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How alcohol industry organisations mislead the public about alcohol and cancer

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Abstract

Introduction and Aims. *Alcohol consumption increases the risk of several types of cancer, including several common cancers. As part of their corporate social responsibility activities, the alcohol industry (AI) disseminates information about alcohol and cancer. We examined the information on this which the AI disseminates to the public through its 'social aspects and public relations organizations' and related bodies. The aim of the study was to determine its comprehensiveness and accuracy.* ***Design and Methods.*** *Qualitative analysis of websites and documents from 27 AI organisations. All text relating to cancer was extracted and analysed thematically.* ***Results.*** *Most of the organisations were found to disseminate misrepresentations of the evidence about the association between alcohol and cancer. Three main industry strategies were identified: (i) denial/omission: denying, omitting or disputing the evidence that alcohol consumption increases cancer risk; (ii) distortion: mentioning cancer, but misrepresenting the risk; and (iii) distraction: focussing discussion away from the independent effects of alcohol on common cancers. Breast cancer and colorectal cancer appeared to be a particular focus for this misrepresentation.* ***Discussion and Conclusions.*** *The AI appears to be engaged in the extensive misrepresentation of evidence about the alcohol-related risk of cancer. These activities have parallels with those of the tobacco industry. This finding is important because the industry is involved in developing alcohol policy in many countries, and in disseminating health information to the public, including schoolchildren. Policymakers, academics, public health and other practitioners should reconsider the appropriateness of their relationships to these AI bodies.* [Petticrew M, Maani Hessari N, Knai C, Weiderpass E. How alcohol industry organisations mislead the public about alcohol and cancer. *Drug Alcohol Rev* 2017]

Key words: alcohol, public health, cancer, corporate influences.

Introduction

Alcohol consumption is a well-established risk factor for a range of cancers, accounting for approximately 4% of new cancer cases annually [1,2]. The evidence of an association has been clear since the 1988 review by the International Agency for Research on Cancer (IARC), which reported an increased risk of oral cavity, pharynx, larynx, oesophagus and liver cancers [3]. In 2007, as more evidence became available, IARC added breast cancer and colorectal cancer to the list [4]. Since then the evidence has strengthened further, with at least 100 studies on alcohol and breast cancer alone [5], and the most comprehensive review of the evidence to date shows that the risk of breast cancer is increased even at low levels of consumption [6]. Both the most recent IARC review in 2012 [7] and the UK's Committee on Carcinogenicity review in 2016 [8] confirmed the increased risks of cancers of the mouth and throat, larynx, oesophagus, upper aerodigestive tract, breast, liver,

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colon and rectum and pancreas (see Table S1, Supporting information). There is little evidence of an association with ovarian and prostate cancer, though a recent meta-analysis has reported an increased risk of prostate cancer [9]. The evidence on other cancers remains unclear [7]. The Committee on Carcinogenicity concluded that the evidence that alcohol consumption reduces the risk of some cancers (including renal cell cancers, and cancers of the kidney, ovary, thyroid and lung) remains limited and inconsistent, and that the increased risk of other cancers as a result of drinking alcohol far outweighs any possible decreased risk [8]. The weight of scientific evidence is therefore clear that drinking increases the risk of some of the most common cancers [10].

The relationship between alcohol consumption and cancer has been disputed by the alcohol industry (AI) and its affiliated organisations [11]. At the same time many AI-funded organisations, most commonly 'social aspects and public relations organizations' (SAPROs), disseminate health information with the stated intention of informing consumers and encouraging 'responsible drinking' [12]. Such organisations are portrayed as delivering on the AI's corporate social responsibility (CSR) goals, but it has been argued that these organisations' activities are in fact aimed at maintaining profits by promoting ineffective interventions, misrepresenting the evidence, and attempting to influence public perceptions in ways that favour industry interests [12].

This study analysed the information on cancer which is disseminated by AI SAPROs and similar organisations. We aimed to determine the extent to which they fully and accurately communicate the scientific evidence on alcohol and cancer to consumers.

Methods

We searched for information on cancer and alcohol consumption disseminated by 27 AI bodies and related organisations (see Table 1 and Table S2). These were identified during September–December 2016 from the Global Alcohol Producers website and its progress reports, and from the CSR sections of alcohol producers' websites [13,14]. We included organisations from English speaking countries or where the information was available in English. One website was inaccessible, leaving 26 for analysis.

