



Short Communication

Global prevalence and content of information about alcohol use as a cancer risk factor on Twitter

Andy J. King^{a,b,*}, Natalie M. Dunbar^c, Drew Margolin^d, Rumi Chunara^{e,f}, Chau Tong^d, Lea Jih-Vieira^d, Cindy B. Matsen^{a,g}, Jeff Niederdeppe^{d,h}

^a Cancer Control & Population Sciences, Huntsman Cancer Institute, Salt Lake City, UT, USA

^b Department of Communication, University of Utah, Salt Lake City, UT, USA

^c Greenlee School of Journalism and Communication, Iowa State University, Ames, IA, USA

^d Department of Communication, Cornell University, Ithaca, NY, USA

^e Department of Biostatistics, New York University, New York City, NY, USA

^f Department of Computer Science & Engineering, New York University, New York City, NY, USA

^g Department of Surgery, University of Utah, Salt Lake City, UT, USA

^h Jeb E. Brooks School of Public Policy, Cornell University, Ithaca, NY, USA

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ABSTRACT

Objectives: Alcohol use is a major risk factor for several forms of cancer, though many people have limited knowledge of this link. Public health communicators and cancer advocates desire to increase awareness of this link with the long-term goal of reducing cancer burden. The current study is the first to examine the prevalence and content of information about alcohol use as a cancer risk on social media internationally.

Methods: We used a three-phase process (hashtag search, dictionary-based auto-identification of content, and human coding of content) to identify and evaluate information from Twitter posts between January 2019 and December 2021.

Results: Our hashtag search retrieved a large set of cancer-related tweets ($N = 1,122,397$). The automatic search process using an alcohol dictionary identified a small number of messages about cancer that also mentioned alcohol ($n = 9061$, 0.8%), a number that got small after adjusting for human coded estimates of the dictionary precision ($n = 5927$, 0.5%). When cancer-related messages also mentioned alcohol, 82% ($n = 1003$ of 1225 examined through human coding) indicated alcohol use as a risk factor. Coding found rare instances of problematic information (e.g., promotion of alcohol, misinformation) in messages about alcohol use and cancer.

Conclusions: Few social media messages about cancer types that can be linked to alcohol mention alcohol as a cancer risk factor. If public health communicators and cancer advocates want to increase knowledge and understanding of alcohol use as a cancer risk factor, efforts will need to be made on social media and through other communication platforms to increase exposure to this information over time.

1. Introduction

Alcohol use is a modifiable risk factor for cancer and is estimated to account for 4.1% of cancer cases globally (Rumgay et al., 2021). One cancer advocacy organization notes, “alcohol [use] is the strongest modifiable risk factor for cancer after tobacco use and excess body weight.” (American Institute for Cancer Research, 2022) Alcohol use is associated with increased risk for several cancer types (National Cancer Institute, 2021) (e.g., breast, colorectal, liver, oral, and esophageal), though, for example, less than one-third of Americans know that alcohol

consumption increases overall cancer risk (American Society of Clinical Oncology, 2019; Kiviniemi et al., 2021; Seidenberg et al., 2022). Cancer advocacy organizations have signaled that improving communication about the alcohol use-cancer link is a priority (American Institute for Cancer Research, 2022; National Cancer Institute, 2021), though at present no research examines how often or what type of risk information is most likely to be encountered by individuals about the link in the public communication environment (PCE) like social media. The current study addresses this gap in the research by examining what type of information related to the alcohol-cancer risk link is present in social

* Corresponding author at: Huntsman Cancer Institute/University of Utah, 2000 Circle of Hope Drive, Salt Lake City, UT 84112, USA.

E-mail address: andy.king@utah.edu (A.J. King).

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media messages (tweets) about five different cancer types via relevant hashtags: #breastcancer, #coloncancer, #esophagealcancer, #livercancer, and #oralcancer. Our study provides an initial evaluation of the prevalence and content of risk-related information about the cancer-alcohol link on Twitter, with the goal of using this knowledge to aid future communication and education efforts to increase public awareness and understanding of the alcohol use-cancer risk link. Our main research question is: what is the prevalence and content of alcohol-related content appearing in cancer-related messages on Twitter?

