

Comment: The Perils of Qualitative Smoking Risk Measures

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ABSTRACT

Quantitative measures of smoking risks indicate substantial overassessment of these hazards. The qualitative risk measures developed by Slovic have no implications for either the direction or degree of perceptual bias. Qualitative risk questions also suffer from the problem that respondents differ in terms of their reference point for what is risky and what agreement with qualitative risk statements implies about their objective risk beliefs. Meaningful objective risk measures imply that people overassess smoking risks. Copyright © 2000 John Wiley & Sons, Ltd.

KEY WORDS risk beliefs; smoking risks; perceptual biases

Smoking risks are among the largest health risks one might potentially face. An increasingly pertinent question for policy is whether people understand these risks. In a quest to further such understanding, for over three decades the US government has required hazard warning labels on cigarettes, has required the inclusion of these warnings on cigarette advertising, and has restricted cigarette advertising in certain media. In addition, the government has issues annual reports of the US Surgeon General to highlight different hazards of smoking, and there has been widespread attention to smoking and its associated health consequences surrounding the entire public debate over smoking.

A reasonable hypothesis that one might develop based on the literature dealing with risk perception is that the overwhelming amount of information pertaining to smoking hazards would lead people to overestimate the risk. Indeed, evidence suggests that the mortality risks that have received the greatest media coverage tend to be the most overestimated (see for example Combs and Slovic, 1979).

Rather than extrapolate to the smoking context from the literature, with its potentially diverse implications, a more reliable approach to assessing the hazards of smoking is to focus directly on how people perceive these risks. Assessing these risk perceptions is an effort in which I have been engaged in for the past decade. Here I will focus on Paul Slovic's critique of existing evidence on smoking risks as well as his own evidence regarding perceptions of risks by high school students.

Slovic's paper consists of both a critique of my work as well as a presentation of new smoking risk perception results. His criticisms are that my risk measures do not convey the severity of the outcome, do not consider optimism bias, fail to consider the repetitive nature of cigarette smoking, and fail to consider the risk of addiction. In the discussion below I will show that these criticisms are not well founded. Moreover, they are even more pertinent to his risk measures than to those that I have developed. Perhaps most fundamentally, I will also show that the qualitative risk measures used by Slovic have no empirical content. These measures are not comparable

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across respondents and provide no evidence whatsoever regarding either the direction or the magnitude of any risk perception bias.

WHAT DO WE KNOW ABOUT SMOKING RISK PERCEPTIONS?

Paul Slovic mentions only my survey evidence on lung cancer risk perceptions. Here I will provide a more comprehensive perspective on the principal risk measures I have analyzed. In doing so, I have used three sources of data. The first is a 1985 random national survey with over 3000 respondents, the second is a 1991 regional survey with over 200 respondents, and the third is a 1997 random national survey with over 1000 respondents.¹ Paul Slovic's sample of 321 students at a local high school is similar in character to my regional survey in that it provides responses that may be instructive but would not be as reliable as the 1985 and 1997 representative national surveys.

Although Slovic's paper alludes to my results pertaining to lung cancer incidence, my studies have focused on three different health outcomes: lung cancer, overall smoking mortality, and life expectancy loss. Slovic's Exhibit 1 summarizes these risk perception results in the case of lung cancer. All questions except for those in my 1991 North Carolina survey focus on the respondent's belief concerning the risk of lung cancer (i.e. out of 100 smokers how many of them will get lung cancer because they smoke), whereas the 1991 survey focuses on lung cancer mortality.

Before considering the specific lung cancer risk assessment responses, it is helpful to have a scientific reference point for the magnitude of the risk. Based on risk estimates of the US Surgeon General, I have estimated the lung cancer risk probability as being 0.05 to 0.10 in 1985 and 0.06 to 0.13 based on the scientific evidence available in 1991 and thereafter (see Viscusi, 1992, p. 70). What is striking is that the lung cancer risk perceptions dwarf these estimates of the true magnitude of the risk. This overestimation of the risk is the greatest in the case of younger individuals, as all respondents age 16 to 21 assess the lung cancer risk probability as 0.49, and smokers in that age group assess the lung cancer risk probability as 0.45. This dramatic overestimation of the risk by people in younger age groups is a result that I have attributed to the stronger anti-smoking environment in which these individuals have been raised, as opposed to those in older age groups.

