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# Can a mass media campaign raise awareness of alcohol as a risk factor for cancer and public support for alcohol related policies?

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## ABSTRACT

Alcohol consumption increases the risk of several cancers, but public awareness of alcohol as a risk factor for cancer is low. Research indicates that public opinion about alcohol related policies can be influenced by mass media campaigns and awareness of alcohol as a carcinogen. The objective of this study was to test whether a mass media campaign intended to raise awareness of the relation between alcohol and cancer is associated with higher public awareness of alcohol as a risk factor for cancer, and higher levels of support for alcohol related policies. Cross-sectional surveys of a nationally representative sample of N = 6000 Danish adults were conducted pre- (n = 3000) and post campaign (n = 3000) in 2017–2018.

Awareness of alcohol as a cancer risk factor significantly increased between the pre and post campaign survey (approximately 5 percentage points). The proportion of respondents who supported minimum unit pricing, a ban on alcohol advertising, and mandatory nutrition labelling was significantly higher post campaign than pre campaign, while support for limited number of retail outlets and limited sale hours were unchanged. For males, but not females, higher support for an 18 year age limit for purchasing alcohol, age limits for buying alcohol at secondary education school parties, and increased enforcement of age limits was found after the campaign than prior to it. Conclusively, the results show that a mass media campaign was associated with an increase in awareness of alcohol as a risk factor for cancer as well as alcohol policy support at a population level.

## 1. Introduction

Globally, alcohol consumption is a major health concern accounting for an estimated 3 million deaths (5.3% of all deaths) and 132.6 million disability-adjusted life years (5.1% of all DALYS) in 2016 (WHO, 2018). Alcohol was classified as a carcinogen by the International Agency for Research into Cancer in 1988 (WHO, 1988), and there is evidence to support a causal association between alcohol and cancers of the mouth, throat, esophagus, breast, liver and bowel (IARC, 2010). In 2016, alcohol accounted for around 4% of cancer deaths worldwide (WHO, 2018). In Denmark, an estimated 5% of incident cancers were attributable to alcohol in 2008 (Schutze et al., 2011).

Despite the well-established contribution of alcohol to the burden of cancer, public knowledge of the relationship between alcohol and cancer is low across the world (Scheideler and Klein, 2018) including Denmark. A 2011 survey found that only 43% of Danish adult recognized alcohol as a risk factor for cancer, when they were directly asked if alcohol increases the risk of cancer (prompted awareness) (Lagerlund et al., 2015). Prompted awareness is generally higher than awareness measured by an open-ended question (unprompted

awareness) (Scheideler and Klein, 2018; Buykx et al., 2016), and awareness seems to differ for different cancer types (Buykx et al., 2016; Martin et al., 2018)

Research has shown that mass media campaigns highlighting the link between alcohol and cancer are associated with increased public awareness of this link (Martin et al., 2018; Dixon et al., 2015). Furthermore, knowledge of alcohol as a risk factor for cancer has been associated with support for policies intended to reduce alcohol related harm (Buykx et al., 2015; Bates et al., 2018). There is robust evidence, that policies including higher age limits for buying alcohol, taxes on alcohol, minimum unit pricing, lower availability of alcohol, and marketing restrictions are associated with lower alcohol consumption (Zhao et al., 2013; Stockwell et al., 2012; Wagenaar and Toomey, 2002; Babor et al., 2010). Public opinion may be a barrier to the adoption of such policies, but research indicates that public opinion can be influenced by mass media campaigns (Martin et al., 2018). A study from England found a significant increase in ‘strong support’ of seven alcohol related policies after a television-led mass media campaign about the link between alcohol and breast cancer (Martin et al., 2018).

In order to increase awareness of alcohol as a risk factor for cancer,

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and secondarily to increase public support for effective alcohol related policies, a mass media campaign about the link between alcohol and cancer was launched by the Danish Cancer Society and the philanthropic foundation TrygFonden in 2017.

The aim of this study was to test whether a mass media campaign intended to raise awareness of the relationship between alcohol and cancer is associated with (a) higher awareness that alcohol increases the risk of cancer, and (b) higher levels of support for alcohol related policies.

