Assessing the effect of public health information by incentivised risk estimation: An example on Swedish snus

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\section*{ABSTRACT}

\textbf{Background:} The provision of accurate information on health damaging behaviours and products is a widely accepted and widespread governmental task. It is easily mismanaged. This study demonstrates a simple method which can help to evaluate whether such information corrects recipient risk beliefs.

\textbf{Methods:} Participants assess risks numerically, before and after being exposed to a relevant risk communication. Accuracy is incentivised by awarding financial prizes to answers closest to a pursued risk belief. To illustrate this method, 228 students from the University of Oslo, Norway, were asked to estimate the mortality risk of Swedish snus and cigarettes twice, before and after being exposed to one of three risk communications with information on the health dangers of snus.

\textbf{Results:} The data allow us to measure how participants updated their risk beliefs after being exposed to different risk communications. Risk information from the government strongly distorted risk perceptions for snus. A newspaper article discussing the relative risks of cigarettes and snus reduced belief errors regarding snus risks, but increased belief errors regarding smoking. The perceived quality of the risk communication was not associated with decreased belief errors.

\textbf{Conclusion:} Public health information can potentially make the public less informed on risks about harmful products or behaviours. This risk can be reduced by targeting identified, measurable belief errors and empirically assessing how alternative communications affect these. The proposed method of incentivised risk estimation might be helpful in future assessments of risk communications.

\section*{Introduction}

While risks may be unavoidable, commercial providers have an incentive to downplay, obscure or misinform society and users about the potential risks associated with their products. This is a serious problem in markets for addictive substances, where industries selectively fund research that serves their case, lobby to loosen regulatory burdens, and develop marketing materials to distort risk perceptions — with the tobacco industry being the most well-documented and pernicious case (Glantz, Bero, & Slade, 1998; Ong & Glantz, 2000; Pollay & Dewhirst, 2002).

To counteract these practises, an important government task is to support informed decision making through policies and programs that help consumers accurately perceive and navigate the risk landscape. In addition to reducing industry disinformation (e.g., marketing restrictions), this involves the provision of credible and pragmatically useful information about risks of dependence and harms.

Given its importance, such publicly provided information on risks needs to be accurate, follow established design principles, and be rigorously evaluated, as emphasised in a recent FDA publication (Fischhoff, Brewer, & Downs, 2011). If the goal is to promote informed decision making, we need to identify people’s prior beliefs and the belief errors that matter for the decisions involved, correcting these through credible, convincing and understandable communications. The review repeatedly stresses the need for empirical evaluations, as “even the best science cannot guarantee results” but rather “produces the best-informed best guesses about how well communications will work.”

While this highlights the difficulties involved in any risk communication, additional issues are raised when the correction of belief errors is seen as potentially harmful to public health concerns. This is well illustrated by the current debate surrounding smokeless nicotine products such as Electronic Nicotine Delivery Systems (ENDS) and Swedish snus, where government information has been strongly criticized for failing to provide relevant information on harm differentials (Kozlowski & Sweanor, 2016, 2017).

Harms from these alternative nicotine-products are not known with...
precision, but there are strong reasons to believe that they are substantially lower than the harms from cigarette use (Levy et al., 2004; Lee, 2013; McNeill et al., 2015; Nutt et al., 2014; Royal College of Physicians of London, 2007), and that considerable improvements in public health would be expected if current cigarette smokers could be persuaded to shift to such products (Gartner, Hall, Vos, et al., 2007; Hajek, Etter, Benowizit, Eissenberg, & McRobbie, 2014; Levy et al., 2017; Ramström & Wikmans, 2014).

Since a large share of cigarette users remain unaware of the harm differential (Kiviniemi & Kozlowski, 2015; Liu et al., 2015; Lund & Scheffels, 2014), some researchers have called for clear communication of the harm differential (Gartner, Hall, Chapman, & Freeman, 2007; Kozlowski, 2002; Kozlowski & Sweanor, 2017; Lund, 2012). This proposal has met strong opposition from other researchers, who fear that such a harm-reduction strategy might cause non-smokers to initiate consumption of nicotine products, or cause current smokers to switch or co-use rather than quit. (Dutra & Glantz, 2014; Mejia & Ling, 2010; Tomar, Fox, & Severson, 2009). Other researchers have presented evidence to refute those fears (Ramström, Borland, & Wikmans, 2016; Ramström & Foulds, 2006). The result has been a heated and contentious debate, with accusations in both directions of bias and misuse of science (Gartner, Hall, Chapman, et al., 2007; Polosa, 2015; West, 2014).

