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Original investigation

Pictorial Cigarette Warning Labels: Effects of Severity and Likelihood of Risk Messages

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Abstract

Introduction: Pictorial cigarette warning labels often contain text-messages about severity of health risks and less often about the likelihood of health risks. We aimed to examine the influence of severity of risk versus likelihood of risk text-messages on information-seeking behavior.

Methods: Study 1: An experimental study with a 2 (severity) × 2 (likelihood) between-subjects design ($n = 260$); Study 2: An experimental study with a 2 (severity) × 2 (likelihood) × 2 (picture) between-subjects design ($n = 537$). Main outcome measures were information-seeking intention and information-seeking behavior (accepting a brochure about smoking cessation in Study 1; clicking on a link to a smoking cessation webpage in Study 2).

Results: In Study 1, exposure to likelihood text-messages was associated with more information-seeking behavior but not with attitudes and intention to quit. In Study 2, exposure to likelihood text-messages was not associated with information-seeking behavior, but was associated with higher warning label ratings and with more positive attitudes towards quitting when it was a pictorial cigarette warning label; exposure to severity text-messages was associated with higher warning label ratings and higher risk perceptions. Presence of a picture with smokers' diseased lungs in Study 2 was associated with higher warning label ratings and with higher risk perceptions, but did not influence attitudes and intention to quit.

Conclusions: We found preliminary indications that pictorial cigarette labels with likelihood of risk text-messages may be effective in influencing behavior. However, results from our two studies were not consistent. Therefore, future studies should examine this further.

Implications: Although we can only draw preliminary conclusions from our study that should be replicated in future studies, our findings suggest that it is worthwhile to further explore the addition of likelihood of risk text-messages to pictorial cigarette warning labels, which is not the current practice in most countries.

Introduction

In Europe, a revised Tobacco Products Directive has been adopted in March 2014 (directive 2014/40/EU). As part of the directive, all cigarette packages sold in European member states will be required

to contain pictorial warning labels. A large majority of the labels contain messages about the severity of smoking-related disease, but none of the new cigarette labels contain likelihood of risk messages (also called vulnerability or susceptibility messages). Only one of

the new labels contains a message about smoking cessation: the text “quit smoking—stay alive for those close to you.” However, the three rotating pictures that are combined with this text display a deceased person in a hospital bed, a deceased person in a coffin, and a child mourning on a cemetery, which may result in the smoking cessation part of the message getting less attention than the severity message in the picture. Furthermore, on all pictures, the text “get help to quit” will be displayed in small font together with a telephone number or website address where smokers can get help with quitting. On the side of all packs, the text “smoking kills, quit now” will be displayed, although countries can also choose to only display “smoking kills.” These new cigarette labels could, thus, only be effective in stimulating smoking cessation if severity of risk information is effective without likelihood of risk information, and without extensive information about smoking cessation.

Fear appeal theories assume that threatening pictures will only have behavioral effects when the message contains both severity and likelihood of risk information.^{1,2} The behavioral effects will only be positive when the threat message is combined with a coping message. Coping messages should give receivers the feeling that something can be done to avert the threat (response efficacy) and that they are capable of performing that behavior (self-efficacy). If messages succeed in inducing fear but do not succeed in raising perceived efficacy, defensive reactions are predicted to follow.

In order to realize behavior change, it has been suggested that it is more important to emphasize people’s likelihood of health risks than to focus on the severity of health risks.^{3,4} Although it has also been recommended that the effects of these two components of risk information should be assessed independently,^{5,6} most studies and meta-analyses did not differentiate between the effects of messages with severity of risk information and likelihood of risk information nor used behavioral outcome measures.^{3,5,7} A recent meta-analysis of experimental studies on pictorial cigarette warning labels concluded that more studies are needed that distinguish between likelihood and severity of risk.⁸ In the current study, we test the effects of a severity of risk message versus a likelihood of risk message with an experimental design. Based on previous research,^{3,4} we hypothesized that likelihood of risk information has a more positive influence on perceptions, attitudes, and intention to quit than severity of risk information (hypothesis 1).

Recently, it has been hypothesized that severity of risk messages without likelihood and coping messages may lead to active information seeking,^{5,9} which could in turn heighten recipients’ knowledge about how vulnerable they are and what they can do to prevent health dangers. Some findings suggest that health risk messages may stimulate information seeking.^{10–13} However, most studies have not distinguished between the influence of severity and likelihood information, and those that did found mixed results. For example, Neuwirth et al.¹⁰ found that severity information but not likelihood information stimulated more information seeking, while Baldwin et al.¹⁴ found the opposite. Because of these mixed results, we did not formulate hypotheses about the influence of severity and likelihood of risk information on information seeking. These analyses should be considered exploratory. In our study, we examine both intentions to search for information about quitting smoking and actual information-seeking behavior. Because it is information about quitting smoking, smokers can use this information to cope with smoking risk messages. Therefore, we consider this to be coping information.

