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Staub, Cornelia; Fuchs, Claudia; Siegrist, Michael

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## Risk perception and acceptance of health warning labels on wine

Cornelia Staub<sup>\*</sup>, Claudia Fuchs, Michael Siegrist

ETH Zürich, Institute for Environmental Decisions, Consumer Behavior, Switzerland

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### ABSTRACT

Wine is an essential part of European culture. Unfortunately, the consumption of alcohol, such as wine, can have negative health effects. Health warning labels (HWLs) are increasingly presented as a measure to warn consumers of the threat alcohol poses to their health. At present, only a few countries in Europe have introduced mandatory HWLs on wine bottles. This may be due to the cultural and economic significance of wine and the European public's refusal to accept HWLs on a product like wine. To investigate this issue, we conducted an online experiment in the German-speaking part of Switzerland and assessed the perception of risk in participants who were presented wine bottles featuring different types of HWLs. We also studied how health beliefs and cultural worldviews influence the perception and acceptance of HWLs. Our study revealed a small effect of HWLs on consumers' risk perception. There was no difference between a simple text-only HWL and a label featuring a deterring picture (image-and-text HWL). The major determinants of HWL acceptability were cultural worldviews and health beliefs. That is, participants who opposed government intervention for collective wellbeing and espoused a belief in the health benefits of wine were less likely to accept HWLs on wine. More research is needed to assess the effectiveness of HWLs in real-life situations and the importance of culture to the acceptance of such a public intervention measure.

### 1. Introduction

Wine production and consumption are essential aspects of European culture. Roughly 60% of the world's wine supply is produced in Europe, and Europeans, who account for only a tenth of the world's population, consume more than half the wine produced worldwide (International Organisation of Vine and Wine [OIV], 2019). Europeans' high consumption of wine and other alcoholic beverages is reflected in high rates of alcohol-related morbidity and mortality (World Health Organization, 2019).

Besides government campaigns to draw consumers' attention to the potential harms of alcohol consumption, health warning labels (HWLs) on alcohol containers are gaining increasing attention as potential interventions to reduce the harms of continuous and/or excessive drinking.

The present study aimed to investigate the effectiveness of different types of HWLs in increasing consumers' perceptions of various risks of alcohol consumption. The study also assessed how different factors, such as perceived health benefits of wine consumption, or individualistic values influence the perception and effectiveness of HWLs among wine

consumers. The next section presents the background of the study. This is followed by a description of the methods used to investigate this issue. Then the results are presented. The discussion contextualizes the findings in relation to the existing literature, and the paper ends with a conclusion and suggestions for future research.

#### 1.1. Background literature

Several studies have investigated the influence of different types of HWLs on outcome variables, such as negative emotions evoked by such labels, consumers' reactions to HWLs, or consumption and buying behaviors. Tobacco labeling has often been used as a benchmark for comparing labels with a simple warning statement (text-only HWL) and those additionally displaying a deterring image (image-and-text HWL). Wigg and Stafford (2016) identified a higher intention to quit or reduce alcohol consumption in people exposed to HWLs than in people not exposed to HWLs. Clarke, Pechey, Mantzari et al. (2020) found that HWLs with a cancer warning increased fear arousal and negatively affected the selection of an alcoholic beverage, with image-and-text HWLs having a stronger impact than text-only HWLs. Stafford and

<sup>\*</sup> Corresponding author at: ETH Zürich, Department of Health Sciences and Technology (D-HEST), Consumer Behavior, Universitätstrasse 22, CH-8092 Zürich, Switzerland.

E-mail address: [costaub@hest.ethz.ch](mailto:costaub@hest.ethz.ch) (C. Staub).

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Salmon (2017) measured consumption speed and found that both text-only and image-and-text HWLs significantly reduced the speed of consumption, which affected the amount consumed. Rosenblatt, Dixon, Wakefield, and Bode (2019) found the strongest effect of image-and-text HWLs on negative emotional arousal. Wigg and Stafford (2016) also identified a significant increase in fear arousal for image-and-text HWLs as well as text-only HWLs compared to HWL-free alcohol containers but no difference between the two labels. Depictions of bowel and liver cancers were found to elicit the most negative emotional response (Pechey et al., 2020).

Although perceived risk plays a key role in determining the degree to which people engage in a risky behavior, like alcohol consumption (Riddell & Hales, 2018), perceived risk has been used as an outcome variable in only a few studies. Clarke, Pechey, Mantzari et al. (2020) found higher perceived risk of cancer in groups exposed to an HWL with a cancer message compared to groups exposed to no HWL. However, Sillero-Rejon et al. (2018) found that perceived risk did not increase with image-and-text HWLs. Therefore, additional research is needed to assess the potential of HWLs to alter consumers' perceived risk of alcohol consumption. For the present study, we hypothesized that HWLs increase consumers' perceived risk of alcohol consumption and that image-and-text HWLs have a stronger effect than text-only HWLs.

At present, warning labels are mandatory in only a few European countries. This may be primarily due to the cultural and economic significance of wine and the lobbying in this sector. Another reason may be that alcohol consumers do not see the need for HWLs because they do not feel wine consumption has a negative impact on their health (Sillero-Rejon et al., 2018), or they may relativize and deny the risks associated with alcohol consumption (Bocquier, Fressard, Verger, Legleye, & Peretti-Watel, 2017).

In fact, studies have repeatedly found that many consumers in Europe and beyond believe that drinking wine in moderation has positive health effects (Annunziata, Pomarici, Vecchio, & Mariani, 2016a; Saliba & Moran, 2010; Vecchio et al., 2017). Although some research has shown the preventative effect of moderate wine consumption on cardiovascular diseases (see, e.g., Saleem & Basha, 2010), the number of scientists and doctors warning of the detrimental effect of guidelines for moderate consumption is growing. Experts have proposed ceasing to provide guidelines for safe consumption to consumers, since such guidelines may be misinterpreted and lead to increased consumption (Latino-Martel et al., 2011). Riddell and Hales (2018) echoed this, suggesting that beliefs in the health benefits of wine may lead to misperceptions of the risk of consuming alcohol. This study aimed to investigate whether health beliefs reduce the perceived risk of consumption and influence the effectiveness of HWLs.