## 2. Methods

### 2.1. Design

Cross-sectional surveys were conducted from September 4 to October 8, 2017 (pre campaign) and from November 27, 2017 to January 7, 2018 (post campaign). The analysis firm Voxmeter A/S recruited n = 3000 respondents aged 18–74 years in their online panel pre- and post campaign (total N = 6000), ensuring not to include respondents in the post campaign survey who already replied in the pre campaign survey. Quota sampling was applied to ensure the samples were nationally representative with respect to age, sex, and geographical region, as well as education (not within specific quota). Incentives consisted of points (equivalent to 1.5 US dollar) for Voxmeters panel shop and participation in a lottery. In both surveys, panel members were invited to participate in an online survey without any information of the content or organisations commissioning the survey. The pre- and post campaign questionnaires were similar, except that the post campaign questionnaire also comprised questions to evaluate the campaign. A flow chart of the selection of the study population is shown in Fig. 1.

### 2.2. Mass media campaign

In November 2017, the campaign “Alcohol does something to us” was launched by the Danish Cancer Society and the philanthropic foundation TrygFonden with financial support from the Danish National Board of Health. The aim of the campaign was to increase awareness that alcohol is a risk factor for cancer, and the target was Danish adults. The campaign was disseminated via social media, primarily on Facebook, and comprised five campaign advertisements of 35 s (see for instance <https://www.youtube.com/watch?v=8JDKipw64sY>), posts on Facebook and Instagram, and a website [www.alkohologkraeft.dk](http://www.alkohologkraeft.dk) combined with stories in the news media (digital/print/radio) over a period of 14 days. The five campaign advertisements showed, in a loving and humorous manner, how alcohol affects us differently; some of us become talkative, others become tired, emotional, flirtatious or lose control on the dancefloor. The takeout message was, that no matter what alcohol does to you, we all have one thing in common: alcohol increases the risk of cancer. No specific cancer types were mentioned.

### 2.3. Study measures

#### 2.3.1. Awareness of alcohol as a risk factor for cancer

Unprompted awareness was measured from the open-ended question “Which diseases do you think, alcohol increases the risk of? Please state

all diseases that come to your mind”. Any mention of cancer, tumor or specific cancer diseases was coded as unprompted awareness. Prompted awareness was measured by asking respondents – irrespective of responses to the open-ended question – “Which of the following diseases and conditions do you think, alcohol increases the risk of?” presented with a list of seven health conditions in random order. The list included cancer, heart disease, diabetes, high cholesterol, liver disease, overweight, and arthritis, which have all been associated with excessive alcohol consumption. Respondents who had prompted awareness, were then asked “Which of the following cancer diseases do you think, alcohol increases the risk of?” followed by a list in random order including cancers that are causally related to alcohol consumption (cancers of the breast, esophagus, head and neck, liver, colorectum), and other types of cancer. For each of these questions, it was also possible to answer “I do not know”.

#### 2.3.2. Support for alcohol related policies

Respondents were asked to indicate their support for seven alcohol related policies including minimum unit pricing, a law prohibiting people younger than 18 years from buying alcohol at school parties at secondary education schools, reduce the number of retail outlets where alcohol can be sold, increase enforcement of legal age limits for buying alcohol, limit sale hours, ban on alcohol advertising, and mandatory nutrition labeling on alcohol. Policies were presented in random order and responses were categorized into support (“very good suggestion”, “good suggestion”) and no support (“neither good or bad suggestion”, “bad suggestion”, “very bad suggestion”, “I do not know”) for the analyses.

In Denmark, the legal age limit for purchasing alcohol off premises is 16 years for alcohol with an alcohol content up to 16.5% and 18 years for alcohol with an alcohol content of 16.5% or above. The age limit is 18 years on premise irrespective of alcohol content. Support for raising age limits for purchasing alcohol were measured by the question “Do you think, there should be an age limit of 18 years for buying alcohol everywhere irrespective of alcohol content?”. Responses were categorized into support (“yes”) and no support (“no”), “I do not know”.

#### 2.3.3. Survey timing

This variable indicated whether the respondent was part of the pre- or post campaign survey.

#### 2.3.4. Campaign awareness

In the post campaign survey, respondents were presented with elements from the campaign (campaign name, advertisements, posts on social media, website) and asked if they knew of any them. Campaign awareness was dichotomized into aware (knew at least one element) and not aware (knew no elements).