The new European cigarette labels contain large pictures. It is still unclear whether pictorial cigarette warning labels can change

behavior, because studies with behavioral outcomes have been limited in amount and quality.^{15,8} However, effects of pictorial cigarette labels on higher ratings of warning label effectiveness, higher perceptions of risk, more positive attitudes towards quitting, and more motivation to quit compared to text labels have been demonstrated in previous research.^{8,16–18} Therefore, we expected that cigarette warning labels with pictures have a more positive influence on perceptions, attitudes, and intention to quit than cigarette warning labels without pictures (hypothesis 2).

The aim of the current study was to examine the influence of cigarette warning labels with severity of risk versus likelihood of risk text-messages with or without pictures. Cigarette warning labels in most countries contain only severity of risk and not likelihood of risk information and they often contain a telephone number or website address that directs smokers to help with quitting smoking. The implicit expectation is thus that smokers will be stimulated by severity of risk information to seek information about quitting. Our study gives a first indication of the relationships between severity and likelihood of risk text-messages and coping information seeking. We conducted two experimental studies. In Study 1, all cigarette label stimuli contained a threatening picture. Based on the results from Study 1, we realized that it could be argued that the picture in Study 1 communicated severity of risk information, suggesting that we had not tested the effects of likelihood of risk information without severity of risk information.⁵ Therefore, Study 2 was conducted in which we did have experimental conditions without threatening pictures.

Methods

Design, Participants and Procedure

Study 1 was an experimental study with a cross-sectional 2 (severity of risk information: yes vs. no) × 2 (likelihood of risk information: yes vs. no) between-subjects design. Study 1 participants were recruited in May and June 2014 in nine different cities in the Netherlands in outdoor public areas such as markets, public parks, music festivals, terraces, in front of workplaces, and at train stations. Only people who were seen smoking were approached and asked whether they wanted to fill in a short anonymous paper-and-pencil survey. Study 1 participants were not reimbursed for their time. In total 260 individuals participated in this first experiment. Participants were randomly assigned to one of the four conditions.

Study 2 was an experimental study with a cross-sectional 2 (severity of risk information: yes vs. no) × 2 (likelihood of risk information: yes vs. no) × 2 (picture: yes vs. no) between-subjects design. Study 2 participants were recruited in November and December 2014 from the panel of the Dutch commercial research company MarketResponse and filled in the survey online. Study 2 participants were not reimbursed for their time. A sample of 1417 panel members was asked to participate of whom 265 were excluded because they reported not to smoke. Of the remaining 1152 smoking panel members, 537 (47%) participated in the second experiment. Study 2 participants were randomly assigned to one of the eight conditions.

Stimulus Material

In Study 1, four different pictorial cigarette warning labels were used. Each contained the same picture of healthy lungs next to smokers’ diseased lungs that was part of the cigarette label image library of the European Commission as part of the 2001 Tobacco Products Directive

(directive 2001/37/EC) and the 2014 Tobacco Products Directive (directive 2014/40/EU). Only the text above the picture varied across conditions. For the control condition, the text “Quit smoking now!” was used, that is, the text did not contain severity information and did not contain likelihood information. For the severity condition, the text “Smoking causes lung cancer. Quit smoking now!” was used. For the likelihood condition, the text “1 in 2 smokers die due to smoking. Quit smoking now!” was used. The severity and likelihood condition combined these texts: “Smoking causes lung cancer. 1 in 2 smokers die due to smoking. Quit smoking now!” See [Supplementary Figure 1](#) for the stimulus materials from Study 1.

In Study 2, the same four cigarette labels were used as in Study 1 and four cigarette labels were added without pictures. The following minor adjustments were made to the stimuli based on participants’ feedback during Study 1: the warning texts were slightly enlarged relative to the picture, the warning texts were placed under the picture, and the branding was replaced with the fictitious brand Gensann ([Supplementary Figure 2](#)). In the conditions without pictures, the pictures were replaced with the same black background as the background of the texts and the texts remained in exactly the same position ([Supplementary Figure 3](#)).

Measures

In both studies, the same short survey was used. First, questions about gender, age, number of cigarettes smoked per day, intention to quit smoking, and self-efficacy for quitting were asked. Then the cigarette warning label was shown together with a short text explaining that European legislation was adopted that required all cigarette packages to contain a pictorial warning label as of 2016. Participants from both studies could look at this cigarette warning label as long as they wanted. Below the example of the cigarette warning label, seven questions asked participants to rate the presented warning label on several characteristics (eg, message credibility). Therefore, the participants from both studies could look back at the cigarette warning label while filling in the seven warning label rating questions. After that, questions about risk perceptions, coping information-seeking intention, attitudes towards quitting, and motivation to stop smoking were asked. Coping information-seeking behavior was measured last.

