



Lung cancer risk perception biases

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ABSTRACT

This paper provides new evidence on biased perceptions about the risks of smoking. It studies predictors of lung cancer risk perceptions. Lung cancer is one of the deadliest and most aggressive cancer types with 5-year survival rates of only up to 15%. A cross-sectional online survey in Berlin assessed lung cancer risk perceptions among smokers ($n = 664$), never smokers ($n = 703$), and former smokers ($n = 501$) in 2013. In addition to lung cancer risk perceptions, the survey measured many respondent characteristics, such as intention to quit smoking and a self-assessment of the likelihood of success in quitting. The findings show that 80% of all respondents overestimated lung cancer survival rates and suggest significant room for public health campaigns to educate smokers and nonsmokers about the deadliness of lung cancer. Multivariate linear regressions show that smokers who do not plan to quit estimate the 5-Year Lung Cancer Survival Rate to be 11% ($p = 0.044$) higher than other smokers. A reduction in risk perception biases may induce some smokers to alter their quitting intentions and others to successfully quit.

1. Introduction

Lung cancer is the most common cancer worldwide (American Cancer Society, 2017). It is one of the deadliest and most aggressive cancer types with 5-year survival rates of only up to 15% (U.S. Department of Health and Human Services, 2014; American Lung Association, 2017; Mannino et al., 1998). Worldwide, 1.7 million people die from lung cancer every year (World Health Organization (WHO), 2015). Eighty to 90% of all lung cancer cases are linked to smoking (American Lung Association, 2017), making lung cancer one of the most preventable cancer types.

A rich strand of existing research in economics, psychology, and epidemiology has elicited smoking-related risk perceptions among smokers and non-smokers (Leventhal et al., 1987; Viscusi, 1990; Halpern-Felsher et al., 2004; Schoenbaum, 1997; Ayanian and Cleary, 1999; McCusker, 2001; Romer and Jamieson, 2001; Slovic, 2001; Slovic et al., 2004; Khwaja et al., 2007a; Khwaja et al., 2007b; Lundborg, 2007; Dionne et al., 2007; Lundborg and Andersson, 2008; Sloan and Wang, 2008; Khwaja et al., 2009; Gerking and Khaddaria, 2012; Lin and Sloan, 2015). Kenkel (2000) provides a thorough discussion and summary of the economic literature on this topic. Studies in cognitive psychology refer to the “experimental system” of humans that affects judgement and decision making (Romer and

Jamieson, 2001; Slovic, 2001; Slovic et al., 2004). Economic studies tend to conclude that smokers either accurately assess risks or even overestimate the health risks of smoking (Viscusi, 1990; Lundborg, 2007; Lundborg and Andersson, 2008; Kenkel, 2000), while medical, public health and psychological studies tend to conclude the opposite (Leventhal et al., 1987; Schoenbaum, 1997; Ayanian and Cleary, 1999; McCusker, 2001; Romer and Jamieson, 2001; Slovic, 2001; Slovic et al., 2004). There is surprisingly little consensus on this question across disciplines, which is at least partly due to methodological differences.

For example, the seminal economics paper on this topic is based on a US survey in 1985 which asked 3119 adults to estimate a smoker's lifetime risk to contract lung cancer because of smoking. Because the true risk lies between 15 and 20% but respondents' estimated average was 42%, Viscusi (1990) concludes that “both smokers and nonsmokers greatly overestimate the lung cancer risk of cigarette smoking [...]” (p. 1253). Several follow-up surveys have validated this finding (Viscusi, 2002). Viscusi (2002) speculates that people may overestimate lung cancer survival rates as well, but then only provides evidence that people also overestimate the overall lifecycle risk of smokers to die from lung cancer (the product of the lifecycle incidence and survival rates).

In contrast, a well-known medical paper (Ayanian and Cleary,

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1999) presents the findings of a US survey in 1995 which asked 3031 adults whether they believed that their personal risk of [...] cancer would be higher, lower, or about the same as other men/women in their age. Because (only) 40% of smokers believed they had an elevated risk of contracting cancer, [Ayanian and Cleary \(1999\)](#) conclude that “most smokers do not view themselves at increased risk of [...] cancer” (p. 1019). In another study, [Schoenbaum \(1997\)](#) uses a representative sample of elderly Americans and compares the personal beliefs of non-smokers, former smokers and smokers to reach age 75 with predictions from smoking-specific life tables. [Schoenbaum \(1997\)](#) concludes that heavy smokers underestimate their risk of premature mortality. This paper bridges the two literature strands in economics and the health sciences by asking respondents in an online survey in Berlin to assess the (clearly defined and evidence-based) probability of a lung cancer patient to survive the next five years. It is one of the first papers to assess risk perceptions about lung cancer survival. The survey question deliberately abstained from asking respondents about *personal* risk perceptions due to the well-documented over-optimism bias ([Weinstein, 1989](#)).

