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Original Research

Improper disclosure: Tobacco packaging and emission labelling regulations

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SUMMARY

Objectives: Cigarette packets in many countries display emission numbers such as tar. These numbers may be misleading as they do not represent the amount of toxins delivered to human smokers. This study examined how consumers interpret and understand numerical and descriptive emission information.

Study design: A discrete choice study was conducted among adult smokers ($n = 312$) and non-smokers ($n = 291$) in Ontario, Canada.

Methods: Participants viewed groups of cigarette packets with emission labels from the European Union (EU), Canada and Australia. Participants completed ratings on perceived tar delivery, health risks, and usefulness and understandability of the information.

Results: Participants were significantly more likely to believe that Canadian and EU packets with lower emission numbers would have lower tar delivery (92.2% and 89.9%, respectively) and lower health risks (89.5% and 82.9%, respectively) than packets with higher numbers. Approximately 74% of participants rated the numerical Canadian label as providing the most useful information; however, 62% also rated this label as most difficult to understand. Most participants rated the descriptive Australian label as easiest to understand.

Conclusions: Labels featuring quantitative emission values are associated with false beliefs regarding lower tar delivery and health risks. Descriptive statements about emissions are easier to understand and associated with more accurate beliefs.

Introduction

Consumer protection laws help to ensure that the public is informed about health risks from consumer products. Product disclosures on packaging, such as ingredient information on pre-packaged food products, are an important component of consumer protection laws. Product disclosure for tobacco products, however, has presented a unique challenge to regulators. Cigarette smoke contains approximately 4000 chemicals, including over 60 carcinogens and toxins such as hydrogen cyanide, benzene and arsenic.[1] Although there is general agreement that cigarette packets should include some information on these chemicals, regulators have struggled with how best to communicate this information in a feasible and meaningful way to consumers.

The traditional regulatory practice in many jurisdictions has been to require manufacturers to print levels for three emissions – tar, nicotine and carbon monoxide – on the side

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of cigarette packets. Fig. 1 shows an example of emission labelling in the European Union (EU). Communicating emissions numbers to consumers was originally an industry practice.[2] Tobacco manufacturers often incorporated tar and nicotine numbers in advertisements and, in some jurisdictions, were required to report emission values directly to government. These early forms of product disclosure appear to have been motivated less by consumer protection than by a marketing strategy intended to capitalize upon widespread misperceptions about the reduced harm of lower tar products.[2]

In contrast to popular belief, the tar and nicotine emission numbers marketed to consumers and reported to governments do not represent the amounts of tar or nicotine present in the cigarette, or the amounts actually delivered to human smokers.[3] Emissions are generated by a machine that 'smokes' cigarettes according to a fixed puffing regimen. However, the regimen does not predict the amount of smoke inhaled by individual consumers, or account for design elements such as filter ventilation (tiny holes poked in the filter that yield low emission levels under machine smoking, but much higher levels under human smoking).[3] In addition, the testing method traditionally used to generate the emission numbers – the ISO regimen – tests cigarettes under much less intense smoking parameters than is typical for most smokers.[4] As a result, there is no association between the machine-generated numbers printed on packets and the health risks of different brands: cigarettes that generate lower tar numbers are no less harmful than higher tar brands.[5]

Despite early objections by regulatory authorities such as the US Federal Trade Commission regarding how machine-based emission numbers would be interpreted by consumers, the industry practice was adopted by the regulatory communities throughout the world.[6] Previous research has shown that many consumers misinterpret tar levels when they are provided by manufacturers.[5] Although many smokers are not able to recall the specific tar level of their brand, a substantial proportion nevertheless equate lower numbers with a reduction in exposure and risk, and many use these numbers to guide their choice of brands.[7–11]