Intention to quit smoking was assessed with the question “Are you planning to quit smoking: ...within the next month?” (4), “...within the next 6 months?” (3), “...sometime in the future, beyond 6 months?” (2), “...or are you not planning to quit?” (1).¹⁹

Self-efficacy for quitting was measured with the question “How easy or hard would it be for you to quit smoking if you wanted to?”²⁰ Response categories were “Not at all difficult” (5), “Slightly difficult” (4), “Moderately difficult” (3), “Very difficult” (2), “Extremely difficult” (1).

Warning label ratings were measured with seven statements that could be answered on a scale from “Not at all” (1) to “Extremely” (10). Participants could rate the cigarette warning label on credibility (“The warning label is believable”), personal relevance (“The warning label is meant for someone like me”), induced fear (“The warning label is frightening”), perceived effectiveness (“The warning label makes me concerned about the risks of smoking” and “The warning label motivates me to quit smoking”), reactance (“The warning label makes me want to smoke more”), and avoidance (“The warning label makes me want to cover up the warning or keep it out of sight”). The first five items were based on previous research.^{17,18} The two statements about perceived effectiveness together form a scale (Cronbach’s Alpha for Study 1 = 0.84, for Study 2 = 0.83), while the

other statements are used as single items.¹⁸ The two statements about reactance and avoidance were inspired by fear appeal theories¹² that predict that fear appeals can sometimes lead to reactance and avoidance. The specific items to measure reactance and avoidance were created for the current study to be in line with the other warning label rating statements. The two items could not be combined in a scale (Cronbach’s Alpha for Study 1 = -0.05, for Study 2 = 0.30).

Both a cognitive and an affective component of perceived likelihood of risk was measured, because previous research found support for a two-factor model of perceived likelihood instead of a one-factor model in which cognition and affect are combined.²¹ Perceived cognitive likelihood of risk was measured with the question “If I keep smoking, my chances of getting lung cancer at some point in my life are: Very small” (1) to “Very big” (10).²¹ Perceived affective likelihood of risk was measured with the question “If I keep smoking, I feel vulnerable to getting lung cancer at some point in my life” with response categories ranging from “Totally disagree” (1) to “Totally agree” (10).²¹

Perceived severity of risk was measured with the question “Compared to other forms of cancer, the consequences of lung cancer are: “Much less bad” (1) to “Much worse” (10).²²

Attitudes towards quitting smoking were assessed with the question “If you quit smoking within the next six months, this would be....”²³ Participants could answer on three 10-point scales whether they thought this would be “Wise” (10) or “Unwise” (1), “Pleasant” (10) or “Unpleasant” (1), and “Positive” (10) or “Negative” (1). Cronbach’s Alpha was 0.67 for Study 1 and 0.65 for Study 2.

Motivation to stop smoking was measured with the Motivation To Stop Scale (MTSS), which is a single-item measure that has been shown to be predictive of smoking cessation attempts.²⁴ Smokers were asked “Which of the following best describes you?” Response categories were: “I don’t want to stop smoking” (1), “I think I should stop smoking but don’t really want to” (2), “I want to stop smoking but haven’t thought about when” (3), “I REALLY want to stop smoking but I don’t know when I will” (4), “I want to stop smoking and hope to soon” (5), “I REALLY want to stop smoking and intend to in the next 3 months” (6), and “I REALLY want to stop smoking and intend to in the next month” (7).

Coping information-seeking intention was measured with the question “To what extent are you planning to seek information about quitting smoking within the next six months?” This question could be answered on a scale from “Not at all” (1) to “Very much plan to do so” (10).

Coping information-seeking behavior was measured when participants thought the experiment was over. In the paper-and-pencil survey (Study 1), the interviewer waited until participants had filled in and returned the questionnaire, thanked them for their participation, and then asked whether they perhaps wanted a brochure about smoking cessation, which actually served as an indicator of information-seeking behavior. In the online survey (Study 2), participants were given the impression that they had answered the final question, were thanked for their participation, and were then asked whether they wanted to be redirected to a webpage about smoking cessation, which also served as an indicator of information-seeking behavior.