2. Methods

This study was based on publicly available data and was assessed as exempt by an institutional review board. We used a three-step process to identify and evaluate relevant messages from the PCE. In step one, we used a hashtag approach (#breastcancer, #coloncancer, #esophagealcancer, #livercancer, and #oralcancer) to identify messages (tweets) about five cancer types where alcohol use is known to be a modifiable risk factor over a three-year period, from January 2019 through December 2021. We selected a three-year period for our search to account for any unknown or hard to detect increases or decreases in relevant content related to secular, seasonal, or event-related trends. A hashtag search provides a lower bound baseline of relevant content that can be augmented with, and inform, future queries and searches for relevant information. This approach is commonly used in health risk communication research (Naganathan et al., 2022; Park et al., 2021; Patel et al., 2022; Ricklefs et al., 2016).

In step two, we used a dictionary-based approach to identify alcohol-related content in the messages with cancer hashtags. We created a composite dictionary of 208 alcohol-related terms based on past computational research about alcohol use in social media (Huang et al., 2017; Pang et al., 2015; Ricard and Hassanpour, 2021). This approach automatically detected alcohol-related terminology appearing within the larger tweet set. We then trained human coders to assess the precision of the approach (e.g., the percentage of automatically identified tweets that the dictionary had properly identified as relevant to alcohol and cancer) to adjust estimates accordingly and provide messages known to be relevant for further human coding. Two human coders (authors blinded), talked through coding procedures, developed a set of coding rules and, after a practice round, examined a random subset of tweets ($n = 120$) that had been automatically identified by the alcohol dictionary to determine precision. Coders were reliable in assessing relevance (Krippendorff's $\alpha = 0.96$). One coder then examined an additional random set of tweets ($n = 1787$) for #breastcancer, #coloncancer, and #livercancer to identify 300 relevant tweets for content dimension analysis, as well as all relevant tweets for #esophagealcancer and #oralcancer.

In step three, human coders analyzed relevant tweets to determine if messages mentioned (1) alcohol use as a cancer risk factor (including being a cause of cancer or leading to more cancer cases), (2) alcohol use guidelines, suggestions limiting use, or some other harm reduction or cessation message, (3) multiple cancer types mentioned, and (4) problematic information (e.g., encouraging alcohol consumption of any kind, downplaying the alcohol use-cancer link, inaccurate or confusing content about alcohol-cancer link). Two coders examined 10% of each hashtag set and were reliable (Krippendorff's α for risk = 0.79, for moderation or harm reduction = 0.82, for other cancers = 0.86, and for problem content = 0.78). One coder then examined remaining tweets presented in the results.

3. Results

Our automated hashtag search identified over one million ($N = 1,122,397$) tweets between January 2019 and December 2021. #breastcancer produced the most messages ($n = 853,352$), followed by #coloncancer ($n = 194,204$, which included #colorectalcancer),

Table 1
Prevalence and content of alcohol-related content within cancer hashtag messages.

	Automated content classification approach (step 2)				Human content coding approach (step 3)									
	# tweets	Auto-identified alcohol tweets	Auto-identified alcohol content prevalence estimate	Human coding-adjusted count of alcohol content	Human coding-adjusted alcohol content prevalence estimate	Precision	Risk (#)	Risk (%)	Guidelines (#)	Guidelines (%)	Other cancers (#)	Other cancers (%)	Problem (#)	Problem (%)
#breastcancer	853,352	6747	0.8%	4318	0.5%	64%	217	72%	83	28%	23	8%	54	18%
#coloncancer	194,204	931	0.5%	493	0.3%	53%	227	76%	94	31%	41	14%	14	5%
#esophagealcancer	15,063	132	0.9%	114	0.8%	86%	108	95%	4	4%	48	42%	3	3%
#livercancer	48,226	1015	2.1%	792	1.6%	78%	256	85%	62	21%	53	18%	14	5%
#oralcancer	11,552	236	2.0%	210	1.8%	89%	195	92%	57	27%	12	7%	6	3%
Total	1,122,397	9061	0.8%	5927	0.5%	65%	1003	82%	300	24%	177	14%	91	7%