#### 2.3.5. Covariates

Covariates included sex, age group (18–23, 24–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74 years), geographical region (Capital, Zealand, Southern, Central, North), highest level of education (primary school, vocational school, upper secondary, higher education ≤ 2 year, higher education > 2 < 5 year, higher education ≥ 5 year, other), smoking (never smoker, previous smoker, occasional smoker, 1–9 cigarettes daily, 10 or more cigarettes daily, unknown), weekly alcohol intake (0 – never drinks, 0 – do not drink on a typical week, 1–7, 8–14, 15–21, 22 or more units/week, do not know).

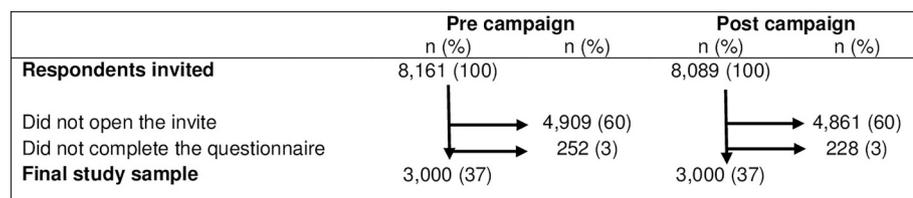


Fig. 1. Flow chart of the selection of the study population (N = 6000) in Denmark 2017–2018.

## 2.4. Statistical analysis

The statistical package STATA/IC 11 was used for all analyses. Selected confounders were based on the literature and a priori knowledge. For logistic regression analyses, we reported odds ratios (ORs) and their 95% confidence interval [95% CI]. P values < 0.05 were considered statistically significant.

$\chi^2$ -analyses were performed in order to determine if unprompted and prompted awareness of alcohol as a carcinogen, and awareness of alcohol's contribution to specific cancer types, were different pre and post campaign. Similarly,  $\chi^2$ -analyses were applied to assess differences in support for alcohol related policies pre and post campaign. Analyses with policy support regarding age limits (18 years age limit for purchasing alcohol, an 18-year age limit for buying alcohol at school parties, enforcement of age limits) were stratified by sex, as the association between survey timing and support for these policies differed by sex. Logistic regression analyses with survey timing as exposure were carried out in order to determine if changes in awareness and policy support were evident after adjustment for age, education, smoking, and weekly alcohol consumption. We did not adjust for sex and geographical region as these variables were evenly distributed in the two samples, due to the quota sampling. Age was adjusted for as quota sampling only ensured an even distribution of age within 10-year age intervals. The associations between age and the different outcomes were not linear, so age was categorized into 11 groups.

Logistic regression analyses were carried out to assess the association between awareness (unprompted and prompted) and support for alcohol related policies in the post campaign survey. Adjustment was made for sex, age, geographical region, education, smoking, and weekly alcohol consumption.

Supplementary analyses were performed to assess if awareness of alcohol as a risk factor for cardiovascular diseases changed from the pre- to the post campaign survey. No change was expected, as the campaign was only focused on cancer. Other supplementary analyses assessed the association between campaign awareness and awareness of alcohol as a risk factor for cancer in the post campaign survey. Furthermore, we performed supplementary analyses with disapproval (e.g. answering “*bad suggestion*” or “*very bad suggestion*”) of alcohol related policies as outcome.

## 3. Results

### 3.1. Description of study population

The samples surveyed pre- and post campaign comprised similar distributions for sex, geographical region, and weekly alcohol consumption, while age, educational level and smoking was unevenly distributed (Table 1). Although age varied, differences were small and the mean age was similar (45.8 years) in the pre- and post campaign data. Furthermore, regarding educational level, there were no clear pattern, showing that educational level was higher in one survey compared to the other.