Although many studies found a potential of HWLs to evoke fear or negative emotions, they have also found that the stronger the effect of the HWL, the more people tried to avoid it and the greater their aversion to HWLs was (Sillero-Rejon et al., 2018). In particular, consumers with the highest consumption levels were found to react the most negatively to HWLs (Jarvis & Pettigrew, 2013). The acceptability of HWLs, most notably of tobacco-related image-and-text HWLs, has been found to be very low (Clarke, Pechey, Kosite, et al., 2020; Clarke, Pechey, Mantzari, et al., 2020). This may be due to the anticipated loss of pleasure when consuming a product, like wine, bearing such a label. In fact, public acceptance of HWLs on alcohol was found to be particularly low for wine (Reynolds et al., 2019). Yet public acceptance is a key driver for the probability of HWLs being implemented (Reynolds et al., 2019).

Therefore, more research is needed to assess how HWLs can increase consumers' risk of consumption while being regarded as acceptable (Clarke, Pechey, Kosite, et al., 2020). For example, text-only HWLs may be less effective but garner more public acceptance and may, therefore, raise awareness while deterring people and lowering their alcohol consumption (Stafford & Salmon, 2017). We hypothesized that text-only HWLs are more accepted than image-and-text HWLs.

Acceptance of attempts to reduce the negative consequences of

alcohol consumption using public intervention methods, such as HWLs, may be affected by consumers' worldviews and their opinions of the role of government in society (Kahan, Jenkins-Smith, & Braman, 2011). Kahan et al. (2011) study showed that cultural predisposition affects how people respond to risks. Annunziata, Agnoli, Vecchio, Charters, and Mariani (2019) stressed that there are important differences between cultures regarding the role of wine in everyday life that may affect perceptions and acceptance of HWLs. In other words, considering the importance of wine in Europe, consumers are likely to perceive HWLs communicating the potential risks of wine consumption as a threat to their cultural values, which may evoke negative reactions toward the HWLs or even their rejection. It is, therefore, important to understand not only what kind of labeling the public will accept but also how cultural worldviews affect consumer acceptance of such interventions.

The goal of the present study was to assess the effectiveness of text-only and image-and-text HWLs with a cancer warning message in increasing consumers' perceptions of various risks. We hypothesized that HWLs increase consumers' perceived risk of consuming wine and that image-and-text HWLs have a stronger effect than text-only HWLs. Furthermore, the study aimed to assess how health beliefs, alcohol consumption, and cultural worldviews affect the perception and acceptance of HWLs on wine bottles. The findings presented in this paper add to the knowledge of HWLs on wine bottles, their potential acceptance by consumers, and the role that cultural values play in this context.

## 2. Material and methods

After participants accessed the online questionnaire, their alcohol consumption level was assessed. They were randomly assigned to one of three experimental conditions and were presented wine bottles with or without HWLs. They had to indicate their perception of various risks. Following this, we assessed participants' perceived need for HWLs and acceptance of the HWLs used in the experiment. Then participants' perceived health benefits of wine consumption were measured. Finally, their cultural orientations and worldviews were examined using a value scale suggested by Kahan et al. (2011). More details about the participants, the conduct of the experiment, and assessment of the different scales are provided below.

### 2.1. Data collection and sample characteristics

We conducted an online experiment in the German-speaking part of Switzerland ( $N = 457$ ). Data were collected in October 2020 by a market research company (respondi AG, Cologne, Germany) until the desired number of responses and quotas for gender and age were attained. Participants had to be at least 18 years old. Wine consumption frequency was used as a filter question to exclude people who do not consume wine. No prior knowledge of wine was required. Following Hartmann, Keller, and Siegrist (2016) approach, participants who did not finish the survey or who completed it within less than half the median duration ( $Mdn = 664$  s) were excluded from further analysis to ensure that participants had read the possible answers and followed the instructions. Of the total of 457 participants, 226 were male and 231 were female. The mean age was 46 years ( $SD = 16$  years). Participants were randomly assigned to one of three experimental conditions: 156 in the control group, 157 with a text-only HWL, and 144 with an image-and-text HWL. Age and gender quotas for the three conditions were the same as for the entire study.

### 2.2. Alcohol consumption

For participants' total alcohol intake, consumption frequency of wine, beer, and spirits were assessed. For consumption frequency, possible answers were *never* (0), *rarely* (1), *once in three months* (2), *once a month* (3), *several times a month* (4), *once a week* (5), *several times a week*

(6), and *daily* (7). Participants who choose *never* were excluded from the study. The mean consumption frequency for wine, beer, and spirits was calculated to use as a proxy for alcohol consumption level. The median split ( $Mdn = 3.3$ ) was used to create groups with less ( $n = 201$ ) and more frequent consumers of alcohol ( $n = 256$ ). People with a value below or equal to the median were assigned to the less frequent alcohol consumers group.

### 2.3. Experiment

To assess the influence of an HWL on risk perception, we designed an experiment with three conditions. Participants in the first condition, the control group, were presented a wine bottle with no warning label. Participants in the second condition were presented a bottle with a textual warning label below the actual wine label stating “Alcohol causes deadly liver cancer.” In the third condition, the same bottle with the text warning was shown with an image of a diseased liver above the text (Fig. 1). The two types of warning labels were chosen for comparison to the existing literature about text-only and image-and-text warning labels on wine (see, e.g., Clarke, Pechey, Kosite, et al., 2020). The main label presenting the origin of the wine was fictitious and was created using Adobe InDesign. It mentioned all mandatory information that is found on wine labels, such as the vintage, origin, alcohol content, and volume, as well as some additional information to make the label look more authentic, such as estate bottled wine (*mise en bouteille au Château*).