These risk perceptions are of substantial consequence to the people themselves. I have estimated that if smokers had accurate risk beliefs instead of overestimating the lung cancer risk of smoking, then societal smoking rates would rise by 6.5 to 7.5 percentage points. Since one-fourth of the adult population currently smokes, these results imply that the size of the smoking population would be more than one-fourth larger than it is now if people had accurate lung cancer risk assessments.

A broader issue is whether people accurately perceive the risk of premature death associated with cigarettes. My 1991 North Carolina survey elicited both the lung cancer fatality risk perception as well as the overall fatality risk assessment with respect to lung cancer, heart disease, throat cancer, and other illnesses due to smoking. The 1997 national survey also addressed these mortality risk beliefs. Once again, before considering the level of risk perceptions, it is instructive to have a reference point to determine whether the risk perceptions are too high or too low. Based on evidence provided by the US Surgeon General, I have estimated the overall mortality risk of smoking to be from 0.18 to 0.36 (see Viscusi, 1992, p.70). These estimates are consistent with those reported by the US Surgeon General that a heavy smoker could face a mortality risk as high as one-third (see US Department of Health and Human Services, 1989). In the case of mortality risks the degree of overestimation of the hazard is less than for lung cancer risks. Nevertheless, even smokers overestimate the level of the risk even if one uses the upper bound risk estimates of the US Surgeon General as the reference point.

While people understand that smoking may lead to premature mortality, do they also understand that a substantial portion of their lives will be lost? In my 1991 North Carolina survey and the 1997 national survey I developed a life expectancy loss question in which respondents were informed of the normal life expectancy for their gender and were asked to assess the life expectancy for a smoker. Using as the scientific reference point an estimate in 1989 by the US Surgeon General, the life expectancy loss for a 30-year-old smoker who consumed a pack a day of cigarettes was 6–8 years.² Based on more recent scientific evidence, I have estimated the life expectancy loss to be from 3.6 to 7.2 years (see Viscusi, 1992, p.80). As is clear from the life expectancy loss statistics reported in Slovic's Exhibit 1, both smokers and the sample overall overestimate the life expectancy loss associated with smoking. The estimates of 9.0 and 9.9 years for the smoking respondents are each above the upper bound life expectancy loss estimates derived using scientific estimates of the level of the risk.

¹ The two national surveys were conducted by Audits and Surveys, an international survey research firm based in New York. These surveys were financed by cigarette defense law firms. I undertook the 1991 survey independently, and the risk questions formed the basis of the 1997 national survey.

² See US Department of Health and Human Services (1989, p.206). This estimate in turn was based on a 1979 study.

SLOVIC'S CRITIQUE

Slovic's paper has four criticisms of this work, which I will consider in turn. First, he suggests that perceived probabilities are not sufficient, as one must also know the nature and severity of the consequences. In my research the consequences have been both severe and well defined. Based on studies I have done on a wide variety of health outcomes for the US Environmental Protection Agency and other agencies, it is clear that death and cancer are among the most highly valued adverse health effects.

The second criticism is that people will suffer from an optimism bias and will not believe that there will be a risk to themselves. Not only is there no documentation of this claim, but it is contradicted by the aforementioned empirical evidence that shows a very substantial link between perceived risks of smoking and the probability that one will engage in this behavior. If the risks were dismissed altogether then there would be no such relationship. Moreover, 96% of smokers believe that cigarette smoking is harmful to their own health.³ In addition, Slovic's own research on adolescents' cigarette risk perceptions found that respondents' assessed personal risk to themselves did not differ to a statistically significant degree from their assessed risk to their peers.⁴

The third criticism is that this research does not recognize the cumulative nature of the risk. On the contrary, it focuses on lifetime risks of lung cancer, premature mortality, and life expectancy loss from one's entire smoking history, as opposed to focusing on the risks from a single smoking event.