### 3.2. Awareness of alcohol as a carcinogen in the pre- and post campaign survey

As shown in Table 2, the proportion who were aware that alcohol increases the risk of cancer, was significantly higher post campaign than pre campaign. Unprompted, 22.2% of respondents in the pre campaign survey and 27.0% of respondents in the post campaign survey mentioned cancer as a potential health outcome of alcohol. When prompted, awareness was 44.8% pre campaign and 49.7% post campaign. A significantly higher proportion were aware, that alcohol increases risk of liver cancer and colorectal cancer post campaign compared to pre campaign. Awareness of alcohol as a risk factor for cancers of the breast, esophagus, and head and neck was not significantly

**Table 1**  
Characteristics of the study population (N = 6000) in Denmark in 2017–2018.

Characteristic	Pre campaign n (%)	Post campaign n (%)	P-value <sup>a</sup>
Total	3000 (100)	3000 (100)	–
Sex			0.7
Male	1500 (50.0)	1514 (50.5)	
Female	1500 (50.0)	1486 (49.5)	
Age in years			< 0.001
18–23	251 (8.4)	212 (7.1)	
24–29	403 (13.4)	432 (14.4)	
30–34	233 (7.8)	225 (7.5)	
35–39	262 (8.7)	254 (8.5)	
40–44	300 (10.0)	179 (6.0)	
45–49	260 (8.7)	389 (13.0)	
50–54	311 (10.4)	246 (8.2)	
55–59	255 (8.5)	330 (11.0)	
60–64	228 (7.6)	480 (16.0)	
65–69	290 (9.7)	152 (5.1)	
70–74	207 (6.9)	101 (3.4)	
Geographical region			0.9
Capital	955 (31.8)	938 (31.3)	
Zealand	431 (14.4)	426 (14.2)	
Southern	629 (21.0)	650 (21.7)	
Central	677 (22.6)	666 (22.2)	
North	308 (10.3)	320 (10.7)	
Educational level			< 0.001
Primary school	310 (10.3)	414 (13.8)	
Vocational school	686 (22.9)	642 (21.4)	
Upper secondary	625 (20.8)	488 (16.3)	
Higher education ≤ 2 year	440 (14.7)	561 (18.7)	
Higher education > 2 < 5 year	557 (18.6)	581 (19.4)	
Higher education ≥ 5 year	359 (12.0)	292 (9.7)	
Other	23 (0.8)	22 (0.7)	
Weekly alcohol intake			0.2
0 units, never drinks	166 (5.5)	177 (5.9)	
0 units on a typical week	901 (30.0)	894 (29.8)	
1–7 units	1190 (39.7)	1135 (37.9)	
8–14 units	344 (11.5)	402 (13.4)	
15–21 units	151 (5.0)	141 (4.7)	
≥ 22 units	103 (3.4)	87 (2.9)	
Does not know	145 (4.8)	164 (5.5)	
Smoking			< 0.001
Never smoker	48.4	41.0	
Previous smoker	27.4	35.2	
Occasional smoker	6.5	5.8	
1–9 daily cigarettes	5.9	6.8	
10 or more daily cigarettes	11.1	10.6	
Unknown	0.6	0.6	

<sup>a</sup> Differences between survey samples were assessed by  $\chi^2$ -tests.

different between surveys. Adjusted logistic regression analyses yielded similar findings (Appendix Table A.1).

### 3.3. Support for alcohol related policies in the pre- and post campaign survey

As shown in Table 3, a significantly higher proportion of respondents supported the following policies in the post campaign survey compared to pre campaign survey: minimum unit pricing, ban on alcohol advertising and mandatory nutrition labeling. Support for limiting number of retail outlets and limiting sale hours did not significantly change. As shown in Table 4, among males, a significantly higher proportion supported all three policies related to age-limits (18 years age limit for purchasing alcohol, age limit on schools and enforcement of age-limits) post campaign compared to pre campaign. For females, there were no association between survey timing and support for the age related policies. Adjusted logistic regression analyses yielded similar results (Appendix Tables A.2 and A.3).

**Table 2**  
Awareness of alcohol as a risk factor for cancer in the study population (N = 6000) in Denmark in 2017–2018.