Considering this potential conflict between public health and political targets on the one hand, and the goal of informed decision making on the other, we designed a study to pilot a new method for assessing the effects of government-provided health information on participant risk beliefs regarding smokeless tobacco (Swedish snus). The study also asked participants to judge the quality of the information to which they were exposed, allowing us to assess whether perceived quality was higher for information materials that measurably reduced belief errors.

Methods

Measuring accuracy of and changes to risk beliefs following exposure to risk communications requires numerical risk estimates. This is complicated by the often low levels of numeracy in the general population, but nonetheless necessary since qualitative measures (‘low risk’) and information is ineffective. As noted in the FDA risk communication guide, qualitative information fails to provide “the details needed to make an informed decision; it increases risk perceptions, and patients vary in their interpretations of what low and high risks are” (Fischhoff et al., 2011). Rather than avoiding numeric likelihoods, “we should work to make numbers more accessible for all individuals.” Based on a review of the literature, the guide recommends constant time-frames to facilitate comparisons, providing absolute risks rather than relative risks, making clear the difference in baseline and treatment risk, and using whole numbers with constant denominators across comparisons (e.g., stating 1 in 10 000 rather than a 0.01%). This is also consistent with the use of a natural frequency format (X of Y individuals) rather than the use of percentages, which has been argued to promote risk reasoning in the general population (Gigerenzer & Edwards, 2003; Hoffrage, Gigerenzer, Krauss, & Martignon, 2002). In our pilot study, numeracy was expected to be above average, as the majority of participants were undergraduate students from STEM disciplines.

Risk estimation was incentivized in order to reduce bias of anchoring to the initial estimate and normative judgements.

Study protocol

As an illustration of the proposed method, we performed a study comparing incentivized risk estimates elicited before and after exposure to risk communications on tobacco products. Risk communications were randomized across participants. Eight prizes of 200 Norwegian kroner, roughly 22 Euro, were awarded for the most accurate beliefs—four prizes based on initial estimates and four prizes based on the post-treatment estimates. In addition, four randomly drawn participation prizes were awarded. Accuracy was defined by the distance to risk estimates drawn from reports of the Norwegian Institute of Public Health (FHI) (Alexander, Schwarze, Becher, & Øya, 2014; Volset, Selmer, Tverdal, & Gjessing, 2006).

Participants were asked to consider three groups, each consisting of 100 individuals 40 years old. Groups were specified to differ only with regards to their tobacco use, with one group being tobacco-abstainers, one group smoking 10–19 cigarettes per day, and one group using 10 portions of snus per day. For each group separately, participants were asked to give an estimate of the expected number of deaths 30 years later, when the surviving group members would turn 70.

Participants were recruited in three separate sessions from the common areas of the University of Oslo in the first two weeks of the fall term 2015. After filling out contact information, participants were given instructions and a risk elicitation survey. As participants finished the first risk survey, they were handed information material and a second risk survey from a block-randomized pile. Participants were free to spend as much time as they wanted on both the first and second survey, the three information texts were randomized across participants within each session, and participants were not told that there was variation in the type of risk information handed out to different participants within their session. Since participants were invited continuously and some groups of recruited participants would likely be similar (having just finished the same lecture, etc.), the materials were randomized within blocks of 21 (with 7 of each of the three texts in each block). This raised the probability that all risk communication groups drew equally from participants recruited at different times.

After completing the post-information risk estimates participants were asked to assess the quality of the information—how comprehensible, new/interesting, credible and clarifying they found it—as well as provide information on gender and own tobacco use.

Subjects

A total of 228 participants were recruited on a total of three separate occasions. Participants were primarily younger students from the faculty of natural sciences and the faculty of social sciences. The distribution of participants by gender and tobacco use across the three information texts is shown in Table 1.

Measures

Baseline and post-information risk estimates are collected and an average change in belief errors is calculated. Belief errors are defined as the absolute difference between a risk estimate and the research-based risk estimate.

Table 1

<table>
<thead>
<tr>
<th>Sex</th>
<th>Tobacco status</th>
<th>Treatment group</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Govt. short</td>
</tr>
<tr>
<td>Male</td>
<td>Smoke</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Daily</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Snus</td>
<td>Never</td>
<td>18</td>
</tr>
<tr>
<td>Daily</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>11</td>
</tr>
<tr>
<td>Daily</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>Smoke</td>
<td>11</td>
</tr>
<tr>
<td>Never</td>
<td>Daily</td>
<td>1</td>
</tr>
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</tr>
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<td>2</td>
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<td></td>
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