After participants inspected the bottle, they were asked five questions about their level of perceived risk regarding wine consumption from the bottle of wine presented to them (Table 1). Two items were used to assess the risk of cancer from regular consumption and impact on health in general without specifying the amount consumed. Another two items assessed the risk of consuming a specified amount of wine—namely, two glasses on a regular basis or half a bottle on just one occasion. Another item was included about the risk to an unborn child, since current warning labels already address this risk, for example, in France. The displayed bottle was the same for every question and the order of the risk questions was randomized. To answer, participants had to move a slider with no indication of value and no grid lines. This rating was transformed into a value between 0 and 100.



Fig. 1. Wine bottles presented in the experiment. Bottles presented in (1) the control group, (2) the second condition with the text-only warning, and (3) the third condition with the image-and-text warning.

Table 1

Risk items evaluated by the experimental groups.

Name	Risk item	Labels of scale <sup>a</sup>
<i>Not quantified consumption</i>		
Cancer	How high do you perceive the risk of falling ill with cancer if you drink this wine regularly?	No risk (0) – very high risk (100)
Health impact	How do you perceive the impact on your health if you regularly consume the above wine?	Not negative at all (0) – very negative (100)
<i>Quantified consumption</i>		
Two glasses	How high do you perceive your personal risk if you consume two glasses a day of the above wine?	No risk (0) – very high risk (100)
Half a bottle	Do you worry about your health if you consume half a bottle of the above wine?	Not at all (0) – yes, a lot (100)
<i>Pregnancy</i>		
Unborn Child	How high do you perceive the health risk to an unborn child if the mother regularly drinks the above wine?	No risk (0) – very high risk (100)

<sup>a</sup> Numbers in parentheses indicate the value assigned to the label.

### 2.4. Acceptance and convincingness of health warning labels

After participants were shown only one of the three bottles (Fig. 1) and were asked to evaluate the perceived risk of wine consumption, they were presented with all three bottles: control, text-only, and image-and-text warning. They were asked to compare the three bottles and state which type of wine labeling they found most convincing, which one was the most acceptable, which one they thought would have the greatest impact on people’s drinking behavior, and which one was most likely to prevent pregnant women from drinking.

### 2.5. Perceived need for health warning labels

Participants were asked about their perceived need for HWLs on wine bottles. They had to indicate their agreement with seven statements using a 5-point Likert-type scale. The items used for this scale were adapted from Annunziata, Pomarici, Vecchio, and Mariani (2016b) and can be found in Table 2. The Likert-type scale had the following answer options: *I disagree* (1), *I rather disagree* (2), *I neither agree nor disagree* (3), *I rather agree* (4), and *I agree* (5). A principal component analysis (PCA) was conducted to see whether the items would load on one factor. The scree plot indicated a one-factor solution for the items and the explained variance was 47%. The scale had a high reliability with Cronbach’s alpha of 0.89. For further analyses, the mean of the seven items was calculated.

### 2.6. Perceived health benefits of wine

Participants were asked about their perceived benefits of wine consumption to their health. Again, participants had to indicate their agreement to statements (Table 2) using the above-described 5-point Likert-type scale. The PCA revealed a one component solution with all factor loadings higher than 0.56. Cronbach’s alpha of 0.76 showed the scale’s good reliability. The mean of the six items was calculated. The midpoint of the scale (3) was used to assign participants to groups representing fewer ( $n = 228$ ) and more ( $n = 229$ ) perceived health benefits of wine consumption. Participants with a mean equal to or smaller than the midpoint were assigned to the group with fewer perceived health benefits of wine.

### 2.7. Cultural worldviews

The implementation of mandatory warning labels on wine bottles is a government intervention. Thus, people may perceive such labels differently depending on their opinion of the state’s responsibility to

**Table 2**  
Items used for the different scales with factor loadings.

	Factor loadings
<i>Perceived need for health warning labels</i>	
Warnings on wine labels have a positive influence on society.	0.69
I don't find it necessary to point out the negative consequences of wine consumption for pregnant women (recoded).	0.50
Wine labels should contain a warning that one is not supposed to drive after drinking.	0.85
Warning labels on wine bottles aren't necessary (recoded).	0.87
I appreciate if wine bottles carry warning labels.	0.88
Wine labels should advise not to drink wine when taking medicine.	0.83
<i>Perceived health benefits of wine</i>	
Moderate consumption of red wine is healthy.	0.68
Wine consumption prevents cardiovascular disease.	0.80
If you only consume small amounts, you can drink wine every day.	0.68
Even small amounts of wine can negatively impact your health (recoded).	0.62
Moderate consumption of white wine is healthy.	0.74
Wine consumption is only dangerous if you get drunk.	0.56
<i>Cultural worldviews (individualistic values)</i>	
The government interferes far too much in our everyday lives.	0.77
The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals (recoded).	0.82
It's not the government's business to try to protect people from themselves.	0.75
The government should stop telling people how to live their lives.	0.85
Sometimes, the government needs to make laws that keep people from hurting themselves (recoded).	0.65
The government should put limits on the choices individuals can make so they don't get in the way of what's good for society (recoded).	0.76

interfere and protect its citizens. Therefore, data were collected on participants' cultural orientations and worldviews using a scale proposed by Kahan et al. (2011). The authors suggested measuring cultural worldviews on two dimensions: hierarchy and individualism. Hierarchy refers to social orderings in terms of race, gender, and class, whereas individualism addresses social orderings in terms of individual rights and their restrictions for the wellbeing of the collective. Since only the individualism subscale was particularly relevant for the present study, the hierarchy subscale was excluded. Table 2 shows the six items from the individualism scale. Responses could be given on a 7-point Likert-type scale ranging from *I don't agree at all* (1) to *I completely agree* (7), where only the extreme points were verbally anchored. The items loaded on one factor and had an explained variance of 59%. As the scale had high reliability ( $\alpha = 0.86$ ), the mean was calculated for use in further analyses. A higher mean indicated more individualistic values, such as thinking the government does not need to determine individual rights for the welfare of society. Conversely, a low mean meant putting societal welfare above individual rights.