	Pre campaign (n = 3000)		Post campaign (n = 3000)		Percentage points difference	P-value <sup>a</sup>
	%		%			
Unprompted awareness	22.2		27.0 <sup>b</sup>		4.8	< 0.001
Prompted awareness	44.8		49.7 <sup>b</sup>		4.9	< 0.001
Breast cancer (prompted)	9.6		10.4		0.8	0.3
Esophagus cancer (prompted)	26.1		27.7		1.6	0.2
Head and neck cancer (prompted)	15.4		14.8		-0.6	0.5
Liver cancer (prompted)	39.5		42.9 <sup>b</sup>		3.4	< 0.01
Colorectal cancer (prompted)	24.1		26.8 <sup>b</sup>		2.7	0.02

<sup>a</sup> Differences in awareness of alcohol as a risk factor for cancer pre- and post campaign were assessed by  $\chi^2$ -tests.

<sup>b</sup> Significantly different to baseline (pre campaign) at  $p < 0.05$  level after controlling for age group, education, smoking, and weekly alcohol consumption in logistic regression analyses (Appendix Table A.1).

**Table 3**  
Support for alcohol related policies in general in the study population (N = 6000) in Denmark in 2017–2018.

	Pre campaign (n = 3000)		Post campaign (n = 3000)		Percentage points difference	P-value <sup>a</sup>
	%		%			
Minimum unit pricing						
Support	25.7	31.0 <sup>b</sup>	5.3	< 0.001		
Limit number of retail outlets						
Support	18.9	20.9	2.0	0.06		
Limit sale hours						
Support	18.3	18.6	0.3	0.74		
Ban on advertising						
Support	40.7	44.1 <sup>b</sup>	3.4	< 0.01		
Nutrition labeling						
Support	43.9	47.5 <sup>b</sup>	3.6	< 0.01		

<sup>a</sup> Differences in support for alcohol related policies pre- and post campaign were assessed by  $\chi^2$ -tests.

<sup>b</sup> Significantly different to baseline (pre campaign) at  $p < 0.05$  level after controlling for age group, education, smoking, and weekly alcohol consumption in logistic regression analyses (Appendix Table A.2).

### 3.4. Association between awareness that alcohol increases risk of cancer and support for alcohol related policies in the post campaign survey

As shown in Table 5, in the post campaign survey, awareness of alcohol as a risk factor for cancer was significantly associated with higher odds of supporting minimum unit pricing (adjusted OR unprompted = 1.60 [1.34–1.91]; prompted: 1.52 [1.29–1.78]), limited number of retail outlets (unprompted: 1.32 [1.08–1.61]; prompted: 1.35 [1.13–1.63]), enforcement of age limits (unprompted: 1.36 [1.13–1.64];

prompted: 1.52 [1.29–1.78]), limited sale hours (unprompted: 1.26 [1.02–1.55]; prompted: 1.35 [1.11–1.63]), ban on alcohol advertising (unprompted: 1.41 [1.19–1.67]; prompted: 1.46 [1.26–1.70]) and mandatory nutrition labeling (unprompted: 1.43 [1.21–1.69]; prompted: 1.71 [1.47–1.99]). Awareness of alcohol as a risk factor for cancer was not associated with support for an 18 year age limit for purchasing alcohol. Neither was unprompted awareness associated with support for an 18 year age limit for buying alcohol at school parties, and the association between prompted awareness and support for this was only of borderline significance (prompted: 1.17 [1.00–1.36]).

### 3.5. Supplementary analyses

Unprompted awareness of alcohol as a risk factor for cardiovascular diseases decreased from 32.2% pre campaign to 29.2 post campaign ( $p$ -value = 0.01). There was no change in prompted awareness (pre: 62.0, post: 60.5,  $p$ -value = 0.27). Adjusted logistic regression analyses yielded similar results (results not shown).

In the post campaign survey, 32% were aware of the mass media campaign. Campaign awareness was significantly associated with higher odds of unprompted (adjusted OR = 1.82 [1.53–2.17]) and prompted awareness (1.83 [1.56–2.15]) of alcohol as a carcinogen, as well as awareness of the link between alcohol and cancers of the breast, esophagus, head and neck, liver, and colorectum in adjusted logistic regression analyses (results not shown).

A significantly lower proportion disapproved most alcohol related policies post campaign compared to pre campaign (results not shown). Only disapproval of increased enforcement of age limits did not change, and disapproval of an 18 years age limit for purchasing alcohol in general and for buying alcohol at school parties decreased only among males.

**Table 4**  
Support for alcohol related policies regarding age limits, stratified by sex, in the study population (N = 6000) in Denmark 2017–2018.