The final critique is that these results do not consider young people's misperceptions of the risks of becoming addicted. His claim, which once again is without empirical support, is contradicted by national survey evidence. The 1992–1993 Current Population Survey Tobacco Supplement provides direct evidence on the perceptions of the difficulty of quitting smoking by 15–20 year olds. For this group, 20.9% believe that smoking is an addiction, 18.5% believe it is a habit, 58.5% believe it is both, and only 2.2% believe that it is neither.⁵ The US Surgeon General formerly classified the costs of giving up cigarettes as a habituation (see US Department of Health, Education and Welfare, 1964) switching to the 'addiction' label in 1988 (see US Department of Health and Human Services, 1988). What matters from the standpoint of judging the rationality of individual behavior is whether people understand that there are real costs to giving up smoking, and the empirical evidence on this issue is overwhelming.

WHAT IS A CUMULATIVE RISK?

How well do Slovic's risk questions fare with respect to the four criticisms he lodged against my risk assessments? First, his risk measurements do a less thorough job of capturing the nature and severity of the health outcome than do my questions relating to lung cancer, mortality, and life expectancy. Asking whether there is a 'risk', 'a little bit of harm', 'harmful effects', or harm to 'this person's health' are less well-defined health outcomes. His second criticism pertaining to the optimism bias is not addressed at all by his different question wording since there is no apparent reason why the question phrasing in Slovic's Exhibit 2 should be less prone to optimism bias than asking questions with respect to an objective risk measure. The third criticism of dealing with cumulative risk was not pertinent to my lifetime risk discussion and does not seem pertinent to his question wordings either. One difficulty in interpreting the different time periods in his questions (a few years, a single cigarette, etc.) is that the nature of the risk, the nature of the harm, and the time period all vary, so that they are not comparable. Finally, the Slovic questions in no way touch on the addiction risks of cigarettes.

The allegedly distinctive feature of Slovic's paper is that it will focus on cumulative risks. However, the meaning of this term is never precisely defined. One can envision a series of independent events that pose a risk, such as driving an automobile throughout one's life, which Slovic indicates is a cumulative risk. On the other hand, one could envision a situation in which people face a non-linear dose response relationship, as with the amount of alcohol one might drink in a particular sitting. It is the latter situation that is most akin to the cumulative risk notion in the risk literature, but Slovic does not make this link, as all repeated risks are cumulative under his broad definition. None of Slovic's survey questions really distinguish either of these possible interpretations of a

³ These results are based on a 1990 Gallup Poll taken 18 July (Question ID: USGALLUP.071890, R08: 'Do you think cigarette smoking is or is not harmful to your health?').

⁴ See Benthim, Slovic, and Severson (1993), p.162. Using a 7-point scale, they found a personal risk rating of 4.31 and a risk to peers rating of 4.42.

⁵ These statistics are reported by Hersch (1998).

cumulative risk, but instead simply focus on whether people understand the consequences of long periods of smoking, which is an issue that is also addressed in my studies as well.

Slovic's series of five questions are all qualitative in nature, e.g. 'Every single cigarette smoked causes a little bit of harm'. This approach has several limitations. First, there is no well-defined risk reference point to determine whether the subjects are underassessing or overassessing the risk. What do we mean, for example, by 'a little bit of harm?' Based on the midpoint lifetime mortality risk estimate for a smoker of 0.26, one can calculate the risk per cigarette. If one smoked, for example, a pack a day for 365 days a year, and for forty years, the mortality risk per cigarette is under one in a million. Does a small risk of this magnitude constitute 'a little bit of harm' or is it 'a lot of harm?' My response would be 'a little bit of harm', but this does not imply ignorance of the truly substantial health risks of smoking. Thus, his questions have no correct answer with respect to a scientific reference point for the true risk.

The second issue raised by Slovic's qualitative risk questions is that different respondents interpret such qualitative measures differently with respect to some objective risk reference point. In Gaba and Viscusi (1998) we show that workers have different thresholds with respect to the objective risk level that will trigger them to designate their job as being dangerous. College-educated and white-collar workers, for example, are more likely to consider a low-risk job dangerous than are their coworkers. Unless answers to qualitative risk questions are debiased using the type of procedure we outline in that paper, then no valid conclusions can be drawn from the responses if there are systematic differences across the groups in terms of the link between the qualitative and objective risk metrics.