Two authors independently extracted information from documents, webpages or reports. These data were coded iteratively by two authors in Excel (Redmond, Washington: Microsoft, 2016) and in nVivo 11.3.2 (QSR International UK Ltd, Daresbury, Cheshire UK), and were analysed using documentary analysis methods [15,16]. The approach comprised reading and understanding meanings of individual texts to identify subthemes; identification of thematic clusters of nodes; triangulation between documents and organisations; checking reliability/validity, and the use of representative examples [17–19]. Disagreements about coding or relevance were referred to a third author. This resulted in 15 codes which were grouped for analysis into three main industry strategies (see Box 1). The quotes were coded independently by two authors, and agreement calculated using the κ statistic ($\kappa = 0.4$). All the data were extracted by one author, and a second author then

Box 1: How the alcohol industry organisations under review misrepresent the evidence on alcohol and cancer

1. Denial/omission: denying, or disputing any link with cancer, or selective omission of the relationship
The approach includes:

- Denying that any relationship exists, or claiming inaccurately that there is no risk for light or 'moderate' drinking.
- Selective omission: avoiding mention of cancer in general, or of specific cancers.

2. Distortion: mentioning some risk of cancer, but misrepresenting or obfuscating the nature or size of that risk
This is done by:

- Claiming or implying that the risk applies only to particular patterns of drinking (heavy drinking or binge drinking).
- Claiming or implying that, as knowledge of the mechanism is incomplete, the evidence of a causal relationship is not trustworthy, and/or claiming a lack of expert consensus.
- Claiming protective effects of alcohol on some cancers, thus confusing the picture of overall risk.

3. Distraction: focussing discussion away from the independent effects of alcohol on common cancers
This is done by:

- Minimising the role of alcohol by pointing to a wide range of other risk factors for cancer.
- Emphasising less common cancers, and emphasising cancer 'types' rather than cancer prevalence.

In addition, there appears to be a particular focus on misrepresenting the risks of breast and colorectal cancer.

Table 1. *Tactics used by alcohol industry (AI) Social Aspects and Public Relations Organisations (SAPRO), and other organisations*

	SAPRO, or other AI-related body	Selective omission of cancer risk, or specific cancers (e.g. breast)	Denies alcohol causes at least one type of cancer	Claims that risk only applies to particular drinking patterns	Confusing the relationship using range of other risk factors	Pointing to complexity to suggest little evidence of risk	Claiming that mechanism not known to undermine evidence of risk	Discussion of breast cancer?	Discussion of colorectal cancer?
1.	ARA (South African industry SAPRO)							Yes	Yes
2.	Pernod Ricard 'Wise Drinking'	X						No	No
3.	CANADA: Éduc'alcool	X	X			X		Yes, but inaccurate	Yes
4.	US: DISCUS 'Distilled Spirits Council of the United States' [54]	X						No	No
5.	Heineken website Heinken.com	X						Yes—mentioned	No
6.	Foundation for Advancing Alcohol Responsibility (Responsibility.org)	X						No	No
7.	Beer Wisdom: Brewers of Europe, http://www.beerwisdom.eu/ [55]	X		X				No	No
8.	www.Drinkaware.ie							Yes	Yes
9.	Ireland: MEAS: Mature Enjoyment of Alcohol in Society, http://www.meas.ie/	X						No	No
10.	Australia: Drinkwise	X		X	X			Yes	No
11.	Australia: The Wine Line (Jacobs Creek wines) [56]	X		X				No	No
12.	UK: Drinkaware			X	X	X		Yes	Yes
13.	IARD (formerly ICAP)		X	X	X		X	Yes, but inaccurate	Yes
14.	ICAP	X		X				No	No
15.	Spirits Europe/ European Forum for Responsible Drinking	X						No	No
16.	www.responsibledrinking.org (IARD education site)			X	X			Yes, but misleading	No
17.	Diageo, DrinkIQ.com [25]	X		X	X	X		Yes, may be misleading re:	No

(Continues)

Table 1. (Continued)