### 2.8. Data analysis

The influence of the three experimental groups with different warning labels was analyzed with one-way analyses of variance (ANOVAs) for each risk. The type of warning label participants saw (no label, text-only HWL, image-and-text HWL) was the independent variable and perceived risk was the dependent variable. Due to the potential influence of perceived health benefits of wine and consumption frequency of alcohol on a participant's risk perception, separate  $3 \times 2 \times 2$  ANOVAs were conducted for the individual risk items. The explanatory variables were the experimental groups, perceived health benefits of wine (2 levels, see above), and consumption frequency (2 levels, less and more frequent consumers). For the acceptability of HWLs, a binary logistic regression analysis was done with the predictors of gender, alcohol consumption frequency, perceived health benefits of wine, and individualistic values. For perceived need for HWLs, a linear regression

analysis was carried out using the same predictors.

### 3. Results

We were interested in whether HWLs affect the perceived risk of wine consumption. Table 3 provides an overview of the means of risk perception ratings of the five risk items presented in the three experimental groups. The three groups did not differ in age, gender, educational level, or alcohol consumption frequency (univariate ANOVAs [chi squared for gender],  $p > 0.05$ ). Thus, we assumed that the randomization was successful. One-way ANOVAs and post-hoc tests were conducted for each risk item separately. The results show significant differences between groups for the risk items in which the consumption quantity was not specified: *cancer* ( $F(2, 452) = 10.95, p < 0.001$ ) and *health impact* ( $F(2, 452) = 3.55, p = 0.030$ ).

No significant differences were detected between the three groups for the risk items in which the consumed quantity was specified and for the *unborn child* item. The latter attained the highest scores of the five risk items with an overall mean of 87 with a standard deviation of 17, indicating a high perceived risk. Therefore, we found that our hypothesis that HWLs can increase consumers' perceived risk of consuming wine is only partially true.

Tukey's post-hoc tests showed that for *cancer*, there was a significant difference between the control group and both the group with the text-only HWL ( $p < 0.001$ ) and the group with the image-and-text HWL ( $p = 0.001$ ). The two groups with warning labels did not differ significantly from each other ( $p = 0.811$ ). For *health impact*, Tukey's post-hoc test revealed significant differences between the control group and the text-only HWL group ( $p = 0.029$ ) but not between the control group and the image-and-text HWL group ( $p = 0.145$ ). Again, the two groups with HWLs did not show a significant difference in perceived risk for this item ( $p = 0.801$ ). Hence, our hypothesis that image-and-text HWLs more strongly increase the perceived risk of consumers could not be confirmed. For the following analyses, we focused on these two risk items for which we found significant differences between the groups.

People who believe in the health benefits of wine may have lower risk sensitivity. Furthermore, higher alcohol consumption frequency was previously found to be negatively correlated with perceived risk of alcohol consumption. Therefore, we conducted two separate  $3 \times 2 \times 2$  ANOVAs with Tukey's post-hoc tests with the dependent variables of *cancer* and *health impact* and used the experimental group, the perceived health benefits of wine (2 levels), and alcohol consumption frequency (2 levels) as independent variables (Table 4). The experimental group had a main effect on the perceived risk of cancer but not on the general health impact. There was a significant main effect of perceived health benefits of wine on both *cancer* and *health impact*. Participants who believe that wine is beneficial to their health if consumed in moderate amounts perceived a lower risk of falling ill with cancer ( $M = 34, SD = 25$ ) compared to participants with less belief in such health benefits of wine ( $M = 53, SD = 26$ ). Similarly, participants with strong health beliefs perceived a lower health impact of wine consumption ( $M = 37, SD = 24$ ) compared to those with fewer beliefs in the health benefits of wine consumption ( $M = 63, SD = 24$ ).

There was a significant interaction effect of experimental group  $\times$  perceived health benefits of wine for the risk item *health impact*. Hence, the effect that the presence of an HWL had on participants' perceived health impact differed between participants with more or less perceived health benefits of wine. In the group with more perceived health benefits of wine, the HWL significantly affected the perceived health impact ( $F(2, 225) = 4.71, p = 0.010$ ). More specifically, participants with the text-only label ( $M = 42, SD = 25$ ) perceived a more negative impact on their health ( $p = 0.014$ ) than participants with no HWL ( $M = 31, SD = 22$ ). Participants in the image-and-text HWL group ( $M = 40, SD = 24$ ) also perceived a more negative health impact than the no HWL group ( $p = 0.052$ ). There was no significant difference between the two groups with text-only and image-and-text HWLs ( $p = 0.895$ ). Conversely, in the

**Table 3**  
Means and standard deviations of the five risk items for the three experimental groups.

Name	Risk item	No HWL	Text-only HWL	Image-and-text HWL
		M (SD)	M (SD)	M (SD)
<i>Not quantified consumption</i>				
Cancer	How high do you perceive the risk of falling ill with cancer if you drink this wine regularly?	36 (26) <sup>a</sup>	49 (27) <sup>b</sup>	47 (27) <sup>b</sup>
Health impact	How do you perceive the impact on your health if you regularly consume the above wine?	45 (27) <sup>a</sup>	53 (27) <sup>b</sup>	51 (27) <sup>ab</sup>
<i>Quantified consumption</i>				
Two glasses	How high do you perceive your personal risk if you consume two glasses a day of the above wine?	48 (29)	52 (30)	49 (28)
Half a bottle	Do you worry about your health if you consume half a bottle of the above wine?	46 (31)	47 (32)	45 (33)
<i>Pregnancy</i>				
Unborn Child	How high do you perceive the health risk for an unborn child if the mother regularly drinks the above wine?	87 (16)	85 (19)	88 (16)

Note. Different letters in the same row indicate significant differences ( $p < 0.05$ ) between the means of the experimental groups based on Tukey's post-hoc test.