In response to concerns about how consumers interpret emission numbers, jurisdictions such as Canada supplemented the emission numbers with additional information. In 2000, Canada increased the list of emissions that must be reported (tar, nicotine, carbon monoxide, benzene, hydrogen cyanide and formaldehyde) and added a second set of emission numbers generated under the Health Canada method, a more intensive machine-smoking method (see Fig. 1). This emission testing method is no better at predicting exposure or risks than the lower set of numbers, but was intended to communicate that each product could deliver a range of chemical amounts.[12] Other jurisdictions, such as Australia, have removed emission numbers from packets and replaced this information with descriptive statements on emissions

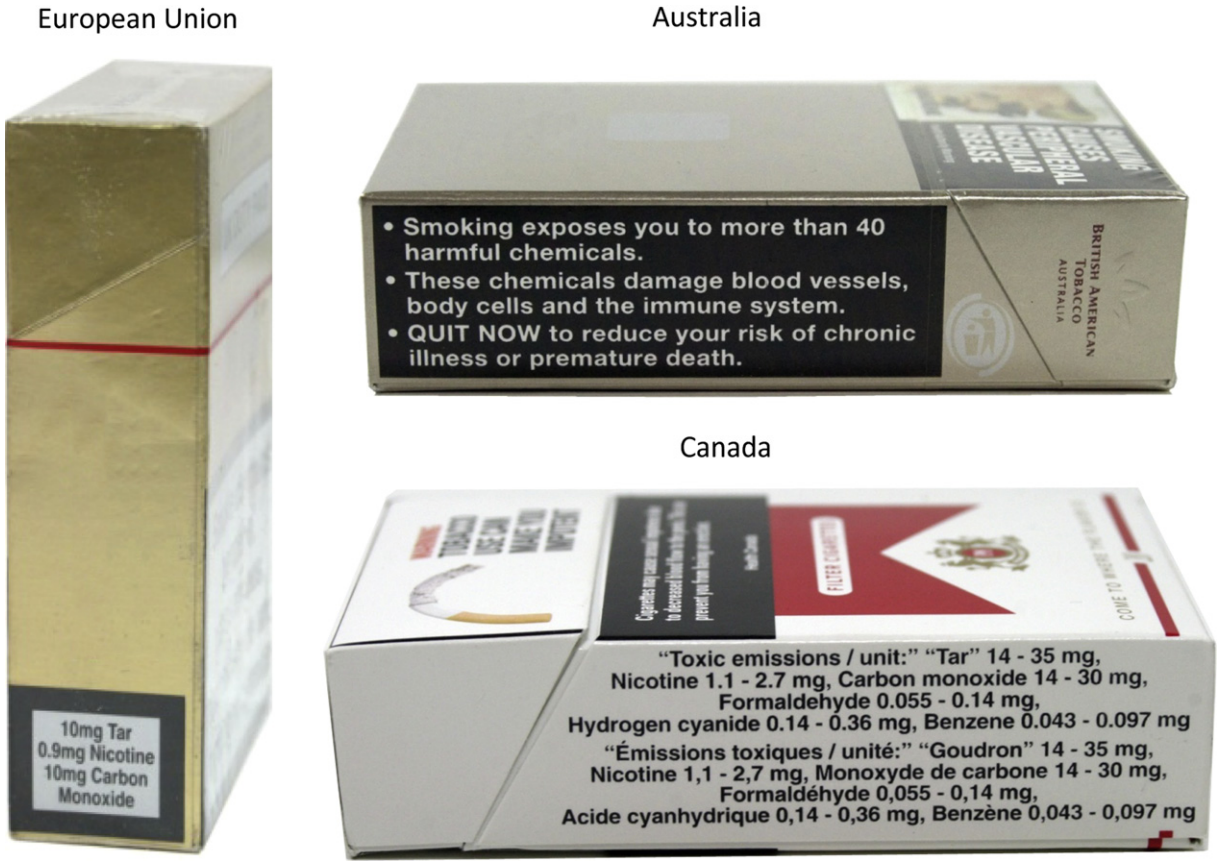


Figure 1 – Example of emission labelling (2010).

and their effects (see Fig. 1). Canada subsequently removed emission numbers from packages as part of new labelling regulations implemented in 2012.[13]

There is a lack of information regarding consumer perceptions of emission labels mandated by governments, including potential differences across the types of emission information provided in different jurisdictions. The current study sought to examine perceptions of cigarette packets displaying emission labels from Canada, the EU and Australia among Canadian smokers and non-smokers. The primary objectives were to examine the association between labelling information and perceptions of relative risk between cigarette brands in terms of tar delivery and health risks. The study also sought to examine which information was interpreted as most useful and easiest to understand.