	SAPRO, or other AI-related body	Selective omission of cancer risk, or specific cancers (e.g. breast)	Denies alcohol causes at least one type of cancer	Claims that risk only applies to particular drinking patterns	Confusing the relationship using range of other risk factors	Pointing to complexity to suggest little evidence of risk	Claiming that mechanism not known to undermine evidence of risk	Discussion of breast cancer?	Discussion of colorectal cancer?
								'moderate' drinking	
18.	Wine in Moderation (http://www.wineinmoderation.eu/) includes the Wine Information Council; members include Moet Hennessy, Pernod Ricard		X	X	X	X	X	Yes, but misleading	No clear statement
19.	SABMiller, Talkingalcohol.com		X	X	X	X	X	Yes, but misleading	Yes, but misleading
20.	Portman Group response to new UK alcohol guidelines, 2016		X	X	X	X		Yes	No
21.	Carlsberg 'Responsible Drinking'; CSR report 2014	X		X				No	No
22.	Bacardi, https://www.bacardilimited.com/corporate-responsibility/	No mention of cancer						No	No
23.	Asahi, http://uk.asahibeer.co.uk/Alcohol-Responsibility	No mention of cancer						No	No
24.	Kirin, http://www.kirinichiban.com/	No mention of cancer						No	No
25.	Molson Coors, http://www.molsoncoors.com/en/responsibility/alcohol%20responsibility	No mention of cancer						No	No
26.	Brown-Forman, https://www.brown-forman.com/alcohol-responsibility/	No mention of cancer						No	No
27.	Beam Suntory, *No access*							N/A	N/A

went back to the same sources to check all data, before the final coding took place.

The detailed information on cancer presented by these organisations is included as Table S2 (online). Representative examples are given below to highlight the common approaches used by these organisations. Additional examples appear in Table S3.

Ethic approval: Ethical approval not required (secondary document analysis).

Results

Most organisational websites (24/26) contain significant omissions and/or misrepresentations of the evidence. They appear to use three main strategies (Box 1).

Denying, disputing or selectively omitting the relationship between alcohol consumption and cancer

Denying that any relationship exists or claiming inaccurately that there is no risk for light or 'moderate' drinking. As noted in Table S1, alcohol consumption is associated with at least seven types of cancer [20]. Five AI organisations deny an association between alcohol and at least one type of cancer with statements which are contradicted by the existing evidence (Table 1). A frequent approach is to present misleading information about the risk associated with 'light' or 'moderate' drinking, as in these examples:

> *'Recent research suggests that light to moderate drinking is not significantly associated with an increased risk for total cancer in either men or women.'* International Alliance for Responsible Drinking [21].

> *'Some studies show a link between alcohol and breast cancer among both pre-menopausal and post-menopausal women. However, no causal relationship has been shown between moderate drinking and breast cancer.'* Éduc'alcool (Quebec) [22].

The first statement from the International Alliance for Responsible Drinking (IARD, an alcohol producers 'responsible drinking' body) misrepresents the well-evidenced association between alcohol consumption and a range of specific, common cancers. The second statement from Éduc'alcool about 'no causal relationship' is factually incorrect.

An informational video about cancer on the SAB Miller website 'TalkingAlcohol.com' similarly states inaccurately that there is no link between alcohol and most cancers except for 'mainly cancers of the upper aerodigestive tract' and the liver [23] (other examples: see Table S3).

Selective omission: avoiding mention of cancer, and/or of specific cancers. Most of the websites or documents (13/21 from SAPROs and 5/5 from producers) either do not mention cancer (while discussing other health risks) or appear to selectively omit specific cancers (Table 1). For example, Pernod's 'Wise Drinking' brochure discusses the need to 'combat unhealthy drinking habits', and lists 'mental retardation in children' as among the most common consequences of alcohol consumption, but presents no information on cancer [24]. Diageo's DrinkIQ.com website has a section entitled 'Alcohol's short-term and long-term effects on your body', listing alcohol dependence, pancreatic problems, liver cirrhosis, brain damage, death and 'physical and emotional health problems' [25]. It does not mention cancer. Educ'alcool (Quebec) has a webpage labelled 'The effects of moderate, regular alcohol consumption', which mentions cardiovascular and peripheral disease, stroke, gallstones, diabetes, psychosocial effects and 'other beneficial effects', but does not mention cancer [22].