Analyses

Differences in sample characteristics between the experimental conditions were tested with a chi-square test (for gender) and ANOVA F tests (for age, number of cigarettes per day, intention to quit smoking, self-efficacy for quitting). Subsequently, the

influence of the severity of risk text-message (Study 1 and 2), the likelihood of risk text-message (Study 1 and 2), and the presence of the picture (Study 2) on warning label ratings, risk perceptions, attitudes towards quitting, motivation to stop smoking, and coping information-seeking intention were tested with ANCOVA analyses. These analyses were adjusted for gender, age, number of cigarettes per day, intention to quit smoking, and self-efficacy for quitting because these covariates were significantly associated with the outcome measures. The influence on coping information-seeking behavior was tested with logistic regression analyses adjusting for the same covariates. First, main effects of severity of risk text-messages (Study 1 and 2), likelihood of risk text-messages (Study 1 and 2), and the picture (Study 2) were examined. Subsequently, significant interactions between severity of risk text-messages (Study 1 and 2), likelihood of risk text-messages (Study 1 and 2), and the picture (Study 2) were explored.

Results

Sample Characteristics

Participants from Study 1 were between 14 and 78 years old with an average age of 36 years ($SD = 15.2$). Participants from Study 2 were between 23- and 87-year-old with an average age of 59 years ($SD = 9.7$). In both studies, approximately half of the participants were male (53% Study 1, 45% Study 2) and 6% of both samples did not smoke each day. The average number of cigarettes per day among daily smokers was 14 cigarettes ($SD = 9.9$) in Study 1 and 13 cigarettes ($SD = 8.1$) in Study 2. Most participants intended to quit smoking sometime in the future, beyond 6 months (57% in both studies). In Study 1, most participants reported it was slightly difficult (28%) or moderately difficult (26%) to quit smoking. In Study 2, most participants reported it was extremely difficult (27%) or very difficult (26%) to quit smoking.

There were no significant differences in sample characteristics between experimental conditions within Study 1 and within Study 2 (Table 1), indicating that randomization has been successful in both studies.

Effects of Severity and Likelihood Information (Study 1)

In Study 1, there were no main effects of severity of risk text-messages or likelihood of risk text-messages for most outcome measures, except for coping information-seeking behavior (accepting a brochure about smoking cessation; Table 2). The proportion of participants that accepted the brochure was significantly higher in the likelihood conditions (24.8%) than in the no likelihood conditions (13.4%; $OR = 2.33$, $P = .015$).

There were significant interactions between severity and likelihood for the outcomes personal relevance of warning label, $F(1, 244) = 4.78$, $P = .030$, perceived severity of risk, $F(1, 242) = 5.26$, $P = .023$, and attitudes towards quitting smoking, $F(1, 244) = 4.54$, $P = .034$. Simple effects analyses showed that in the conditions without likelihood text, those who were exposed to the severity text evaluated the personal relevance of the label as lower ($M = 5.55$, $SD = 3.24$) than those who were not exposed to the severity text ($M = 6.85$, $SD = 2.81$; $F(1,244) = 7.26$, $P = .008$; Figure 1A). Furthermore, in the severity conditions, those who were exposed to the likelihood text evaluated the severity of risk higher ($M = 6.43$, $SD = 2.01$) than those who were not exposed to the likelihood text ($M = 6.11$, $SD = 2.06$; $F(1,242)=6.23$, $P = .013$; Figure 1B). And

in the conditions without likelihood text, those who were exposed to the severity text evaluated the severity of risk lower ($M = 5.56$, $SD = 2.12$) than those who were not exposed to the severity text ($M = 6.28$, $SD = 2.00$; $F(1,242) = 4.74$, $P = .030$). Simple effects analyses also showed that in the conditions without severity, those who were exposed to the likelihood text reported nonsignificantly lower attitudes towards quitting ($M = 6.81$, $SD = 2.21$) than those who were not exposed to the likelihood text ($M = 7.30$, $SD = 2.05$; $F(1,244) = 3.67$, $P = .057$; Figure 1C).

Effects of Severity and Likelihood Information With and Without Picture (Study 2)

In Study 2, main effects of picture, severity, and likelihood were found for warning label ratings and perceived cognitive likelihood of risk (Table 3). Participants who were exposed to a warning label with picture perceived the label to be more credible, more personally relevant, more frightening, more effective, reported to want to avoid the warning label more, and scored higher on perceived cognitive likelihood of risk than participants who were exposed to a warning label without picture. Participants who were exposed to a warning label with the severity text-message perceived the warning label to be more credible, more frightening, more effective, reported less often to want to smoke more because of the warning label, and scored higher on perceived cognitive likelihood of risk than participants who were exposed to a warning label without the severity text-message. Finally, participants who were exposed to a warning label with the likelihood text-message perceived the warning label to be more frightening and effective than participants who were exposed to a warning label without the likelihood text-message.