The total # of tweets refer to all tweets for the five specified hashtags (including #colorectalcancer within #coloncancer) from January 2019 through December 2021. Auto-identified alcohol tweets refers to the subset of tweets flagged by the dictionary approach and the alcohol content prevalence estimate is the auto-identified tweets divided by the total tweets from the hashtags. Human coding-adjusted counts multiply the precision by the auto-identified alcohol tweet prevalence estimate. For the human content coding approach (Step 3), 1225 tweets (in total) were evaluated for the analysis reported in this table ($n = 300$ for #breastcancer, #coloncancer, and #livercancer; $n = 114$ for #esophagealcancer and $n = 211$ for #oralcancer). Percentages within cancer hashtag rows refer to the count divided by the total tweets evaluated in the analysis. Risk (#) = count of tweets mentioning alcohol use as a cancer risk factor; Risk (%) = count divided by tweets evaluated for a hashtag; Guidelines = alcohol use guidelines, suggestions of limiting use, or some other harm reduction or cessation message by (#) count and (%) proportion; Other Cancers = mention of a cancer other than the cancer hashtag within the message by (#) count and (%) proportion; Problem = potentially problematic content in the message by (#) count and (%) proportion.

Table 2
Content examples by category and cancer site hashtag.

Cancer site hashtag	Risk	Guidelines/limiting use	Other cancers	Problematic
#breastcancer	Over the next ten years drinking alcohol will reportedly lead to a 13% increase in #breastcancer cases in premenopausal women. <i>(only coded for risk)</i>	October is #breastcancer awareness month. Definitely avoid any alcoholic beverages. <i>(only coded for guidelines/limiting use)</i>	There is strong evidence that drinking alcohol increase the risk of mouth pharynx and larynx cancers esophageal cancer, #breastcancer, colorectal cancer, stomach cancer liver cancer. Find out more. #alcoholawareness <i>(also coded for risk)</i>	Enjoy wine tasting and desserts and hear from researchers who are among those leading the charge to find a cure for #breastcancer. <i>(only coded for problematic)</i>
#coloncancer	March is #colorectalcancer awareness. Reduce your risk by avoiding alcohol and tobacco. <i>(also coded for guidelines/limiting use)</i>	Reduce your risk of #coloncancer. Eat a variety of fruits, veggies, and whole grains. Drink alcohol in moderation. Stop smoking. Exercise and maintain a healthy weight. #colorectalcancer <i>(also coded for risk)</i>	A new report highlights link between alcohol use and some common cancers (e.g., #breastcancer, #colorectalcancer). Health warnings on alcoholic beverages could raise awareness of harm. <i>(also coded for risk)</i>	It's 5:00 somewhere. Getting ready to have some cocktails. #colorectalcancer #checkyourcolon <i>(only coded for problematic)</i>
#esophagealcancer	New dietary guidelines for Americans ignore critical evidence on alcohol and cancer. Intake of even less than one drink per day elevates the risk for several cancer types including #esophagealcancer. <i>(only coded for risk)</i>	#esophagealcancer occurs in the esophagus (a long tube that runs from the throat to stomach). It usually begins inside the esophagus and spreads to the outer layers as it grows. Avoiding tobacco in all forms and alcohol. Watching your diet and weight can reduce risk for this disease. <i>(also coded for risk)</i>	There is a strong scientific consensus that drinking alcohol can cause several types of cancer including head and neck cancer, #esophagealcancer, #livercancer, breast cancer, and colorectal cancer. <i>(also coded for risk)</i>	Thank you for donating a bottle of wine and gift card for our annual event for esophageal cancer awareness and research coming up soon. #esophagealcancer <i>(only coded for problematic)</i>
#livercancer	Considering alcoholism is a big LGBTQIA issue: Alcohol use was linked to 7000 news cases of cancer in 2020. This includes 24% of #breastcancer, 20% of #coloncancer, 15% of #rectalcancer, and 13% of #oralcancer and #livercancer. <i>(also coded for other cancers)</i>	October is liver cancer awareness month. To reduce #livercancer risk: Drink alcohol in moderation or not at all, maintain a healthy weight, get vaccinated for hepatitis B, take measures to prevent hepatitis C, and if you have hepatitis B or C seek treatment. <i>(also coded for risk)</i>	Almost 20,000 cases of cancer in France in 2020 were caused by drinking alcohol. #breastcancer, #colorectalcancer, and #livercancer were the cancer types most frequently caused by alcohol in France. <i>(also coded for risk)</i>	National survey shows that some populations are unaware of the risk factors for #livercancer. They wrongly attribute it to alcohol consumption and smoking, with only 23% of participants believing viral hepatitis can be its cause. <i>(also coded for risk)</i>
#oralcancer	April is #oralcancer awareness month. Avoiding tobacco and alcohol, getting the HPV vaccine, and opportunistic screenings are keys to early discovery and prevention. Be sure to follow us for more facts and information. <i>(also coded for guidelines/limiting use)</i>	India has 1 out of 3 oral cancer cases in the world. Tobacco and alcohol are the main cause of #oralcancer. If you have any signs mentioned below, visit a doctor. #quittobacco #quitalcohol <i>(also coded for risk)</i>	It is well known that smoking tobacco and consuming alcohol at the same time significantly increases the risk of many types of cancers, particularly #oralcancer. <i>(also coded for risk)</i>	Make sure to register for our virtual gala or you can sign up to host a viewing party with some wine. Get those wine glasses and gather your family and friends and join our community. #oralcancer #thyroidcancer <i>(also code for other cancers)</i>