Distortion: mentioning some risk of cancer, but obscuring, misrepresenting or obfuscating the nature or size of that risk

The second and most common approach involves presenting the relationship between alcohol and cancer as highly complex (for example, in terms of subgroup effects and patterns of drinking), with the implication, or statement, that there is no evidence of a consistent, or independent link. Within this, three approaches were identified (see also Table S3):

Claiming or implying that risk only applies to particular patterns of drinking. It is commonly stated by these organisations (12/20 SAPROs) that the risk of some common cancers only exists for 'heavy', 'excessive' or 'binge' drinking. For example,

> *'Cancer risk associated with the consumption of alcohol is related to patterns of drinking, particularly heavy drinking over extended periods of time.'* Australia, Drinkwise [26].

Similar statements also appear on the IARD website, such as 'In general, alcohol-associated cancers have been linked with heavy drinking' [27].

The scientific evidence suggests that such statements are misleading (Table S1), because the increased risk of some common cancers, such as breast, oesophageal, laryngeal, mouth and throat cancers and cancers of the upper aerodigestive tract, starts at low levels of consumption, even though it is low at those low levels [7,8] (see also Table S3).

Claiming or implying that, as knowledge of the mechanism is incomplete, the evidence of a causal relationship is not trustworthy, and/or claiming a lack of expert consensus. Other industry claims (from three organisations) relate to disputation of the mechanisms, or involve claims about the consistency of the evidence, as in these examples:

> *'Recent studies indicate a dose-response relationship between alcohol consumption and breast cancer, although this relationship was not evident in some past studies.'* IARD [27].

> *'All the studies show that the knowledge about the causes of breast cancer is still very incomplete and as scientists from the National Institute on Alcohol Abuse and Alcoholism in the USA recently pointed out, some other (possible confounding) factors have not been considered in the research relating the consumption of alcoholic beverages to breast cancer.'* Wine Information Council [28].

This is also a feature of SABMiller materials:

> *'The mechanism by which alcohol consumption may cause breast cancer is not fully known…. The relationship… is undergoing vigorous research… If and how these two factors may interact and affect risk is not completely known.'* (Table S2).

Claiming protective effects of alcohol on some cancers, thus confusing the picture of overall risk. The evidence that alcohol reduces the risk of some cancers is very limited. The Committee on Carcinogenicity review of 2016 stated in relation to protective effects:

> *'We think that it is difficult to draw firm conclusions from a small number of studies that indicate that kidney cancer, non-Hodgkin lymphoma, Hodgkin lymphoma, and extra-hepatic bile system cancer are less common in people who drink alcohol than in non-drinkers. However, it is clear that the increased risk of other cancers as a result of drinking alcohol far outweighs any possible decreased risk of these cancers.'* [8].

In relation to non-Hodgkin lymphoma and Hodgkin lymphoma, the Committee on Carcinogenicity also stated in their review of the evidence that they '….have concerns about the consistency of the classification of cancers of this type and the confounding effect of diverse lymphoma types. In addition, there is no immediately obvious mode of action that could explain the association' [8].

Despite the lack of evidence for protective effects of alcohol consumption on cancer, a wide range of protective effects are claimed in industry websites. For example ARA, a South African SAPRO [29], and the industry body IARD [27], state that there is a protective effect for renal-cell cancer and non-Hodgkin lymphoma. IARD also appears to claim a protective effect against multiple myeloma, while at the same time acknowledging that the findings from individual studies are inconsistent [27]. The IARD conclusion regarding an inverse risk of non-Hodgkin lymphoma is consistent with the IARC report in 2012 [7]. The IARD conclusion regarding multiple myeloma is not in agreement with that of IARC, who reported no consistent association with multiple myeloma in most studies [7].

The Wine Information Council claims that:

> *'Moderate wine intake may actually reduce the risk of oesophagus, thyroid, lung, kidney and colorectal cancers as well as Non-Hodgkin's Lymphoma. …Concerning breast cancer, there may also be a protective role for wine.'* Wine Information Council [30].

Claims about the protective effects are also made on the SABMiller website, which states that moderate alcohol consumption can be linked to lower risk of bladder, kidney, ovarian and prostate cancer [31]. IARD also appears to recommend drinking as protective in smokers:

> *'Among long-term smokers consumption of alcohol has been shown to be protective against colorectal adenomas.'* [27].

The Portman Group's response to the consultation on the revised UK guidelines (issued in 2016) includes a section in which the evidence is disputed, referring to protective effects. It refers to the 'increased risk of a small number of cancer types' and states: 'Different levels of alcohol consumption have a range of effects on cancer risk including no impact on the majority of cancers, and in some cases, an inverse relationship.' [11]. As well as misrepresenting the evidence, this statement is misleading as it confuses the number of different 'types' of cancer, with the risk of specific cancers. This is discussed further below.