**Table 4**  
Univariate ANOVAs for the risk items *cancer and health impact*.

Main effects	Cancer			Health impact		
	F	df1, df2	p	F	df1, df2	p
Experimental group	9.62	2, 445	< 0.001	2.23	2, 445	0.108
Perceived health benefits of wine	51.39	1, 445	< 0.001	110.00	1, 445	< 0.001
Alcohol consumption frequency	0.74	1, 445	0.389	6.02	1, 445	0.015
<i>Interaction effects</i>						
Experimental group × Perceived health benefits of wine	1.53	2, 445	0.219	3.75	2, 445	0.024
Experimental group × Alcohol consumption frequency	2.04	2, 445	0.131	0.37	2, 445	0.690
Perceived health benefits of wine × Alcohol consumption frequency	0.07	1, 445	0.791	0.08	1, 445	0.777
Experimental group × Perceived health benefits of wine × Alcohol consumption frequency	0.87	2, 445	0.421	1.68	2, 445	0.188

Note.  $N = 457$ .

group with fewer perceived health benefits of wine, there was no significant difference between the three experimental groups with and without HWLs ( $F(2, 226) = 0.081, p = 0.922$ ).

Alcohol consumption frequency had a significant main effect on *health impact* but did not significantly affect participants' perceived risk of cancer. The health impact of regular wine consumption was perceived as more severe by participants who consume alcohol less frequently ( $M = 47, SD = 27$ ) than by participants with higher alcohol consumption ( $M = 41, SD = 27$ ). There were no significant interaction effects between alcohol consumption and the experimental group or perceived health benefits of wine, nor were there significant three-way interactions.

The above results show that labels on wine bottles warning consumers of liver cancer increased the perceived health risk if the quantity consumed was not specified. However, the presence of a warning label did not alter participants' perceived risk in a realistic scenario in which the amount consumed was specified, nor did it affect the perceived health risk of another person—namely, an unborn baby intoxicated by a drinking mother. The results also indicate the importance of the perception of health beliefs from wine and the relationship between alcohol consumption frequency and the perceived risk.

For the successful implementation of HWLs, public acceptance is crucial. We found that the image-and-text HWL had the lowest acceptability. Labeling with no health warning was considered the most acceptable (59.5%) and the most convincing (54.5%). However, in terms of people's drinking behavior, 53.4% stated that the wine label with the image-and-text HWL had the highest impact (Table 5). Similarly, 54.9% thought the latter was the most likely label to prevent pregnant women from drinking.

To ensure that the responses were not influenced by the experimental manipulation, we conducted chi-squared tests. None of the comparisons were significant, indicating that exposure to a bottle with a warning label did not affect participants' assessments of the label's acceptability, convincingness, perceived effectiveness in influencing people's drinking behavior, and ability to prevent pregnant women from drinking.

For the potential implementation of HWLs on wine bottles, it is important to know what determines consumers' acceptance of such warning labels. We conducted a binary logistic regression analysis to

**Table 5**  
Comparison of wine labels in terms of convincingness, acceptability, and effectiveness.

Variable	Question	No HWL		Text-only HWL		Image-and-text HWL	
		n	%	n	%	n	%
Convincingness	Which of the wine labels do you find most convincing?	249	54.5	107	23.4	101	22.1
Acceptance	Which of the wine labels do you find most acceptable?	272	59.5	153	33.5	32	7
Effectiveness drinking	Which of the wine labels do you think has the greatest influence on people's drinking behavior?	121	26.5	92	20.1	244	53.4
Effectiveness pregnancy	Which of the wine labels do you think is most likely to prevent pregnant women from drinking?	101	22.1	105	23.0	251	54.9

Note.  $N = 457$ . Participants had to choose one of the three bottles with either no HWL, a text-only HWL, or an image-and-text HWL. The percentages are calculated for rows.

predict whether or not a participant will accept HWLs on wine bottles. We dummy-coded the dependent variable *acceptance*. If participants chose the wine bottle with no HWL as the most acceptable one, the dummy value was 0; if they chose either the text or image-and-text HWL, the dummy value was 1. As predictor variables, we used alcohol consumption frequency, perceived health benefits of wine, individualistic values, and gender (Table 6).

As Table 6 shows, participants who perceived no health benefits of wine consumption and tended to be communitarian rather than individualistic were the likeliest participants to accept HWLs on wine bottles. The model was significant ( $\chi^2(4) = 77.57, p < 0.001$ ) and the strongest negative predictors were individualistic values and perceived health benefits of wine.

Previous studies found that consumers' acceptance of HWLs will likely depend on their perceived need for displaying such warnings on wine bottles. Increasing consumers' awareness of this need, therefore, may lead to increased acceptance of such HWLs. We conducted a linear regression analysis for perceived need for HWLs with the predictors of alcohol consumption frequency, perceived health benefits of wine, individualistic values, and gender (Table 7).

The model was significant ( $F(4, 452) = 35.58, p < 0.001$ ) and explained 23% of the variance in perceived need for HWLs on wine bottles. The results show that being individualistic and perceiving health benefits of wine decreased the perceived need for HWLs on wine bottles. The strongest negative predictor was the variable individualistic values. This indicates that participants with critical views on public authorities' use of interventions for the welfare of society perceived HWLs as being less necessary compared to participants supporting curbing individual rights for collective wellbeing.

#### 4. Discussion

The present study examined the influence of HWLs on wine bottles on consumers' perceived risk of wine consumption. It further investigated how beliefs in the health benefits of wine, alcohol consumption frequency, and cultural worldviews influence the perception and acceptance of HWLs.