	Males				Females			
	Pre campaign (n = 1500)	Post campaign (n = 1514)	Percentage points difference	P-value <sup>a</sup>	Pre campaign (n = 1500)	Post campaign (n = 1486)	Percentage points difference	P-value <sup>a</sup>
	%		%		%		%	
18 years age limit for purchasing alcohol								
Support	42.5	51.8	9.3 <sup>b</sup>	< 0.001	54.9	55.0	0.1	0.92
Age limit on schools								
Support	44.2	53.8	9.6 <sup>b</sup>	< 0.001	53.9	53.6	-0.3	0.87
Enforcement of age limits								
Support	62.9	67.4	4.5 <sup>b</sup>	< 0.01	72.3	71.3	-1.0	0.54

<sup>a</sup> Differences in support for alcohol related policies pre- and post campaign were assessed by  $\chi^2$ -tests.

<sup>b</sup> Significantly different to baseline (pre campaign) at  $p < 0.05$  level after controlling for age group, education, smoking, and weekly alcohol consumption in logistic regression analyses (Appendix Table A.3).

**Table 5**

Odds ratios for support for alcohol related policies according to awareness of alcohol as a risk factor for cancer (unprompted and prompted) in the post campaign survey (n = 3.000) in Denmark in 2017–2018.

Post campaign survey (n = 3000)			
	n	Unadjusted OR [95% CI]	Adjusted <sup>a</sup> OR [95% CI]
<b>18 years age limit for purchasing alcohol</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	0.96 [0.82–1.13]	0.99 [0.84–1.18]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.12 [0.97–1.29]	1.14 [0.98–1.33]
<b>Minimum unit pricing</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.62 [1.37–1.92]	1.60 [1.34–1.91]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.55 [1.33–1.82]	1.52 [1.29–1.78]
<b>Age limit on schools</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.03 [0.88–1.21]	1.10 [0.92–1.30]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.13 [0.98–1.30]	1.17 [1.00–1.36]
<b>Limit number of retail outlets</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.34 [1.11–1.63]	1.32 [1.08–1.61]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.37 [1.15–1.64]	1.35 [1.13–1.63]
<b>Enforcement of age limits</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.39 [1.16–1.66]	1.36 [1.13–1.64]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.53 [1.31–1.79]	1.52 [1.29–1.78]
<b>Limit sale hours</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.25 [1.03–1.53]	1.26 [1.02–1.55]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.34 [1.11–1.61]	1.35 [1.11–1.63]
<b>Ban on alcohol advertising</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.45 [1.23–1.71]	1.41 [1.19–1.67]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.52 [1.31–1.76]	1.46 [1.26–1.70]
<b>Nutrition labeling</b>			
Unprompted awareness			
No	2189	1 (ref)	1 (ref)
Yes	811	1.49 [1.27–1.75]	1.43 [1.21–1.69]
Prompted awareness			
No	1509	1 (ref)	1 (ref)
Yes	1491	1.73 [1.50–2.00]	1.71 [1.47–1.99]

<sup>a</sup> Adjusted for sex, age group, geographical region, education, smoking, and weekly alcohol consumption.

#### 4. Discussion

Awareness of alcohol as a risk factor for cancer was significantly higher post campaign compared to pre campaign. Furthermore, support for minimum unit pricing, a ban on alcohol advertising and mandatory

nutrition labeling were significantly higher after the campaign than prior to it. Support for limiting number of retail outlets where alcohol can be sold and limiting sale hours were not significantly different pre and post campaign. Support for an 18-year age limit for purchasing alcohol, an 18-year age limit for buying alcohol at school parties and increased enforcement of age limits significantly increased among males but not females. In the post campaign survey, unprompted and prompted awareness of alcohol as a risk factor for cancer was significantly associated with higher support for most alcohol related policies.