Methods

Protocol

Respondents were recruited between January and March 2007 from shopping malls in South-western Ontario using convenience sampling methods to participate in a discrete choice study. Eligible participants included smokers and non-smokers aged ≥18 years. After providing consent, participants were seated at a table in a private area and asked to complete a 5-min survey on their smoking status and sociodemographic variables. Participants were then asked to view a series of cigarette packets presented on a small display. Packets were presented to participants in groups of two or three, and the placement of packets on the display (i.e. left, right or middle position) was counterbalanced across participants. Participants were allowed to pick up and look at the packets if they wished, after which participants responded to questions about each group of packets (see measures below). Upon conclusion of the study, participants were compensated $10 and were entered into a draw for a $100 gift certificate.

Cigarette packets

Cigarette packets were created specifically for this study. Packets were printed on high-quality cardboard, scored and folded in the same manner as actual cigarette packets. High-density foam was inserted into the packets to mimic the weight and feel of cigarettes. The groups of cigarette packets presented to participants were identical except for the emission label format. In Part 1 of the study, each pair of packets featured a 10-mg tar product and a 4-mg tar product. The first pair featured corresponding emission labels from the EU, the second pair featured emission labels from Canada (as of 2007), and the third pair featured emission labels from Australia (note: as Australian labels do not include numbers and instead have a single emission statement, the two packets in the Australia condition were identical). The presentation order of the pairs featuring EU, Canadian and Australian emission labels was counterbalanced across participants. In Part 2, participants were presented with a group of three packets that differed only in terms of the type of emission label: EU, Canada or Australia emission information for an 8-mg ISO product. All packets featured the same brand design and pictorial warning covering 50% of the principal display area, as required under Canadian regulations.

Measures

Sociodemographics and smoking status

Current smokers were defined as individuals who had smoked 100 cigarettes in their lifetime and reported smoking at least one cigarette in the past month. Participants were asked about the highest level of formal education they had completed. Responses were grouped into three categories: low (grade school or some high school), middle (completed high school, technical or trade school or some university) and high (completed university degree or postgraduate degree).

Packet ratings

After viewing each pair of packets, participants were asked 'Which brand would you expect to deliver the most tar if you were to smoke it?' and 'If you were to choose between these two brands, which one would you buy if you were trying to reduce the risks to your health?' Participants were asked to select one of the two packets, or to indicate 'no difference' in response to each question.

In order to examine the usefulness and comprehensibility of the emission information, participants were shown a group of three packets and asked four questions: (1) 'Overall, which side panel gives you the most useful information about this brand?'; (2) 'Which side panel gives you the least useful information about this brand?'; (3) 'Overall, which side panel is easiest to understand?'; and (4) 'Which side panel is the most difficult to understand?' Participants were asked to select one of the three packets, or to indicate 'no difference' in response to each question.

Analysis

All analyses were conducted using Statistical Package for the Social Sciences Version 16.0 (SPSS Inc., Chicago, IL, USA). Chi-squared tests were used to test the significance of proportions for packaging ratings of tar delivery and health risks, as well as ratings of labels that were most useful and easiest to understand. Logistic regressions were used to examine age, gender, education and smoking status as predictors of the packaging ratings, where 0 = no difference/10-mg tar and 1 = 4-mg tar for the lower health risk ratings, and 0 = no difference/4-mg tar and 1 = 10-mg tar for the higher tar delivery ratings.

Results

Sample characteristics

Table 1 shows sample characteristics for the 603 participants.

Perceptions of packets

Table 2 shows perceptions of tar delivery and health risks for pairs of packets displaying different emission labels. For the

Table 1 – Sample characteristics (n = 603).

