situation. This finding diverges somewhat from prior evidence, which suggested awareness is not associated with factors such as education (Scheideler and Klein, 2018). Although evidence indicates alcohol consumption is higher in those of higher socioeconomic status, adverse health outcomes from alcohol use disproportionately affect those of lower socioeconomic status (Collins, 2016). Research to further examine how alcohol use and perceptions of alcohol-related cancer risk differ by young adults' socioeconomic status is warranted to guide interventions targeted to populations at high-risk.

4.1. Limitations

The study findings should be interpreted in light of important limitations. We used an online convenience sample of young adults, and generalizability of the findings to young adults nationally and to other populations is limited. Replication in representative samples will be important. We used two self-report items to capture awareness of alcohol as a risk factor for cancer and perceived risk, respectively. In prior studies, respondents are more likely to identify alcohol as a risk factor (i.e., awareness) when given a predetermined list of possible risk factors and asked to indicate their choices versus when asked to list risk factors in an open-ended response (Scheideler and Klein, 2018). Our measure of awareness also did not include a "don't know" response option, which is a notable limitation given recent research indicating that many U.S. adults, including younger adults, chose this option when awareness of alcohol as a cancer risk factor was assessed (Wiseman and Klein, 2019). As noted above, our measurement approach likely produced higher levels of awareness than other published studies. Awareness outcomes may also have been impacted by the order of survey items since our perceived risk measure was asked prior to assessing awareness. Our perceived risk measure was a relatively broad item, and although our findings provide insights into young adults' perceived risk of a serious disease such as cancer from alcohol use, future work using multi-item measures of perceived risks and items that capture perceived risks of specific cancers associated with alcohol consumption is needed.

5. Conclusions

By identifying correlates of awareness and perceived risk of cancer

due to alcohol use, the current study is an important first step to understanding how we can develop interventions to raise awareness and encourage cancer preventive behavior change. The study findings indicate that awareness and perceived risk were lower among lower socioeconomic status young adults, while awareness and perceived risks were higher with more alcohol consumption and with tobacco use. These findings indicate research is warranted to better understand awareness of alcohol as a behavioral risk factor for cancer and associated beliefs in subgroups of young adults to help guide the development of interventions to raise awareness of the risks of cancer associated with alcohol use.

CRediT authorship contribution statement

Lauren Long: Formal analysis, Writing – original draft, Writing – review & editing. **Mahmood A. Alalwan:** Formal analysis, Writing – review & editing. **Brittney Keller-Hamilton:** Writing – review & editing. **Michael D. Slater:** Writing – review & editing. **Darren Mays:** Conceptualization, Funding acquisition, Data curation, Investigation, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Funding Sources: Data collection was supported by a pilot award under grant number P30CA051008 from the National Cancer Institute of the National Institutes of Health. The sponsor had no role in the study design; in the collection, analysis, or interpretation of the data; in the writing of the report; or in the decision to submit the manuscript for publication.

Human Rights: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Georgetown University and Ohio State University Institutional Review boards.

Welfare of Animals: This article does not contain any studies with animals performed by any of the authors.

Transparency Statements

Registration: This is a secondary analysis of data from a larger investigation, so the study was not formally pre-registered.

Analytic Plan: This is a secondary analysis of data from a larger investigation, so the analytic plan was not formally pre-registered.

Data Availability: De-identified data from this study are not available in a public archive. De-identified data will be made available according to institutional IRB standards by emailing the corresponding author.

Analytic Code Availability: Analytic code used to conduct the analyses presented in this study are not available in a public archive. They will be made available by emailing the corresponding author.

Materials Availability: Materials used to conduct the study are not publicly available. They will be made available by emailing the corresponding author.

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