Content examples are reworded for clarity and to avoid identification of users (i.e., location data is removed, some other hashtags used have been removed, etc.). In parenthetical italics (*example*), we provide information about other content dimensions (if any) for which the message was coded. Risk = content about alcohol use as a cancer risk factor (including being a cause of cancer or leading to more cancer cases), Guidelines/Limiting Use = alcohol use guidelines, suggestions limiting use, or some other harm reduction or cessation message, Other Cancers = multiple cancer types mentioned, and Problematic = problematic information (e.g., encouraging alcohol consumption of any kind, downplaying the alcohol use-cancer link, inaccurate or confusing content about alcohol-cancer link).

#livercancer ($n = 48,226$), #esophagealcancer ($n = 15,063$), and #oralcancer ($n = 11,552$).

The application of the alcohol dictionary to these tweets found that only 0.8% of messages ($n = 9061$) in the sample of over 1 million Twitter messages referenced alcohol at all. #breastcancer had the highest number of tweets mentioning alcohol ($n = 6747$, 0.8% within #breastcancer), while #livercancer ($n = 1015$, 2.1% within #livercancer) and #oralcancer ($n = 236$ tweets, 2.0% within #oralcancer) had the highest proportion of tweets with alcohol-related content. Tweets about alcohol-related content were proportionally lowest, similar to #breastcancer, for #coloncancer ($n = 931$, 0.5% within #coloncancer) and #esophagealcancer ($n = 132$, 0.9% within #esophagealcancer). The automated approach had varied precision across the five cancer hashtags (see Table 1).

Table 1 provides descriptive information related to the four content dimensions coded. Overall, there was considerable variability in how often different cancer hashtags included risk information. Content about alcohol use guidelines, suggestions of limiting use, or harm reduction appeared infrequently. Most messages featured only one type of cancer, though for #esophagealcancer, other cancers were mentioned in 42% of the messages ($n = 48$). That was due in part to a handful of messages appearing as retweets in the data. Across all cancer types, problematic

information was rare and usually the tweets in question were confusing in composition (e.g., obfuscating the alcohol-cancer link) or promoted consumption (e.g., saying one drink is ok or promoting drinking to celebrate cancer prevention). There were no major instances of misinformation identified. Problematic information did appear in #breastcancer messages more than any other hashtag. See examples of the four content dimensions in Table 2.