Distraction: focussing discussion away from the independent effects of alcohol in increasing the risk of common cancers

Minimising the role of alcohol by pointing to a wide range of other risk factors. A common strategy appears to involve discussing a wide range of real and potential risk factors, thus presenting alcohol as just one risk among many. Eight of the SAPROs appear to do this. A wide range of risk factors, including irrelevant and non-modifiable ones, are referred to, for example:

> *'Not all heavy drinkers get cancer, as multiple risk factors are involved in the development of cancers including genetics and family history of cancer, age, environmental factors, and behavioural variables, as well as social determinants of health.'* Australia: Drinkwise [26].

> *'Alcohol has been identified as a known human carcinogen by IARC, along with over 1,000 others, including solvents and chemical compounds, certain drugs, viral infection, solar radiation from exposure to sunlight, and processed meat.'* IARD [27].

> *'For example, the fact that you are female is a risk factor in developing breast cancer. We also know breast cancer is age-related so you're more likely to develop it as you get older and that you're more prone to breast cancer if it is part of your family history. These are all factors beyond our control. We also know that risk is related to the 'hormone environment' that women experience during the course of early pregnancy, child birth and breastfeeding which all exert a protective effect.'* Drinkaware, UK [32].

In other cases, wider socioeconomic factors are also stated as possible causes by IARD [27], SABMiller [31] and the Portman Group [11].

Such messages are misleading and potentially confusing. Misleading, because they emphasise potential moderating factors without acknowledging the clear independent risk of alcohol consumption; the information therefore may suggest to readers that only people with these co-factors are at risk. Confusing, because it is unclear how the consumer is meant to interpret them or what action she is meant to take (e.g. messages about increasing risk with age at beginning of menarche or about wider socioeconomic factors).

Discussion of smoking may also be used in this way to distract from the independent effects of alcohol. The scientific evidence shows that the risk is indeed higher among smokers [7,8], and there is a strong interaction between alcohol and smoking for cancers of the upper aerodigestive tract [8]. The risk of cancer is also independent of smoking [10,33,34]. As for specific cancers, for breast cancer the risk does not appear to be confounded by smoking [7], and the association is unclear for colorectal and pancreatic cancer [8]. AI bodies in some cases appear to imply that it is mainly smokers who should be concerned. For example, the Portman Group's response to the consultation on the new UK alcohol guidelines places considerable weight on smoking, recommending that it should be emphasised (see Table S2) [11]. An emphasis on smoking appears in other AI materials [27] (Table S2).

Emphasising less common cancers, and emphasising cancer 'types' rather than cancer prevalence. In a few cases alcohol organisations places an emphasis on less common cancers. The SABMiller website'TalkingAlcohol.com' appears to imply that alcohol is only associated with less common forms of breast cancer:

> *'Recent studies indicate that alcohol consumption may be more strongly linked to a certain less common form of breast cancer (lobular cancer), than it is to the most common type of breast cancer (ductal cancer).'* [31].

The evidence regarding lobular and ductal cancers is itself unclear. The Women's Health Initiative Observational study found that, compared with never-drinkers, women consuming 7+ alcoholic drinks per week had a slightly increased risk of hormone-receptor positive lobular cancer, than ductal cancer [35]. However the authors also concluded that alcohol was significantly positively associated with total breast cancer, with even a moderate amount of alcohol (>10 g day^{-1}) significantly increasing breast cancer risk. Other studies have not found that alcohol risk is clearly differentiated by subtype [3]. It is possible that the risk may be slightly greater for lobular than ductal tumours, though the direct relevance of this information for SABMiller's consumers is unclear.

The Portman Group document also appears to imply that the risk only applies to less common cancers, by conflating cancer type with cancer prevalence. It asserts that 'the vast majority of cancer types are not associated with alcohol consumption', and criticises the revised UK guidelines on the grounds that they 'amplify the small number of cancer types where increased risk is linked to alcohol consumption' [11]. The small number of cancer 'types' distracts from the fact that these include two of the most common cancers (breast and colorectal cancer) [1,2].