There was an interaction between picture, severity of risk text-message, and likelihood of risk text-message for the outcome perceived credibility of the warning label, $F(1, 524) = 5.98$, $P = .015$ (Figure 1D). The interaction between severity of risk text-message and likelihood of risk text-message was only significant for the conditions without picture. Simple effects analyses showed that for the conditions without picture and without severity text, those who were exposed to the likelihood text evaluated the credibility of the warning label as higher ($M = 5.59$, $SD = 2.07$) than those who were not exposed to the likelihood text ($M = 3.82$, $SD = 2.71$; $F(1,266) = 13.74$, $P < .001$). Similarly, for the conditions without picture and without likelihood text, those who were exposed to the severity text evaluated the credibility of the warning label as higher ($M = 5.91$, $SD = 2.73$) than those who were not exposed to the severity text ($M = 3.82$, $SD = 2.71$; $F(1,266) = 24.77$, $P < .001$).

There was also an interaction between picture and likelihood for the outcome attitudes towards quitting smoking, $F(1, 524) = 4.80$, $P = .029$ (Figure 1E). Simple effects analyses showed that only in the conditions with picture, those who were exposed to the likelihood text reported higher attitudes towards quitting ($M = 7.10$, $SD = 1.81$) than those who were not exposed to the likelihood text ($M = 6.83$, $SD = 1.84$; $F(1,524) = 5.75$, $P = .017$).

Discussion

Pictorial cigarette warning labels that will be implemented in the entire European Union in 2016 mainly contain messages about the severity of the health risk of smoking and do not contain likelihood of risk information. Our first hypothesis was that likelihood of risk information affected perceptions, attitudes, and intention more than severity

Table 1. Sample Characteristics and Differences Between Experimental Conditions in Study 1 and Study 2

Study 1	With picture				Without picture				Difference between conditions
	Control condition (n = 65)	Severity condition (n = 65)	Likelihood condition (n = 65)	Severity and likelihood condition (n = 65)	Control condition (n = 67)	Severity condition (n = 77)	Likelihood condition (n = 71)	Severity and likelihood condition (n = 60)	
Gender									
Male (%)	49.2	50.8	58.5	53.8		48.1	35.2	45.0	$\chi^2 = 1.30, P = .730$
Female (%)	50.8	49.2	41.5	46.2		51.9	64.8	55.0	
Age (M, SD)	36.9 (13.4)	36.2 (15.3)	37.0 (16.3)	34.9 (15.7)	59.0 (9.4)	59.4 (9.9)	59.4 (9.8)	57.5 (8.9)	F = 0.26, P = .858
Number of cigarettes per day	14.1 (12.2)	14.2 (9.4)	14.5 (9.6)	13.3 (8.0)	14.4 (7.9)	14.1 (7.9)	12.3 (6.7)	13.8 (7.7)	F = 0.16, P = .924
daily smokers (M, SD)									
Intention to quit smoking ^a (M, SD)	2.1 (0.7)	2.3 (0.9)	2.2 (0.8)	2.1 (0.8)	2.0 (0.8)	2.0 (0.8)	2.1 (0.7)	2.0 (0.7)	F = 0.88, P = .452
Self-efficacy for quitting ^b (M, SD)	2.7 (1.3)	3.0 (1.4)	3.1 (1.3)	3.0 (1.2)	2.3 (1.3)	2.4 (1.2)	2.5 (1.4)	2.7 (1.2)	F = 1.32, P = .268
Study 2	With picture				Without picture				
Gender									
Male (%)	40.0	41.4	44.1	50.7	52.2	48.1	35.2	45.0	$\chi^2 = 6.30, P = .506$
Female (%)	60.0	58.6	55.9	49.3	47.8	51.9	64.8	55.0	
Age (M, SD)	58.8 (9.7)	58.6 (9.3)	59.6 (11.2)	61.5 (9.1)	59.0 (9.4)	59.4 (9.9)	59.4 (9.8)	57.5 (8.9)	F = 0.88, P = .523
Number of cigarettes per day	13.8 (8.2)	13.6 (7.0)	13.2 (8.3)	13.9 (7.9)	14.4 (7.9)	14.1 (7.9)	12.3 (6.7)	13.8 (7.7)	F = 0.46, P = .865
daily smokers (M, SD)									
Intention to quit smoking ^a (M, SD)	2.0 (0.7)	2.2 (0.9)	1.8 (0.6)	2.1 (0.9)	2.0 (0.8)	2.0 (0.8)	2.1 (0.7)	2.0 (0.7)	F = 1.08, P = .374
Self-efficacy for quitting ^b (M, SD)	2.5 (1.3)	2.5 (1.1)	2.7 (1.3)	2.5 (1.3)	2.3 (1.3)	2.4 (1.2)	2.5 (1.4)	2.7 (1.2)	F = 0.70, P = .669

^aOn a scale from 1 to 4.^bOn a scale from 1 to 5.