Our results are in line with studies from England and Australia, also indicating that awareness of alcohol as a risk factor for cancer can be increased through a mass media campaign (Martin et al., 2018; Dixon et al., 2015). This was found even though, unlike campaigns evaluated by previous studies (Martin et al., 2018; Dixon et al., 2015), our campaign was not TV-led but was only on social media and in the news media (digital/print/radio). Like Martin et al. (2018) we also found an increase in support for alcohol policies. However, they evaluated on two campaign waves approximately 4 months apart. After the first wave, they only found a significant increase in ‘strong support’ for one out of seven alcohol related policies, whereas, after the second wave of the campaign, an increase in ‘strong support’ was seen for all seven alcohol related policies. Furthermore, an increase in ‘any support’ was only seen for ‘a ban on TV alcohol advertising before 9 pm’ and only after the second wave. In the present study, we found increased support for most alcohol related policies after just one wave of campaigning. Pre campaign support levels of alcohol policies were lower in our study compared to the study by Martin et al., and it might be easier to increase support levels if they are low to begin with. This hypothesis could also offer an explanation to, why support for age related alcohol policies increased in males, and not females, who were more supportive at baseline, in our study.

Our finding that awareness of alcohol as a carcinogen was significantly associated with higher support for most alcohol related policies, is consistent with other research (Buykx et al., 2015; Bates et al., 2018). Buykx et al. (2015) and Bates et al. (2018) both reported significant associations between awareness of alcohol as a risk factor for cancer and support for all alcohol policies under investigation.

Taken together, available evidence indicates that media campaigns are effective in improving awareness of alcohol as a carcinogen and support for alcohol related policies. Furthermore, evidence indicates that increased awareness of alcohol as a risk factor for cancer may affect public support for alcohol policies.

##### 4.1. Study limitations and strengths

A strength of this pre- and post campaign design was that it included a baseline assessment of awareness of alcohol as a risk factor for cancer and support for alcohol related policies. Due to quota sampling, pre- and post campaign survey samples were similar with respect to sex and geographical region, with no clear difference seen with respect to age and education. This increases the likelihood that the higher awareness of alcohol as a carcinogen and the overall higher policy support levels seen post campaign were due to the campaign. However, it is possible that our results were affected by seasonal effects. The pre campaign survey was undertaken in the autumn while the post campaign survey was undertaken around Christmas, where attitudes and behaviors regarding alcohol may be different. Furthermore, other news about alcohol and health could possibly have affected awareness of alcohol as a risk factor of cancer, as well as support for alcohol policies.

However, prompted awareness of alcohol as a risk factor for cardiovascular diseases did not change, while – surprisingly – unprompted cardiovascular awareness was actually lower after the campaign. These results makes it more likely, that the observed increase in unprompted and prompted awareness of the link between alcohol and cancer was due to the campaign itself rather than other news about alcohol and

health. The strong association between campaign awareness and unprompted as well as prompted awareness of alcohol as a carcinogen further indicates that the observed increase in awareness is probably due to the campaign.

Preferably, we should have performed more than one post campaign evaluation, for instance 6 months after the campaign, in order to assess if awareness of alcohol as a risk factor for cancer and policy support levels were still higher compared to the pre campaign survey. However, this was not within the scope of the campaign and the evaluation of it.

The sample size of each survey wave ( $n = 3000$ ) was fairly large, allowing for stratified analyses when relevant. The use of panel data is a limitation of the study, as panel members may differ from the background population. For instance, panel members may be more highly educated and more curious and information seeking compared to the background population. A further limitation is the relative low response rate (37%), which is typical for online surveys. Hence, the findings of the present study cannot necessarily be generalized to the adult Danish population as a whole.

No golden standard exists for measuring awareness of alcohol as a risk factor for cancer. When cancer is listed as a reply option, respondents may tick it off, even though they do not know that alcohol increases the risk of cancer. When an open-ended question is formulated, respondents may wish to skip it quickly by only mentioning some of the diseases that comes to their mind. To complement each other, we choose to measure awareness of alcohol as a risk factor for cancer by an open-ended question (unprompted awareness) as well as a question with cancer as a reply option (prompted awareness). In line with previous research (Scheideler and Klein, 2018; Buykx et al., 2016), awareness of alcohol as a risk factor for cancer was lower, when an open-ended question was given, but the secular trends and the associations with support for policies were overall similar regardless of whether unprompted or prompted awareness was used.