Misrepresentation of the risks of breast and colorectal cancer

There appears to be two particularly frequent areas of misinformation on these sites: breast cancer and colorectal cancer. In all, 21 of the organisations present no, or misleading information on breast cancer, and 22 present no information, or misleading information on colorectal cancer (Table 1). Some websites single out these cancers (but not others) to dispute or deny the increase in risk. This can be seen on the websites of Éduc'alcool (Quebec) [22] and on the Drinkwise (Australia) website [26]. One such example is Éduc'alcool's statement (above) that 'no causal relationship has been shown between moderate drinking and breast cancer' [36]. The Wine in Moderation website includes a lengthy section on confounding in relation

to the risk of breast cancer, concluding that 'based on scientific evidence, in post-menopausal women, the increase in the risk of breast cancer, if there is any at all, is small' [37] (our emphasis). The SAB Miller website also has a significant focus on proposing alternative risk factors for breast cancer, other than alcohol (see interview in Table S2) [37]. The Portman Group's response to the UK guidelines includes a section on breast cancer, in which the evidence is disputed. For example, it states that 'studies associating moderate alcohol consumption are contradictory'. The IARD 'Drinking and NCDs' brochure wrongly links breast cancer only to heavy drinking [38].

In the case of Drinkwise (Australia), an interactive tool (see: https://drinkwise.org.au/alcohol-and-your-health/#app) includes clickable links to the immune system, heart, liver, skin, brain, liver, stomach, pancreas, bowel kidneys and reproductive system, but not the breast. Clicking on the 'Liver' and 'Bowel' links takes the user to other pages about cancers, but there is no similar link to information on breast cancer.

Most of the websites/documents do not mention colorectal cancer, even when in some cases (e.g. Heineken, Drinkwise) they specifically mention other cancers. In one other case (Wine in Moderation) it is stated inaccurately that alcohol reduces the risk of colorectal cancer [30]. On the Australian Drinkwise website, colorectal cancer is mentioned in the list of cancers caused by alcohol, but not in the 'Alcohol and your bowel' section, which discusses 'bacterial overgrowth in your small intestine which may cause bloating, gas, abdominal pain, constipation and diarrhoea, and irritable bowel syndrome' [29]. The information on colorectal cancer presented on two other websites appears to be accurate (Canada's Educ'alcool, and the IARD website) [27,37].

References cited by SAPROs to substantiate their statements. Six SAPRO websites substantiate their statements on cancer and alcohol by providing a list of references cited in the text, or a bibliography. Of the SAPROS which include references, IARD is most likely to cite peer-reviewed alcohol-cancer-related publications (48), followed by ARA (16), and Drinkaware UK (12). However, this does not mean that the citations used are the most relevant. For example, independent IARC reports are rarely cited, and in disputing the evidence on increased breast cancer risk, the Portman Group document does not reference the IARC reviews, other systematic reviews, nor the Committee on Carcinogenicity review. The only cited academic review paper disputes the relationship between breast cancer and alcohol consumption, using many of the arguments discussed above [39]. The lead author of the paper is head of Scientific Affairs of the U.S. Distilled Spirits Council.

Discussion

Principal findings

Public awareness of the risk of cancer from alcohol consumption is low [40], and it has been argued that greater public awareness, particularly of the risk of breast cancer, poses a significant threat to the AI [20]. Our analysis suggests that the major global alcohol producers may attempt to mitigate this risk by disseminating misleading information about cancer through their 'responsible drinking' bodies. The existing evidence of strategies employed by the AI suggests that this may not be a matter of simple error [41,42]. It is already known that the AI misrepresents scientific evidence, for example in relation to Minimum Unit Pricing of alcohol [43], where it has been demonstrated that the industry employs 'denialism' in public discussions [43]. Our analysis suggests that AI denialism may extend to the relationship between alcohol and cancer.

Strengths and weaknesses of the study, and in relation to other studies

The main strength of the study is its breadth: it analyses all information about cancer provided by the major international CSR bodies which are used by the AI to disseminate information to the public. This strengthens the conclusion that the findings are both robust and generalisable. The main weakness is that there are many other mechanisms and organisations through which industry disseminates health-related information (e.g. through Twitter accounts, at meetings and via advertising campaigns) which we did not examine. It seems implausible however that industry would adopt different messaging regarding cancer through other outlets, though this is an important issue for further research. It is also possible that these industry sources misquote or present out of context, expert opinions or other commentary which they include.