Table 2. Differences Between Conditions for Warning Label (WL) Ratings, Risk Perceptions, Attitudes Towards Quitting, Motivation to Stop Smoking, and Coping Information-Seeking Intention and Behavior (Study 1)

	Severity (n = 130)	No severity (n = 130)	Likelihood (n = 130)	No likelihood (n = 130)
WL credibility (M, SD)	6.66 (2.82)	6.71 (2.86)	6.64 (2.82)	6.73 (2.87)
WL personal relevance (M, SD)	5.93 (3.23)	6.55 (2.97)	6.28 (3.15)	6.20 (3.09)
WL induced fear (M, SD)	4.78 (3.07)	5.28 (3.13)	5.17 (3.22)	4.88 (2.99)
WL perceived effectiveness (M, SD)	4.03 (2.46)	4.49 (2.76)	4.54 (2.76)	3.98 (2.45)
WL reactance (M, SD)	2.12 (2.28)	1.91 (1.79)	2.05 (2.07)	1.98 (2.04)
WL avoidance (M, SD)	4.39 (3.22)	4.19 (3.07)	4.38 (3.11)	4.20 (3.18)
Perceived cognitive likelihood of risk (M, SD)	6.58 (2.32)	6.74 (2.19)	6.48 (2.22)	6.84 (2.28)
Perceived affective likelihood of risk (M, SD)	5.84 (2.49)	5.95 (2.59)	5.89 (2.55)	5.89 (2.53)
Perceived severity of risk (M, SD)	5.99 (2.10)	6.19 (2.02)	6.27 (2.03)	5.92 (2.08)
Attitudes towards quitting smoking (M, SD)	7.04 (2.39)	7.06 (2.14)	7.02 (2.31)	7.08 (2.22)
Motivation to stop smoking ^a (M, SD)	3.15 (1.70)	3.29 (1.58)	3.14 (1.62)	3.29 (1.66)
Coping information-seeking intention (M, SD)	3.31 (2.69)	3.02 (2.45)	3.11 (2.49)	3.22 (2.66)
Coping information-seeking behavior ^a (accepting a brochure) (%)	18.9	19.4	24.8	13.4
				OR = 1.01, P = .989
				OR = 2.33, P = .015

OR = odds ratio.

^aAll outcome measures had a scale from 1 to 10 except motivation to stop smoking which had a scale from 1 to 7 and coping information-seeking behavior which was dichotomous.

of risk information. This hypothesis was not supported. In Study 1 we did not find any main effects of likelihood or severity on perceptions, attitudes, and intentions. In Study 2, we found that exposure to the likelihood text-message was associated with higher self-reported warning label ratings. Likelihood was also associated with more positive attitudes towards quitting, but only when there was a picture on the warning label. However, exposure to the severity text-message was also associated with higher self-reported warning label ratings, and with higher risk perceptions. The findings are not consistent across studies and we can thus not draw strong conclusions from them.

Because of mixed findings in previous studies,^{10,14} we did not formulate hypotheses about the influence of severity and likelihood on coping information seeking. In the exploratory analyses regarding coping information seeking, we did not find any influence of our stimuli on intention to search for coping information. In Study 1, we did find that adding a likelihood of risk text-message to a warning label with a picture of smokers' diseased lungs can stimulate coping information-seeking behavior (ie, accepting a brochure about smoking cessation). In Study 2, we did not find effects on coping information-seeking behavior, which was operationalized in the online survey as clicking on a link that redirected participants to a webpage about smoking cessation. Although both accepting a brochure and clicking on a link are behavioral outcome measures, not all people who accept a brochure will actually read it, while clicking on a link is probably only done by people who actually will read the information at that moment. We should thus interpret these results with caution and future studies should examine whether likelihood of risk information can stimulate behavioral reactions beyond accepting a brochure.

Our second hypothesis was that cigarette warning labels with pictures affected perceptions, attitudes, and intention to quit more than cigarette warning labels without pictures. This was examined in Study 2. The hypothesis was partly supported. The warning label with picture affected self-reported warning label ratings and increased smokers' risk perceptions, but did not influence attitudes towards quitting or intentions to quit. The largest effect of the picture seemed to be that smokers got frightened and wanted to avoid the warning label, whereas effects on risk perceptions were much smaller. Pictorial cigarette warning labels may be more effective and less likely to be counterproductive if they are combined with coping messages.^{2,7,25,26} The new European pictorial cigarette labels do contain some information about smoking cessation, but are not likely to raise self-efficacy for quitting.

Implications

The goal of cigarette warning labels is to inform the population of smokers about the health risks of smoking and to direct them to help with quitting smoking. The population of smokers is very diverse, ranging for example from light to heavy smokers, low socioeconomic status to high socioeconomic status smokers, and from hard-core smokers who do not want to quit to those who are preparing to quit. Therefore, a diverse set of cigarette warning labels is probably needed to target different subgroups of smokers.¹⁶⁻¹⁸ The findings from our study suggest that it is worthwhile to further explore the addition of likelihood of risk messages to cigarette warning labels. Future research should examine whether these kinds of messages are equally effective for different subgroups of smokers.