Characteristic	% (n)
Age (years)	
18–24	23.4 (141)
25–39	27.9 (168)
40–54	31.7 (191)
55–85	17.1 (103)
Gender	
Male	55.6 (335)
Female	44.4 (268)
Educational level	
Low	24.9 (150)
Middle	62.7 (378)
High	12.4 (75)
Smoking status	
Non-smoker	48.3 (291)
Smoker	51.7 (312)

packets with EU labels, 92.2% of participants reported that the 4-mg product would deliver less tar than the 10-mg product, whereas 7.8% reported that the 10-mg product would deliver less or an equal amount of tar compared with the 4-mg product ($\chi^2 = 427.7$, $P < 0.001$). Likewise, 89.5% reported that they would purchase the 4-mg product rather than the 10-mg product if they were trying to reduce their health risks, whereas 10.5% reported that the 10-mg product would have lower or equal health risks ($\chi^2 = 375.4$, $P < 0.001$). Similar results were observed for perceptions of Canadian packets: participants were significantly more likely to report that the packet with lower numbers would deliver less tar ($\chi^2 = 381.8$, $P < 0.001$) and lower health risks ($\chi^2 = 259.6$, $P < 0.001$).

Pearson's correlation coefficients were used to examine the association between perceived tar delivery and health risks. For both the EU and the Canadian packets, perceptions of tar level and health risks were significantly correlated ($r = 0.45$, $P < 0.001$ and $r = 0.46$, $P < 0.001$, respectively).

Table 2 also shows perceptions of the Australian packets, which displayed identical emission information. Overall, 84.7% of participants reported that there was no difference in tar level between the Australian packets (the correct response) compared with 1.3% who reported no difference for the EU packets ($\chi^2 = 495.1$, $P < 0.001$) and 2.0% for the Canadian packets ($\chi^2 = 495.0$, $P < 0.001$). Participants were also more likely to report no difference in terms of health risks when viewing the Australian packets than when viewing the EU packets (83.4% vs 5.3%; $\chi^2 = 465.0$, $P < 0.001$) and Canadian packets (83.4% vs 5.7%; $\chi^2 = 465.0$, $P < 0.001$).

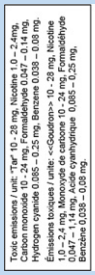
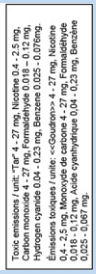
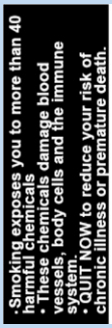
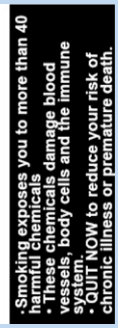
Predictors of packet perceptions

Logistic regression models were run to examine whether gender, age, education and smoking status were associated with perceived tar level and health risks. As Table 3 indicates, younger age groups were generally more likely to report that the 4-mg products would have lower health risks and deliver less tar than the 10-mg products for both the EU and Canadian labels. In addition, adults with a moderate level of education were more likely than adults with a lower level of education to report that the 4-mg products with EU labels would have less tar than the 10-mg products. Smoking status and gender had no effect on consumer perceptions of health risks or tar delivery between products.

Usefulness and understandability of information

Participants were presented with three packets displaying each of the three emission labels (EU, Canadian and Australian) and asked to select the most and least useful and understandable labels. As shown in Table 4, the vast majority of participants (74.6%) reported that the Canadian emission label provided the most useful information. However, the Canadian label was also rated as the most difficult to understand (62.1%). The Australian label was most likely to be rated as easiest to understand (40.2%), followed by the EU label (34.4%).

Table 2 – Consumer perceptions of the emission information on cigarette packets (n = 601).

	European Union			Canada			Australia	
			No difference			No difference			No difference
Delivers less tar	6.5	92.2	1.3	8.2	89.9	2.0	15.3[a]	84.7
Lower health risk	5.2	89.5	5.3	11.5	82.9	5.7	16.6[a]	83.4

a Percentage of participants who reported a difference between the Australian packets. As the two packets were the same, the percentage is shown for both packets.