This paper has several aims. The first aim is to empirically test whether people have biased perceptions about the 5-year lung cancer survival rate, as suggested by the literature. The hypothesis is that a significant share of respondents either overestimate or underestimate this risk. The second aim is to test whether risk perceptions differ significantly between smokers, former smokers and never smokers. The hypotheses here is that smokers' risk perceptions differ significantly and that smokers underestimate the health risks of smoking more often. The third aim is to test for the existence of other predictors of biased risk perceptions such as risk aversion, discount rates or smokers' intentions to quit. Based on previous research, the author expects higher risk tolerance levels and biased risk perceptions to be significantly linked. Researchers have also linked discount rates to smoking status ([Khawaja et al., 2007a](#)). In this context, the hypothesis is that people who emphasize the present much more than the future may be less informed about the risks of smoking and the mortality risks of lung cancer. The study also hypothesizes that smokers who do not plan to quit have particularly biased risk perceptions. This would be a highly policy-relevant finding as it would suggest that targeting and educating those smokers may alter their quitting intentions ([Lyna et al., 2002](#)).

2. Methods

An online survey measured perceived lung cancer risk among current smokers, former smokers, and non-smokers between July 23 and September 13, 2013 in Berlin. The online survey used the Ipsos Interactive Services Panel (IIS) on a rolling weekly basis in order to sustain stable response rates over the duration of seven weeks. The survey company Ipsos MORI set loose quotas ($\pm 30\%$) on age, gender, and work status according to the general population in Berlin. All survey respondents participated in a €1500 lottery in order to maximize response rates. Disregarding respondents with missing data on variables of interest, the main sample consists of 1868 respondents.

Comparing the online survey's responses with data from the nationally representative German Socio-Economic Panel Study (SOEP) illustrates some differences ([Socio-Economic Panel \(SOEP\), 2014](#)). According to the SOEP, the average Berliner is 51 years old, whereas the online survey yields an average age of 45 years (see [Appendix B](#)). Comparing gender (54% vs. 57%), marital status (24% vs. 28% single), employment status (37% vs. 47% full-time employed), and the self-reported risk tolerance (5.01 vs. 4.09) shows that the online survey is slightly younger, includes more singles, females, full-time employees and more risk loving individuals.

Data collection methods followed all ethics guidelines for good

scientific practice by the German Science Foundation.¹ The large majority of respondents answered the survey in German. (The survey questions in [Appendix A](#) are in English.)

2.1. Definition and measurement of outcome: lung cancer risk perceptions

[Appendix A](#) displays the wording of the questions that measured respondents' perceptions about lung cancer survival rates. The main outcome variable is *5-Year Lung Cancer Survival Rate*. Respondents could choose between ten answer categories provided in increments of 10%, i.e., 0–10%, 10–20%, ..., 80–90%, 90–100% to the following question (see [Appendix A](#))²: “Please estimate: When diagnosed with lung cancer, how likely is it that a patient survives the next 5 years?”

The true lung cancer survival rates lie between 5 and 15%—around 15% in North America and Central Europe and below 10% in the UK ([Mannino et al., 1998](#); [Butler et al., 2006](#); [Coleman et al., 2010](#); [Couraud et al., 2012](#); [World Health Organization \(WHO\), 2017](#)). To allow for some degree of uncertainty and to define risk perception biases conservatively, the binary *Overestimation Lung Cancer Survival* is 1 if respondents indicate values above 20%.³

2.2. Definition and measurement of smoking-related variables

The smoking status of an individual can potentially be an important predictor of biased perceptions about the risk of smoking. This paper compares the risk perceptions of current smokers to those of former smokers and never smokers ([Tota et al., 2014](#)).

2.2.1. Smoking status

[Appendix A](#) shows that *Never Smokers*, *Current Smokers* and *Former Smokers* were identified by directly asking respondents about this status. For example, the main question asks: “Do you currently smoke cigarettes, cigars or pipes?” and the three response categories include (a) *No, I have never smoked in my life*, (b) *No, I quit smoking*, and (c) *Yes*. While this definition does not allow one to differentiate among cigarette, cigar or pipe smokers (who all have different lung cancer risks), it should be noted that the share of pipe and cigar smokers in Germany is only 0.4% and 1%, respectively ([SOEP, 2013](#)).

2.2.2. Smoking intensity and being a heavy smoker

[Appendix A](#) also lists the separate survey question that measures how many cigarettes, pipes or cigars were smoked on the day before the interview (*#Cigarettes Smoked*). In addition, *Heavy Smoker* is a binary measure of whether someone is a heavy smoker. Because there is no standard definition of being a heavy smoker, the definition follows studies that use a pack-a-day cutoff ([Neumann et al., 2013](#)) and defines being a *Heavy Smoker* as someone who smoked at least 20 cigarettes on the day prior to the interview.

¹ The research has been approved and funded by the Deutsche Forschungsgemeinschaft (DFG; “German Science Foundation”, WA 547/5-1) and the Open Research Area in Europe for the Social Sciences (ORA-10-36). The survey followed the principles of the Declaration of Helsinki and is in line with the ethics guidelines of the German Science Foundation: http://www.dfg.de/download/pdf/dfg_im_profil/reden_stellungnahmen/download/empfehlung_wiss_praxis_0198.pdf.

² It has been shown that responses are robust to the format in which risk beliefs are elicited, i.e., whether responses are open-ended, provided in categories, or have a different denominator than “100 smokers” in the question asked ([Slovic, 2001](#); [Slovic et al., 2004](#)). Note that the intention was to force respondents to estimate this risk and to not offer a separate “Don't know” category. Assessing the confidence that people place on their estimate is beyond the scope of this paper and would be a separate research question.

³ Lung cancer survival rates vary across countries, over time and potentially by the method of measurement. Some reported numbers for Germany lie around 10% ([Butler et al., 2006](#)). Lowering the threshold to 15% or 10% yields robust results (available upon request).

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