Likelihood of risk messages can sometimes be more difficult to understand than severity of risk messages. Previous studies have shown that people tend to be unrealistically optimistic about their

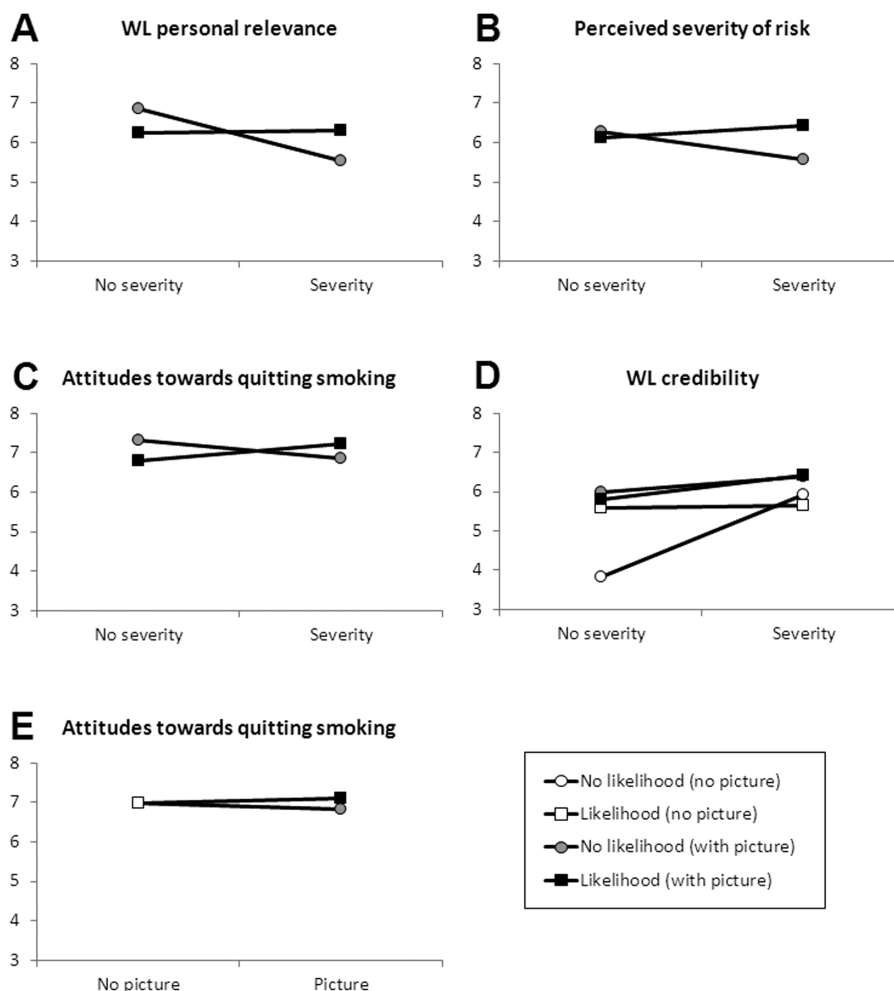


Figure 1. Visual representation of the interactions for Study 1 (A, B, and C) and Study 2 (D and E).

likelihood of health risk in general and their likelihood of smoking-related health risks in specific.^{27,28} The likelihood of risk message that we used in our study (“1 in 2 smokers die due to smoking”) is a relatively simple message. However, when creating disease-specific likelihood of risk messages, they may get more complicated to understand. Future research should develop simple disease-specific likelihood of risk messages and test whether they are understandable and effective.

Study Limitations

The main limitation of the current study is that, due to our experimental design, participants’ attention was focused strongly on the manipulated cigarette labels. In real-life, smokers may not always notice the cigarette labels and effects of the labels may thus be different. Also, smokers are more often exposed to cigarette labels in real-life than only once as in our experiments. The repetition of exposure in real-life may ensure larger effects than we found in our study,²⁹ but it is also possible that effects become smaller after a longer exposure period due to habituation.

Another limitation is the specific combination of the picture with smokers’ diseased lungs and the text-messages about likelihood and severity of risk that we used in our study. The severity text-message (“Smoking causes lung cancer”) is congruent with the picture with

smokers’ diseased lungs. However, the likelihood text-message (“1 in 2 smokers die due to smoking”) is not as congruent with this picture as the severity text-message. There is evidence that congruent messages are evaluated as more effective than incongruent messages,³⁰ which could be an alternative explanation for observed differences in effects of the likelihood and severity of risk text-messages in our study.