## Appendix A

Table A.1

Odds ratios for awareness of alcohol as a risk factor for cancer and different cancer types according to survey timing in Denmark in 2017–2018 ( $N = 6000$ ).

	n	Unadjusted OR [95% CI]	Adjusted <sup>a</sup> OR [95% CI]
Unprompted awareness			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.30 [1.15–1.46]	1.34 [1.18–1.52]
Prompted awareness			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.22 [1.10–1.35]	1.24 [1.12–1.38]
Breast cancer (prompted)			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.10 [0.93–1.30]	1.14 [0.96–1.36]
Esophagus cancer (prompted)			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.08 [0.96–1.21]	1.09 [0.97–1.23]
Head and neck cancer (prompted)			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	0.95 [0.83–1.10]	0.99 [0.85–1.14]
Liver cancer (prompted)			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.15 [1.04–1.27]	1.18 [1.06–1.31]
Colorectal cancer (prompted)			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.15 [1.02–1.29]	1.17 [1.03–1.32]

<sup>a</sup> Adjusted for age group, education, smoking, and weekly alcohol consumption.

The dichotomization into support and no support for the suggested alcohol policies made us unable to detect differences in the proportion who disapproved the alcohol related policy suggestions. However, supplementary analyses showed a decrease in disapproval of the majority of these policies. This is an important finding, as it may be equally important to decrease resistance as to increase support if effective alcohol policies are to have a chance in being implemented.

## 5. Conclusion

A mass media campaign communicating that alcohol is carcinogenic was associated with a significant increase in awareness of alcohol as a risk factor for cancer and levels of public support for a range of alcohol related policies.

Further mass media campaigns are warranted, as the public have a right to know the consequences of alcohol consumption. Information itself does not necessarily decrease consumption, but evidence is growing that increased awareness of alcohol as a carcinogen is associated with greater support for alcohol related policies thereby creating an environment where effective alcohol policies are more likely to be implemented.

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## Declaration of Competing Interest

The authors declare that there are no conflicts of interest.

Table A.2

Odds ratios for support for alcohol related policies in general according to survey timing in Denmark in 2017–2018 (N = 6000).

	n	Unadjusted OR [95% CI]	Adjusted <sup>a</sup> OR [95% CI]
Minimum unit pricing			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.30 [1.16–1.45]	1.30 [1.16–1.46]
Limit number of retail outlets			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.13 [1.00–1.28]	1.11 [0.98–1.27]
Limit sale hours			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.02 [0.90–1.16]	1.02 [0.89–1.17]
Ban on alcohol advertising			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.15 [1.04–1.27]	1.14 [1.03–1.27]
Nutrition labeling			
Pre campaign	3000	1 (ref)	1 (ref)
Post campaign	3000	1.16 [1.04–1.28]	1.17 [1.05–1.30]

<sup>a</sup> Adjusted for age group, education, smoking, and weekly alcohol consumption.

Table A.3

Odds ratios for support for alcohol related policies regarding age limits, stratified by sex, according to survey timing in Denmark in 2017–2018 (N = 6000).

OR for policy support regarding age limits (support vs. other answers), stratified by sex						
Males (n = 3014)			Females (n = 2986)			
	n	Unadjusted OR [95% CI]	Adjusted <sup>a</sup> OR [95% CI]	n	Unadjusted OR [95% CI]	Adjusted <sup>a</sup> OR [95% CI]
18 years age limit for purchasing alcohol						
Pre campaign	1500	1 (ref)	1 (ref)	1500	1 (ref)	1 (ref)
Post campaign	1514	1.45 [1.26–1.68]	1.40 [1.20–1.64]	1486	1.01 [0.87–1.16]	0.96 [0.82–1.12]
Age limit on schools						
Pre campaign	1500	1 (ref)	1 (ref)	1500	1 (ref)	1 (ref)
Post campaign	1514	1.47 [1.28–1.70]	1.51 [1.29–1.76]	1486	0.99 [0.86–1.14]	0.92 [0.79–1.08]
Enforcement of age limits						
Pre campaign	1500	1 (ref)	1 (ref)	1500	1 (ref)	1 (ref)
Post campaign	1514	1.22 [1.05–1.42]	1.26 [1.08–1.48]	1486	0.95 [0.81–1.12]	0.95 [0.80–1.12]

<sup>a</sup> Adjusted for age group, education, smoking, and weekly alcohol consumption.

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