4. Discussion

The National Cancer Institute in the United States has identified public communication and awareness about the link between alcohol use and cancer to be an important research priority (National Cancer Institute, 2021). Past work indicates that only about 1 out of 3 Americans know alcohol use increases risk of cancer. Understanding how the public communication environment (PCE) presents relevant risk information on this topic will help us to determine why the alcohol-cancer link is relatively unknown and will aid in the development of messages to raise awareness of this link. Our results suggest one explanation for limited public awareness is that there is a lack of information about the alcohol-cancer link in one component of the PCE (posts on Twitter). While the few messages that do mention alcohol mention risk, the

overall proportion of alcohol-related cancer messages is extremely low.

Some limitations of our approach to analyzing the PCE merit discussion. While we examined three years of tweets, public discourse on alcohol as a risk factor for cancer has continued to evolve and there may have been changes in the prevalence of content in the years since our sampling ended. Additionally, while we were systematic in our approach to analyzing Twitter content, we only analyzed one social media platform. We do not know if the prevalence of such messages would be the same on other social media platforms (e.g., Facebook, TikTok, YouTube, etc.). Each platform has different audiences of most frequent users, which could influence the likelihood of certain content appearing. We also examined only some of the cancers linked to alcohol use and left out others (e.g., head/neck cancer and cancers of the pharynx and larynx). Data on additional cancer sites would provide useful information for planning future communication efforts.

Future research should investigate risk communication strategies, on social media platforms and throughout the public communication environment more broadly (e.g., using legacy media like TV and radio to reach audiences), to improve the public's knowledge and understanding of the link between alcohol use and cancer morbidity and mortality to promote harm reduction and reduced cancer burden. Past research provides evidence of clear benefits of mass media campaigns, internationally, to promote the alcohol-cancer link (Booth et al., 2023; Dixon et al., 2015; Martin et al., 2018). Additionally, more research on social media outlets could be increasingly important given patterns of early onset colorectal cancer (Pan et al., 2022) and the shifts in social media platform use by younger people (Vogels et al., 2022). Additional research on effective strategies to communicate about alcohol as a risk factor for cancer may help public health advocates improve communication interventions, increase the likelihood of their affecting downstream outcomes like reduced alcohol consumption, and help reduce cancer incidence and mortality attributable to alcohol use.

CRedit authorship contribution statement

Andy J. King: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Natalie M. Dunbar:** Methodology, Writing – review & editing. **Drew Margolin:** Conceptualization, Methodology, Data curation, Writing – review & editing, Supervision, Funding acquisition. **Rumi Chunara:** Conceptualization, Methodology, Writing – review & editing, Funding acquisition. **Chau Tong:** Methodology, Data curation, Supervision, Writing – review & editing. **Lea Jih-Vieira:** Data curation, Writing – review & editing. **Cindy B. Matsen:** Writing – review & editing. **Jeff Niederdeppe:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition.

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.

The authors have no conflicts of interest or financial disclosures for this submission.

Data availability

Data will be made available on request.