Furthermore, the results from our study may be biased due to the sampling methods that we used. For Study 1 we used a convenience sample of smokers recruited in public settings. For Study 2 we used an online panel with unknown generalizability to the population of smokers. Although this should not affect the differences between experimental conditions, we cannot be sure about the generalizability of our findings. Finally, both studies had small sample sizes and some nonsignificant results may thus be explained by a lack of power. Some effects were only marginally significant and should be replicated in a study with a larger sample size or more within-subject stimulus assessments.

Conclusion

We found preliminary indications that pictorial cigarette labels with likelihood of risk text-messages may be effective in influencing

Table 3. Differences Between Conditions With and Without Picture, With and Without Severity Information, and With and Without Likelihood Information on Warning Label (WL) Ratings, Risk Perceptions, Attitudes Towards Quitting, Motivation to Stop Smoking, Coping Information-Seeking Intention and Behavior (Study 2)

	Picture (n = 262)	No picture (n = 275)	Severity (n = 276)	No severity (n = 261)	Likelihood (n = 268)	No likelihood (n = 269)	
WL credibility (M, SD)	6.17 (2.69)	5.26 (2.69)	6.11 (2.71)	5.28 (2.62)	5.87 (2.52)	5.54 (2.85)	F = 2.40, P = .122
WL personal relevance (M, SD)	6.13 (2.92)	5.32 (2.98)	5.98 (3.07)	5.64 (2.85)	5.99 (2.75)	5.65 (3.16)	F = 2.73, P = .099
WL induced fear (M, SD)	5.58 (2.81)	4.11 (2.63)	5.17 (2.88)	4.46 (2.71)	5.07 (2.68)	4.58 (2.93)	F = 5.01, P = .026
WL perceived effectiveness (M, SD)	4.65 (2.21)	3.86 (2.27)	4.47 (2.42)	4.01 (2.09)	4.50 (2.23)	3.99 (2.29)	F = 8.78, P = .003
WL reactance (M, SD)	2.69 (2.09)	2.62 (2.00)	2.46 (1.95)	2.87 (2.12)	2.67 (2.03)	2.65 (2.06)	F = 0.00, P = .985
WL avoidance (M, SD)	4.69 (2.83)	3.24 (2.28)	3.85 (2.69)	4.05 (2.64)	3.97 (2.58)	3.92 (2.74)	F = 0.01, P = .937
Perceived cognitive likelihood of risk (M, SD)	6.27 (1.74)	6.03 (1.95)	6.30 (1.87)	5.98 (1.83)	6.11 (1.74)	6.18 (1.96)	F = 0.05, P = .818
Perceived affective likelihood of risk (M, SD)	5.90 (2.05)	5.63 (2.21)	5.89 (2.16)	5.63 (2.11)	5.77 (2.01)	5.76 (2.26)	F = 0.28, P = .594
Perceived severity of risk (M, SD)	6.36 (1.56)	6.36 (1.73)	6.37 (1.68)	6.34 (1.62)	6.28 (1.61)	6.44 (1.69)	F = 1.07, P = .302
Attitudes towards quitting smoking (M, SD)	6.97 (1.83)	6.99 (1.86)	7.06 (1.83)	6.90 (1.85)	7.05 (1.81)	6.92 (1.87)	F = 1.37, P = .243
Motivation to stop smoking ^a (M, SD)	3.00 (1.60)	3.00 (1.53)	3.08 (1.65)	2.92 (1.46)	2.90 (1.51)	3.10 (1.62)	F = 2.54, P = .112
Coping information-seeking intention (M, SD)	3.75 (2.46)	3.78 (2.67)	3.67 (2.58)	3.87 (2.56)	3.80 (2.56)	3.72 (2.58)	F = 0.60, P = .438
Coping information-seeking behavior ^a (clicking a link) (%)	13.3	17.6	16.6	14.1	11.7	19.1	OR = 0.61, P = .075

OR = odds ratio.

^aAll outcome measures had a scale from 1 to 10 except motivation to stop smoking which had a scale from 1 to 7 and coping information-seeking behavior which was dichotomous.

behavior. However, results from our two studies were not consistent. Therefore, future studies should examine this further. Furthermore, the picture on the warning label affected self-reported warning label ratings (in particular more induced fear and more avoidance) and increased smokers' perceptions of risk of getting the depicted disease, but did not influence attitudes towards quitting and intention to quit. Although we can only draw preliminary conclusions from our study that should be replicated in future studies, our findings suggest that it is worthwhile to further explore the addition of likelihood of risk text-messages to pictorial cigarette warning labels, which is not the current practice in most countries.

Supplementary Material

Supplementary Figures 1–3 can be found online at <http://www.ntr.oxfordjournals.org>

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Declaration of Interests

None declared.

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