There are no closely similar studies to this, though our findings have similarities with other AI strategies, particularly the focus on individual causal factors, and personal variability in risk, even where these are not relevant [42]. The systematic review by Savell *et al.* (2015), for example, found that manipulation of evidence was a key alcohol strategy for influencing marketing regulations. This included selective citation of industry-favourable evidence, omission of evidence, removal of industry-troubling phrases and contesting

the nature of the evidence, all of which we found here [42].

The most obvious parallel is with the global tobacco industry's decades-long campaign to mislead the public about the risk of cancer, which also used front organisations and CSR activities to mislead the public [44,45]. The tobacco industry also developed arguments which emphasise the complex aetiology of lung cancer and CHD, in order to help deny the epidemiological evidence; for example, it engaged in an ever-wider search for any factor, however unlikely (such as keeping pet birds, or inadequate consumption of green tea) that might serve as an independent risk factor for smoking-related diseases [46]. The extensive AI discussions of potential confounders in the alcohol–cancer relationship may be seen in the same light. The analysis by Ulucanlar *et al.* (2014) of tobacco industry submissions to the public consultation on plain packaging found similar extensive misrepresentation of evidence, including distortion of the findings of scientific studies [47].

One important finding is that AI materials appear to specifically omit or misrepresent the evidence on breast and colorectal cancer. One possible reason is that these are among the most common cancers, and therefore may be more well-known or salient than oral and oesophageal cancers (which we found to be more commonly acknowledged by industry SAPROs (Table 1)). The provision of misleading information about breast cancer may also reflect existing industry strategies aimed at developing the female alcohol market [20]. Note also that these data were collected in 2016. Some website content may therefore have changed since the data were collected.

Implications for clinicians and policymakers

Overall, through its provision of misleading information, the AI can maintain 'the illusion of righteousness' in the eyes of policymakers [48], while negating any significant impact on consumption and profits. These findings therefore have significant implications. They provide evidence that the AI, like the tobacco industry, misleads the public and policymakers about the cancer risks of their products. Our findings are also a reminder of the risk which accompanies giving to the AI the responsibility of informing the public about alcohol and health [49].

The findings also suggest that major international alcohol companies may be misleading their shareholders about the risks of their products. This may leave the industry open to litigation in some countries, as has happened with the tobacco and, more recently, other industries. For example, Coca-Cola and the American Beverage Association are currently being sued for downplaying the risks of their products [50].

Finally, some public health bodies, academics and practitioners liaise with the industry bodies included in this study, for example by acting as advisors or trustees, or by collaborating with them in implementation activities. Despite their undoubtedly good intentions, we suggest that it is unethical for them to lend their expertise and legitimacy to industry campaigns which mislead the public about alcohol-related harms.

Areas for further research

Further analysis of citation bias is needed, as cherry-picking of evidence sources appears common (e.g. single studies, and magazine and newspaper articles frequently appear to be cited in preference to up-to-date systematic reviews). The analysis of information produced by new AI bodies which disseminate information about alcohol and health—such as the newly established Alcohol Information Partnership [51]—should also be carefully monitored. There is also an urgent need to examine other industry websites, documents, social media and other materials in order to assess the nature and extent of the distortion of evidence, and whether it extends to other health information—for example, in relation to cardiovascular disease. Comparative research across industries and with other areas of alcohol policy to examine industry distortion of evidence is also needed.

Conclusion

It has often been assumed that, by and large, the AI, unlike the tobacco industry, has tended not to deny the harms of alcohol [52]. Our analysis shows that, on the contrary, the global AI is currently actively disseminating misinformation about alcohol and cancer risk, particularly breast cancer [48]. The AI, unlike the tobacco industry, still has significant access in many countries to government health departments [52,53]. It is also active in the international policy arena, with, for example, partner or stakeholder status at World Health Organization and United Nations meetings relevant to alcohol, on occasions when the tobacco industry is excluded [52]. This study shows that the AI uses similar tactics to the tobacco industry, to the same ends: to protect its profits, to the detriment of public health. The full scale and nature of these activities requires urgent investigation.

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Conflict of interest

None to declare.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Table S1. Summary of International Agency for Research on Cancer review (2012), and UK Committee on Carcinogenicity review (2016)

Table S2. Advice related to cancer disseminated by alcohol industry Social Aspects and Public Relations Organizations (SAPRO) via websites and other documents

Table S3. Additional examples of misleading or false statements about alcohol and cancer