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References

- American Institute for Cancer Research, 2022. Most Americans Still Unaware that Alcohol is a Cause of Cancer. <https://aicr.org/news/most-americans-still-unaware-re-that-alcohol-is-a-cause-of-cancer/>. Published February 16, 2022. Accessed April 25, 2022.
- American Society of Clinical Oncology, 2019. National ASCO Survey Finds Major Gaps in Americans' Knowledge of Cancer Prevention, e-cigarettes, and End-of-Life care. <https://www.asco.org/about-asco/press-center/news-releases/national-asco-survey-finds-major-gaps-americans-knowledge/>.
- Booth, L., McCausland, T., Keric, D., Kennington, K., Stevens-Cutler, J., Scott, L., Pettigrew, S., 2023. Evaluating an alcohol harm-reduction campaign advising drinkers of the alcohol-cancer link. *Addict. Behav.* 145, 107760 <https://doi.org/10.1016/j.addbeh.2023.107760>.
- Dixon, H.G., Pratt, I.S., Scully, M.L., Miller, J.R., Patterson, C., Hood, R., Slevin, T.J., 2015. Using a mass media campaign to raise women's awareness of the link between alcohol and cancer: cross-sectional pre-intervention and post-intervention evaluation surveys. *BMJ Open* 5 (3), e006511. <https://doi.org/10.1136/bmjopen-2014-006511>.
- Huang, T., Eghafari, A., Relia, K., Chunara, R., 2017. High-resolution temporal representations of alcohol and tobacco behaviors from social media data. *Proc. ACM Hum. Comput. Interact.* 1 (CSCW), 54. <https://doi.org/10.1145/3134689>.
- Kiviniemi, M.T., Orom, H., Hay, J.L., Waters, E.A., 2021. Limitations in American adults' awareness of and beliefs about alcohol as a risk factor for cancer. *Prev. Med. Rep.* 23, 101433 <https://doi.org/10.1016/j.pmedr.2021.101433>.
- Martin, N., Buykx, P., Shevills, C., Sullivan, C., Clark, L., Newbury-Birch, D., 2018. Population level effects of a mass media alcohol and breast cancer campaign: a cross-sectional pre-intervention and post-intervention evaluation. *Alcohol Alcohol.* 53 (1), 31–38. <https://doi.org/10.1093/alcac/agx071>.
- Naganathan, G., Bilgen, I., Cleland, J., Reel, E., Cil, T., 2022. #COVID19 and #Breastcancer: a qualitative analysis of tweets. *Curr. Oncol.* 29 (11), 8483–8500. <https://doi.org/10.3390/curroncol29110669>.
- National Cancer Institute, 2021. Alcohol and Cancer Risk Fact Sheet – NCI. <https://www.cancer.gov/about-cancer/prevention/risk/alcohol/alcohol-fact-sheet/>. Published July 14, 2021. Accessed April 25, 2022.
- Pan, H., Zhao, Z., Deng, Y., Zheng, Z., Huang, Y., Huang, S., Chi, P., 2022. The global, regional, and national early-onset colorectal cancer burden and trends from 1990 to 2019: results from the global burden of disease study 2019. *BMC Public Health* 22 (1), 1896. <https://doi.org/10.1186/s12889-022-14274-7>.
- Pang, R., Baretto, A., Kautz, H., Luo, J., 2015. Monitoring adolescent alcohol use via multimodal analysis in social multimedia. *Proc. IEEE Int. Conf. Big Data.* 1 (Big Data), 1509–1518. <https://doi.org/10.1109/BigData.2015.7363914>.
- Park, S., Han, S., Kim, J., et al., 2021. COVID-19 discourse on twitter in four Asian countries: case study of risk communication. *J. Med. Internet Res.* 23 (3), e23272 <https://doi.org/10.2196/23272>.
- Patel, V.R., Gereta, S., Blanton, C.J., et al., 2022. #ColonCancer: social media discussion about colorectal cancer during the COVID-19 pandemic. *JCO Clin. Cancer Inform.* 6, e2100180 <https://doi.org/10.1200/CCI.21.00180>.
- Ricard, B.J., Hassanpour, S., 2021. Deep learning identification of alcohol-related content on social media (Reddit and twitter): exploratory analysis of alcohol-related outcomes. *J. Med. Internet Res.* 23 (9), e27314 <https://doi.org/10.2196/27314>.
- Ricklefs, C.A., Asdigian, N.L., Kalra, H.L., et al., 2016. Indoor tanning promotions on social media in six US cities #UVTanning #tanning. *Transl. Behav. Med.* 6 (2), 260–270. <https://doi.org/10.1007/s13142-015-0378-0>.
- Rumgay, H., Shield, K., Charvat, H., et al., 2021. Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study. *Lancet Oncol.* 22 (8), 1071–1080. [https://doi.org/10.1016/S1470-2045\(21\)00279-5](https://doi.org/10.1016/S1470-2045(21)00279-5).
- Seidenberg, A.B., Wiseman, K.P., Eck, R.H., et al., 2022. Awareness of alcohol as a carcinogen and support for alcohol control policies. *Am. J. Prev. Med.* 62 (2), 174–182. <https://doi.org/10.1016/j.amepre.2021.07.005>.
- Vogels, E.A., Gelles-Watnick, R., Massarat, N., 2022. Teens, Social Media and Technology 2022. Pew Research Center. <https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/>.