Table 3 – Logistic regression analyses examining the relationship between demographic characteristics and interpretations of the emission information on cigarette packets in the European Union and Canada (n = 601).

Odds ratios (95% CI)

Parameters	European Union		Canada	
	Lower health risk	Less tar delivery	Lower health risk	Less tar delivery
Sex				
Female	1.32 (0.75–2.33)	1.31 (0.69–2.50)	1.38 (0.88–2.18)	1.12 (0.58–1.78)
Age (years) (reference: 18–24 years)				
25–39	0.61 (0.24–1.55)	1.01 (0.32–3.12)	0.49 (0.24–1.01)	0.40 (0.14–1.17)
40–54	0.28[a] (0.12–0.64)	0.36[a] (0.14–0.93)	0.37[a] (0.19–0.73)	0.23[a] (0.08–0.61)
55–85	0.45 (0.17–1.20)	0.32[a] (0.11–0.92)	0.27[a] (0.13–0.58)	0.14[a] (0.05–0.41)
Education (reference: low)				
Middle	2.17[a] (1.21–3.91)	2.05[a] (1.03–4.08)	1.26 (0.76–2.08)	1.11 (0.59–2.09)
High	2.42 (0.90–6.51)	1.14 (0.44–2.98)	2.06 (0.89–4.76)	1.62 (0.58–4.49)
Smoking status				
Smoker	0.92 (0.52–1.64)	1.08 (0.56–2.09)	0.84 (0.53–1.34)	0.71 (0.40–1.27)

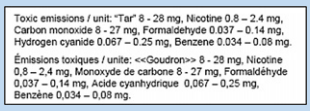
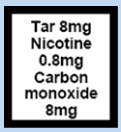
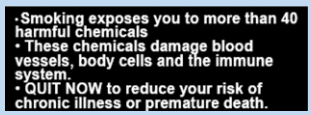
CI, confidence interval.
a $P < 0.001$.

Discussion

The current study provides important evidence on consumer perceptions of emission labelling for cigarettes – the most lethal consumer product available. The findings demonstrate that the vast majority of smokers and non-smokers draw false inferences about the relative risk of cigarette brands based on emission numbers provided in government-mandated labels. For example, more than 90% of participants indicated that they would buy a brand with 4 mg of tar if they were trying to reduce the health risks of smoking. These findings are generally consistent with other research showing that consumers interpret tar and nicotine numbers as indicators of risks, and believe that brands with lower yields are less harmful.[3,7–11,14] False beliefs about low tar cigarettes are critically important given that many smokers report switching to these brands as an alternative to quitting.[3,15]

The findings also suggest that adding complexity to labels does not reduce false beliefs about tar delivery and health risks. The Canadian labels tested in this study displayed a greater number of chemical emissions and provided numerical ranges for each emission. The purpose of displaying a range of emission numbers for each chemical in the Canadian warnings was to emphasize that each brand could deliver a range of emission amounts, rather than a single amount. While the increased complexity of the Canadian emission labels increased the perceived usefulness of the information, the labels were also rated as the most difficult to understand. Most importantly, almost 90% of respondents selected the brand with the lower ranges as potentially less harmful. Similar levels of response were found with the simplified EU labels. These findings are consistent with a series of qualitative and quantitative studies conducted on behalf of Health Canada. For example, a national survey conducted in 2003 found that 80% of smokers did not understand the emission information; nevertheless, more than half reported that they would use these numbers to find a less harmful brand.[7] These results are also consistent with other focus groups conducted in 2003, in which most Canadian participants stated that they had no idea or did not really know what the numbers on the side of packets meant.[16] Some were confused about whether the dosage referred to one cigarette or a whole packet, some questioned the accuracy of

Table 4 – Consumer perceptions of quality of emissions information in Canada, the European Union and Australia (n = 599).