We found that although HWLs increased the perception of some risks, the effect was small. The findings support the hypothesis that HWLs can increase some perceived risks of wine consumption. However, no evidence was found that image-and-text HWLs have a stronger effect than text-only HWLs, which was reported in an earlier work (Wigg and Stafford, 2016). Kersbergen and Field (2017) showed that the attention consumers pay to warning labels is proportional to the size of the label, which may, in turn, influence the label's effect. Even though the image-and-text HWL in this study was larger, we did not find a stronger effect in comparison to the smaller text-only HWL. This may be because labels with deterring images, like the ones used in this study, can cause consumers to avoid or reject the labels, diminish the time spent looking at them, and thus, lessen their effect (Clarke, Pechey, Mantzari, et al., 2020; Sillero-Rejon et al., 2018). We also found that the HWLs only elevated participants' perceived risk when the consumption quantity was not specified. Participants with drinking patterns that differed from

**Table 6**

Results from the binary logistic regression analysis for acceptance of HWLs on wine bottles.

Variable	B	SE B	OR
Constant	2.97	0.68	19.45**
Alcohol consumption frequency	0.00	0.08	1.00
Perceived health benefits of wine	-0.32	0.15	0.72*
Individualistic values	-0.65	0.10	0.52**
Gender <sup>a</sup>	0.32	0.22	1.38

Note.  $N = 457$ . Nagelkerke  $R^2 = 0.21$ .

\* $p < 0.05$ , \*\* $p < 0.001$

<sup>a</sup> Dummy-coded gender: 0 = male, 1 = female.

**Table 7**

Results from the regression analysis for perceived need for health warning labels.

Variable	B	SE B	$\beta$
Constant	5.01	0.27	
Alcohol consumption frequency	-0.04	0.03	-0.05
Perceived health benefits of wine	-0.16	0.06	-0.11*
Individualistic values	-0.34	0.04	-0.42**
Gender <sup>a</sup>	0.10	0.09	0.05

Note.  $N = 457$ .  $R^2 = 0.23$

\* $p < 0.05$ , \*\* $p < 0.01$

<sup>a</sup> Dummy coded gender: 0 = male, 1 = female.

those specified may not have felt susceptible in the first place; thus, the warning label did not affect their risk perception of such a drinking habit. A previous study found that HWLs did not affect people's perceived susceptibility to alcohol-related risks even when the imagery was highly severe (Sillero-Rejon et al., 2018). Hence, if consumers do not feel susceptible to a risk, a warning label may have no effect.

The study further demonstrated that beliefs in the health benefits of wine and a person's drinking habits strongly influenced their perceived risk of wine consumption. Beliefs that wine can have a beneficial effect on health if it is consumed in moderation are widespread in Europe (Annunziata et al., 2016b; Vecchio et al., 2017) and may lead consumers to relativize or even deny the risk they face when they drink (Bocquier et al., 2017). This study found that participants who believe in the potential health benefits of wine consumption had lower perceived risk compared to those with no such convictions. Addressing such health beliefs may be a challenge for policymakers, since it was previously found that many consumers feel they are well informed about the risks of alcohol consumption, though they, in fact, are not (Annunziata et al., 2016a; Bocquier et al., 2017).

Moreover, participants with higher alcohol consumption frequency had lower perceived risk compared to participants with a less frequent alcohol consumption, which has been reported in the literature (see, e.g., Riddell & Hales, 2018; Sjöberg, 1998). Consumers with a high alcohol consumption may more strongly downplay the risk of alcohol consumption (Bocquier et al., 2017) and react more negatively to HWLs on alcohol containers (Jarvis & Pettigrew, 2013). However, we cannot say whether frequent drinking is a result of low perceived risk or whether consumers relativize the perceived risk of their (high) consumption to reduce the cognitive dissonance between their behavior and the risk they expose themselves to.

HWLs are part of mandatory labeling in only a few countries in Europe. Low acceptance of such warning labels on alcohol containers has been identified (Reynolds et al., 2019), especially if these labels include deterring images similar to those on tobacco products (Clarke, Pechey, Kosite, et al., 2020). In traditional wine-producing countries, such as those in Europe, lack of consumer acceptance is a key driver against the implementation of HWLs on wine bottles (Stafford & Salmon, 2017). The findings of the present study support our hypothesis that acceptance of text-only HWLs is higher compared to image-and-text HWLs. A bottle with no warning label was perceived as most acceptable, which was also observed in samples of French and Italian consumers (Annunziata et al., 2019). Further, we found cultural worldviews to be the most decisive factor in the acceptance of HWLs (or the lack thereof). The importance of cultural worldviews in people's openness regarding policy interventions has been reported previously, for example, regarding climate change (Shi, Visschers, & Siegrist, 2015).

The lack of acceptance of HWLs on wine bottles may be a result of consumers' lack of awareness of the link between wine consumption and negative health effects (Pechey et al., 2020). In the cases of energy-dense foods and sugar-sweetened beverages, it was found that the acceptance of HWLs on packaging was related to higher public awareness of the negative impact of consumption on health (Pechey et al., 2020). Ignorance of the potential harm of alcohol consumption combined with a

belief in the health benefits of wine may reduce consumers' perceived need for, and acceptance of, HWLs (Annunziata et al., 2016b; Bocquier et al., 2017; Corrales-Gutierrez, Mendoza, Gomez-Baya, & Leon-Larios, 2019; Saliba & Moran, 2010). Hence, raising awareness of the link between alcohol consumption and its associated risks by providing accurate information seems essential for increasing consumers' acceptance of HWLs on beverages like wine.