The third shortcoming of the wording of the questions is the qualitative nature of the responses — strongly agree, disagree, don't know. If the 'don't knows' vary across groups, then reporting on only the various 'agrees', as in Slovic's Exhibit 1, can be misleading. More importantly, there is no justification whatsoever for treating these qualitative agreement responses and assigning to them a quantitative metric, as is done in his Exhibit 2. Slovic's variable is only an ordinal scale, but he inexplicably assigns quantitative values (strongly disagree = 1, disagree = 2, agree = 3, and strongly agree = 4). This formulation implausibly assumes that different gradations of disagreement (strongly disagree vs. disagree) have the same quantitative risk implications as going from disagreement to agreement. Slovic's approach is only valid if going each unit on his scorecard (disagree = 2, agree = 3, etc.) would have the same proportional effect on the quantitative risk rating for all respondent. There is no reason to believe that this is the case.

The fallacy of making this assumption is apparent in contexts where we know the quantitative results, as in the height of five players on a basketball team. Slovic's measure would rank the players from 1 to 5 based on their height, with the shortest being 1. Turning this variable into a quantitative measure assumes that the second shortest person is twice as tall as the shortest and the tallest player is 5 times as tall as the shortest.

Even taking Slovic's results at face value, it is not clear that they provide any cause for concern. His own results imply that the overwhelming majority of smokers believe that smoking a pack a day will eventually harm their health and that a single cigarette causes a little bit of harm. Believing that a single cigarette or a few years of smoking will cause less risk certainly is quite accurate, and there is no reason to believe that these attitudes towards risk imply that people underestimate the hazards of smoking.

For the lifetime statement ('Smoking at the daily rate of one package of cigarettes each day will eventually harm this persons health'), smokers were more likely than nonsmokers to agree with this risk claim (100% versus 96% for nonsmokers, but the differences are not statistically significant).⁶ For comparability with Slovic's discussion, I exclude light smokers from these comparisons, and focus on heavy smokers versus nonsmokers. Similarly, for the precisely specified short-term question ('Every single cigarette causes a little bit of harm') there is no significant difference between the percentage agreement for smokers and nonsmokers regardless of the break point one selects in distinguishing the agree/disagree responses. Whereas all of my results implied that smokers had lower risk assessment than non-smokers, Slovic's results imply no significant difference for both a short term and a long-term risk measure.

The relative risk assessments to the other questions vary depending on the break point one selects for the qualitative agree/disagree variable. Slovic found lower risk assessments for smokers when the break point was between agree/disagree, but often break points along his qualitative scale have different implications. For example, no smokers strongly disagreed with the claim the 'there really is no risk at all for the first few years', whereas 2% of the nonsmokers did disagree. Similarly, the percentage of respondents who strongly agree with a similar statement ('Although smoking may eventually harm this person's health, the *very next single cigarette* he or she smokes will probably not cause any harm') does not vary significantly between smokers (2%) and nonsmokers (1%). The differences across smokers and nonsmokers are less evident either when the nature of the smoking risk exposure

⁶ These calculations and those discussed below are based on Slovic's unpublished computer printouts.

(i.e. 'one package of cigarettes per day', 'every single cigarette', and 'the very next single cigarette') is well defined, or the response involves strong endorsement of the most anti-smoking interpretation of the question.

Unfortunately, all Slovic's questions suffer from a lack of a well-defined risk level and the fact that all judgements being made are relative using a qualitative scale. Both smokers and nonsmokers may overestimate the risk. Smokers may, however, be less prone to such overestimation, as I found in my objective risk data. Or there may be no significant difference, as is implied by some of Slovic's results. Relative risk comparisons of smokers and nonsmokers tell us nothing about whether nonsmokers' risk beliefs are too high or too low.

CONCLUSION

What, then, is the nature of the controversy? The disagreement as I see it is that it is not over recognition of hazards of smoking, which each of us believe are quite substantial. Rather, the controversy is over scientific method. Slovic's variables have no validity in making risk belief comparisons across subjects. To assess whether people understand the risk of smoking one needs a meaningful risk metric that one can objectively compare with scientific evidence in order to assess whether risk perceptions are too high or too low. My research has developed a wide variety of such measures, each of which indicates an overestimation of the risks of smoking to differing degrees. In contrast, the results by Slovic have no clearcut implications with respect to the direction or magnitude of the bias in risk beliefs. Indeed, his measures have no quantitative significance whatsoever.

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