	Canada	European Union	Australia	No difference
				
Most useful	74.6%[a]	7.3%	17.4%	0.7%
Least useful	3.8%[a]	34.3%	61.4%	0.5%
Easiest to understand	24.9%[a]	34.4%	40.2%	0.5%
Difficult to understand	62.1%[a]	15.6%	20.3%	2.0%

a Chi-squared test: $P < 0.001$.

information because a large range of emission measurements was provided, and some found it 'too scientific to understand'.

To the authors' knowledge, the current study is among the first to provide preliminary evidence on the impact of non-numerical, descriptive emission labels on cigarette packets. The Australian emission labels, in which descriptive statements replaced emission numbers, were rated as most understandable. The Australian labels were also much less likely to be used as indicators of tar delivery and health risks, which is not surprising given that all packets feature the exact same information. Descriptive warnings may be superior given that they are not promoting false beliefs; however, there is a lack of research to indicate whether they are having any positive impact on beliefs, attitudes or behaviour. Previous research suggests that most smokers express support for descriptive statements of cigarette emissions. For example, a strong majority of Canadian smokers expressed a desire for descriptive explanations of the health effects of chemical constituents on the packaging in simple language, rather than detailed quantitative values.[17,18] When given an option between several alternatives, more than three-quarters of Canadian adults and youth reported that a list of toxic constituents with a descriptive statement about one of the chemicals would help to discourage youth from starting to smoke, and more than half thought that the list and descriptive statement would discourage smoking among youth who currently smoke.[16] Given that an increasing number of countries have replaced emission numbers with descriptive statements, including Brazil, Venezuela, Thailand, Uruguay and, as of 2012, Canada, there is an urgent need for additional research.

Few sociodemographic differences were observed with respect to perceptions of emission labelling. Younger respondents were more likely to report that the 4-mg products would have lower health risks and deliver less tar than the 10-mg products for both the EU and Canadian labels, as were adults with a moderate level of education for the EU labels. It is unclear why younger respondents would report higher levels of false beliefs; one explanation could be less exposure to public health messages countering the belief that low tar cigarettes are less harmful. The association between greater education and false beliefs may seem counter-intuitive, although it may reflect greater interest and trust in technical information such as tar levels. Overall, however, the findings suggest that perceptions of emission labels are very consistent across subgroups, and it is the nature of the information in the labels – rather than individual differences – that underlie false perceptions.

Limitations

Participants in this study were not recruited using random sampling. Therefore, the findings are not necessarily representative of Canadian smokers and some degree of bias is likely. Nevertheless, the sample represents a heterogeneous group of smokers and non-smokers from different age groups and socio-economic levels which is broadly similar to the profile of Canadian smokers. The authors would not anticipate significant differences in response patterns among smokers and non-smokers in other geographical areas, given that few regional differences exist with respect to tobacco packaging and marketing in Canada. A second potential limitation of the current study is the 'forced choice' nature of the packet ratings. This method may result in higher levels of endorsement than some other methods; however, participants were given the option to select 'no difference' and many participants did so for several of the comparisons. A third potential limitation concerns social desirability response bias. Given the public health messages that all cigarettes are equally harmful, which have included high-profile mass media campaigns on the risk of light and mild cigarettes in Canada, one might expect social desirability bias to result in greater endorsement of the 'no difference' option, rather than identifying one of the two brands as lower tar or health risks.

Implications

The findings from this study raise important questions about the inclusion of emission information on cigarette packaging. Legislation in the EU currently requires manufacturers to display numerical yields for tar, nicotine and carbon monoxide on the side of cigarette packets. However, this study provides additional evidence that these numbers are misleading to consumers. Given that the scientific consensus is that all conventional cigarette brands are equally hazardous and there are no measureable differences in risk, regulators should not communicate numerical toxicant levels that suggest otherwise.[5] Descriptive statements, such as those currently used in Australia and scheduled for implementation in Canada, were rated as easiest to understand and may be an appropriate replacement for the numerical information.

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Ethical approval

Ethical approval for this work was obtained from the Office of Research Ethics at the University of Waterloo (ORE# 13530). Informed consent was obtained from all study participants prior to data collection.

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Competing interests

None declared.

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