The literature concerning HWLs on alcohol containers has often suggested that HWLs represent a way of informing consumers about the downsides of alcohol consumption and may, therefore, help people make better decisions and decrease their consumption (Al-Hamdani & Smith, 2017; Annunziata et al., 2019; Jongenelis et al., 2018; Wigg and Stafford, 2016). However, if the goal of depicting a deterring image or a warning text is to simply inform consumers, it is questionable why the warnings should aim to evoke feelings like fear or an elevated perception of risk to prevent people from drinking. Other studies have suggested that HWLs that evoke negative feelings (rather than inform) motivate consumers to drink less (Rosenblatt et al., 2019; Sillero-Rejon et al., 2018; Wigg and Stafford, 2016). Our results show that many participants thought HWLs could effectively influence drinking behavior, which was reported previously in the literature (Miller, Ramsey, Baratin, & Olver, 2016). However, in France, where HWLs on wine bottles are mandatory, consumers have been repeatedly found to underestimate the risk of consumption and perceive the HWLs to be ineffective (Annunziata et al., 2019; Annunziata et al., 2016a). Thus, the warning label in place is either not effective in informing consumers or is not a sufficient deterrent to raise consumers' perceived risk. Jongenelis et al. (2018) stressed that in cultures where alcohol consumption is well accepted, as in Europe, warning labels on wine bottles are unlikely to change behavior if used in isolation. The results from this study confirm the importance of cultural worldviews in the perception of HWLs and suggest that the effectiveness of such labels may be restricted by widespread beliefs in the health benefits of wine consumption.

The present study faced several limitations. As participants answered an online questionnaire, we cannot state how HWLs affect perceived risk in a real-life consumption situation and whether they are (unable to) alter consumers' buying and consumption behaviors. The online questionnaire assessed consumption using overlapping answer options. We do not, however, assume that this significantly influenced our results. Investigations into perceptions and behaviors with alcohol are prone to social desirability bias (Davis, Thake, & Vilhena, 2010). While acceptance of HWLs on wine bottles was found to be low and cultural values seemed to play a pivotal role in this context, we do not know whether HWLs on alcoholic beverages that are not as deeply rooted in Swiss culture as wine is may be more acceptable.

Future studies should use real-life scenarios to assess how effective HWLs are in altering people's drinking behavior in the long term. Consumers' acceptance is key to the implementation of warning labels (Reynolds et al., 2019). Hence, research must address the question of whether an HWL that consumers accept can nevertheless alter their perceived risk of consuming wine and, by doing so, affect their drinking behavior. Furthermore, future studies should investigate the role of culture in the acceptance of HWLs by comparing different countries and alcoholic beverages. For example, vodka does not have the important place in Swiss culture that wine does, and therefore, an HWL on a beverage like vodka may be received differently. Public policies must take into account consumers' lack of knowledge of the effects of alcohol consumption and address the widely held belief that moderate wine consumption is healthy.

## 5. Conclusion

The present study assessed the impact of HWLs on wine bottles on wine consumers' risk perception. Specifically, it investigated consumers' acceptance of HWLs and the degree to which perceived health benefits and cultural worldviews affect consumers' perceptions of such

labels. The effect of HWLs on perceived risk in a sample of Swiss consumers was small. The results indicate that HWLs may not increase consumers' risk perception if they do not feel susceptible to a risk in the first place. The effects of text-only and image-and-text HWLs were similar, but the latter was regarded as much less acceptable. Belief in the health benefits of wine consumption negatively affected the risk perception and acceptance of HWLs. The present study further showed that cultural worldviews play a pivotal role in determining consumers' acceptance of HWLs. Future studies should investigate the role of culture in the perception of HWLs and whether HWLs that are acceptable to consumers are effective in raising awareness of the potential harm related to regular and/or excessive wine consumption and, consequently, influence consumers' buying and consumption behaviors.

## CRedit authorship contribution statement

**Cornelia Staub:** Conceptualization, Data curation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Claudia Fuchs:** Conceptualization, Investigation, Data curation, Writing – review & editing. **Michael Siegrist:** Conceptualization, Supervision, Writing – review & editing, Validation.

## Declaration of Competing Interests

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

## References

- Al-Hamdani, M., & Smith, S. M. (2017). Alcohol health-warning labels: Promises and challenges. *Journal of Public Health*, 39(1), 3–5. <https://doi.org/10.1093/pubmed/fox010>
- Annunziata, A., Agnoli, L., Vecchio, R., Charters, S., & Mariani, A. (2019). Health warnings on wine labels: A discrete choice analysis of Italian and French Generation Y consumers. *Wine Economics and Policy*, 8(1), 81–90. <https://doi.org/10.1016/j.wep.2019.03.001>
- Annunziata, A., Pomarici, E., Vecchio, R., & Mariani, A. (2016a). Health warnings on wine: A consumer perspective. *British Food Journal*, 118(3), 647–659. <https://doi.org/10.1108/BFJ-08-2015-0300>
- Annunziata, A., Pomarici, E., Vecchio, R., & Mariani, A. (2016). Nutritional information and health warnings on wine labels: Exploring consumer interest and preferences. *Appetite*, 106, 58–69. <https://doi.org/10.1016/j.appet.2016.02.152>
- Bocquier, A., Fressard, L., Verger, P., Legleye, S., & Peretti-Watel, P. (2017). Alcohol and cancer: Risk perception and risk denial beliefs among the French general population. *European Journal of Public Health*, 27(4), 705–710. <https://doi.org/10.1093/eurpub/ckx024>
- Clarke, N., Pechey, E., Kosite, D., Konig, L. M., Mantzari, E., Blackwell, A. K. M., ... Hollands, G. J. (2020). Impact of health warning labels on selection and consumption of food and alcohol products: Systematic review with meta-analysis. *Health Psychology Review*, 1–24. <https://doi.org/10.1080/17437199.2020.1780147>
- Clarke, N., Pechey, E., Mantzari, E., Blackwell, A. K. M., De-loyde, K., Morris, R. W., ... Hollands, G. J. (2021). Impact of health warning labels communicating the risk of cancer on alcohol selection: An online experimental study. *Addiction*, 116(1), 41–52. <https://doi.org/10.1111/add.15072>
- Corrales-Gutierrez, I., Mendoza, R., Gomez-Baya, D., & Leon-Larios, F. (2019). Pregnant Women's Risk Perception of the Teratogenic Effects of Alcohol Consumption in Pregnancy. *Journal of Clinical Medicine*, 8(6). <https://doi.org/10.3390/jcm8060907>
- Davis, C. G., Thake, J., & Vilhena, N. (2010). Social desirability biases in self-reported alcohol consumption and harms. *Addictive Behaviors*, 35(4), 302–311. <https://doi.org/10.1016/j.addbeh.2009.11.001>
- Hartmann, C., Keller, C., & Siegrist, M. (2016). Compensatory beliefs, nutrition knowledge and eating styles of users and non-users of meal replacement products. *Appetite*, 105, 775–781. <https://doi.org/10.1016/j.appet.2016.07.013>
- International Organisation of Vine and Wine. (2019). *OIV statistical report on world vitiviniculture*.
- Jarvis, W., & Pettigrew, S. (2013). The relative influence of alcohol warning statement type on young drinkers' stated choices. *Food Quality and Preference*, 28(1), 244–252. <https://doi.org/10.1016/j.foodqual.2012.08.011>
- Jongenelis, M. I., Pratt, I. S., Slevin, T., Chikritzh, T., Liang, W., & Pettigrew, S. (2018). The effect of chronic disease warning statements on alcohol-related health beliefs and consumption intentions among at-risk drinkers. *Health Education Research*, 33(5), 351–360. <https://doi.org/10.1093/her/cyy025>
- Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, 14(2), 147–174. <https://doi.org/10.1080/13669877.2010.511246>



- Kersbergen, I., & Field, M. (2017). Alcohol consumers' attention to warning labels and brand information on alcohol packaging: Findings from cross-sectional and experimental studies. *BMC Public Health*, 17(1), 123. <https://doi.org/10.1186/s12889-017-4055-8>
- Latino-Martel, P., Arwidson, P., Ancellin, R., Druesne-Pecollo, N., Hercberg, S., Le Quellec-Nathan, M., ... Maraninchi, D. (2011). Alcohol consumption and cancer risk: Revisiting guidelines for sensible drinking. *CMAJ, Canadian Medical Association*, 183(16), 1861–1865. <https://doi.org/10.1503/cmaj.110363>
- Miller, E. R., Ramsey, I. J., Baratiny, G. Y., & Olver, I. N. (2016). Message on a bottle: Are alcohol warning labels about cancer appropriate? *BMC Public Health*, 16, 139. <https://doi.org/10.1186/s12889-016-2812-8>
- Pechey, E., Clarke, N., Mantzari, E., Blackwell, A. K. M., De-Loyde, K., Morris, R. W., ... Hollands, G. J. (2020). Image-and-text health warning labels on alcohol and food: Potential effectiveness and acceptability. *BMC Public Health*, 20(1), 376. <https://doi.org/10.1186/s12889-020-8403-8>
- Reynolds, J. P., Archer, S., Pilling, M., Kenny, M., Hollands, G. J., & Marteau, T. M. (2019). Public acceptability of nudging and taxing to reduce consumption of alcohol, tobacco, and food: A population-based survey experiment. *Social Science & Medicine*, 236, 112395. <https://doi.org/10.1016/j.socscimed.2019.112395>
- Riddel, M., & Hales, D. (2018). Predicting cancer-prevention behavior: Disentangling the effects of risk aversion and risk perceptions. *Risk Analysis*, 38(10), 2161–2177. <https://doi.org/10.1111/risa.13111>
- Rosenblatt, D. H., Dixon, H., Wakefield, M., & Bode, S. (2019). Evaluating the influence of message framing and graphic imagery on perceptions of food product health warnings. *Food Quality and Preference*, 77, 32–42. <https://doi.org/10.1016/j.foodqual.2019.05.003>
- Saleem, T. S., & Basha, S. D. (2010). Red wine: A drink to your heart. *Journal of Cardiovascular Disease Research*, 1(4), 171–176. <https://doi.org/10.4103/0975-3583.74259>
- Saliba, A. J., & Moran, C. C. (2010). The influence of perceived healthiness on wine consumption patterns. *Food Quality and Preference*, 21(7), 692–696. <https://doi.org/10.1016/j.foodqual.2010.05.006>
- Shi, J., Visschers, V. H., & Siegrist, M. (2015). Public perception of climate change: The importance of knowledge and cultural worldviews. *Risk Analysis*, 35(12), 2183–2201. <https://doi.org/10.1111/risa.12406>
- Sillero-Rejon, C., Attwood, A. S., Blackwell, A. K. M., Ibanez-Zapata, J. A., Munafo, M. R., & Maynard, O. M. (2018). Alcohol pictorial health warning labels: The impact of self-affirmation and health warning severity. *BMC Public Health*, 18(1), 1403. <https://doi.org/10.1186/s12889-018-6243-6>
- Sjoberg, L. (1998). Risk perception of alcohol consumption. *Alcoholism, Clinical and Experimental Research*, 22(s7), 277s–284s. <https://doi.org/10.1111/j.1530-0277.1998.tb04380.x>
- Stafford, L. D., & Salmon, J. (2017). Alcohol health warnings can influence the speed of consumption. *Journal of Public Health*, 25(2), 147–154. <https://doi.org/10.1007/s10389-016-0770-3>
- Vecchio, R., Decordi, G., Grésillon, L., Gugenberger, C., Mahéo, M., & Jourjon, F. (2017). European consumers' perception of moderate wine consumption on health. *Wine Economics and Policy*, 6(1), 14–22. <https://doi.org/10.1016/j.wep.2017.04.001>
- Wigg, S., & Stafford, L. D. (2016). Health warnings on alcoholic beverages: Perceptions of the health risks and intentions towards alcohol consumption. *PLoS One*, 11(4), e0153027. <https://doi.org/10.1371/journal.pone.0153027>
- World Health Organization. (2019). *Status report on alcohol consumption, harm and policy responses in 30 European countries*.