

VALUING THE COST OF SMOKING
*ASSESSMENT METHODS, RISK PERCEPTION
AND POLICY OPTIONS*

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1999 **KLUWER ACADEMIC PUBLISHERS**
BOSTON/DORDRECHT/LONDON

PUBLIC PERCEPTION OF SMOKING RISKS

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INTRODUCTION

Cigarette smoking is perhaps the largest single consumer risk that individuals incur on a mass scale. Scientific estimates of the hazards of smoking dwarf the risks associated with motor-vehicle travel, hazardous jobs, and other risky activities. A policy question of fundamental importance is whether people in fact understand these risks and act upon them in a reasonable manner. The point of view that I will take here is that in assessing any market failure, the appropriate reference point is the same as economists apply in other contexts, which is to assess whether people are making informed and rational choices. My primary focus will be on people's assessment of the health risks of smoking¹.

Suppose, for example, that people did not understand the health implications of their smoking decisions. Such a finding would be pertinent to assessing the private cost to the individual. The gap between the expected costs and those that will actually occur based on the true probabilities serves as a measure of the private loss. In addition, to the extent that people are not knowledgeable of the risks, these unanticipated private costs also might be pertinent for various tallies of the social costs of smoking. The principal economic rationale for excluding these private costs is that they are

¹ For a more comprehensive perspective on this literature, see Viscusi (1990, 1991, 1992, 1995, 1998).

anticipated by smokers and hence fully internalised, but if this is not the case then the social calculus must be altered as well.

From a policy standpoint, knowledge of the extent to which people understand the risks associated with smoking should be of fundamental concern. In the United States, for over three decades the government has undertaken mandatory on-product warnings regarding the hazards of smoking, mandatory warnings in advertising, restrictions of advertising, and various public health reports disseminating smoking risk information. These official information sources have obviously been coupled with private information as well, such as that in the media. What has been the outcome of this public information campaign? Do people in fact understand the risks of smoking as one would expect if these public information efforts have been effective? Are there any glaring informational gaps that need to be addressed through further information dissemination efforts? Somewhat surprisingly, this type of question has never been addressed by the public health establishment in the United States. Rather, the focus has been on using the campaigns as a form of persuasion rather than attempting to identify specific information gaps that need to be remedied.

Setting the standard for what consumers should know to be adequately informed can be cast within the context of economists' standard expected utility calculations. For all the various health outcomes associated with smoking, do consumers have a sufficient understanding of the risks? Are they deterred from smoking to the same extent as they would be if they accurately assessed all the pertinent probabilities of the adverse health outcomes linked to smoking? If, for example, consumers were to underestimate the risk of heart disease, this effect could be offset by overestimating the risk of lung cancer. Similarly, consumers may not know the precise chemical constituents of cigarettes, which additives cause cancer and which do not, or similar highly detailed scientific aspects of the risks. Yet, they may nevertheless be knowledgeable in the sense of having risk beliefs that deter smoking to the same extent as would sound processing of the scientific information pertaining to smoking. This paper will attempt to provide a comprehensive perspective on public perception of smoking risks, focusing on the hazards of lung cancer, overall mortality risk, and life expectancy loss.

I shall first discuss the background context of the smoking information that has been disseminated to consumers in the United States. In the following section, I focus on whether this and other information provided to consumers has been sufficient to lead to a perception of the lung cancer risks of smoking, which was the hazard first highlighted by the government

in its landmark 1964 report on smoking². This evidence, which is from surveys undertaken in 1985 and 1991, indicates that smokers greatly overestimate the risks of lung cancer. The extent of this risk overestimation is, however, less in the case of mortality risks, which is the focus of the next section. A related issue is the extent of life that people lose through smoking, not simply their probability of death. Estimates for life expectancy loss reported in the penultimate section indicate these hazards are overestimated as well.

SMOKING RISK INFORMATION

Smoking critics often assume that they alone have access to information about the hazards of smoking. For some inexplicable reason, smokers are assumed to either not have had access to this information or have not been able to understand it and have thus been excluded from knowledge of the substantial risks of smoking. This mindset in turn can potentially influence the direction of government policies, leading to greater reliance on hazard warnings when in fact other policy interventions may be more beneficial.

A useful starting point for investigating the basis of the public's knowledge about smoking risks is to consider the information disseminated by the federal government. The 1964 report on the lung cancer risks associated with smoking marked the beginning, not the end, of the public pronouncements on cigarette hazards. Beginning in 1967 the U.S. government issued annual reports on the health consequences of smoking, where these reports were from the U.S. Surgeon General. These reports began more as literature surveys of a general nature, and then evolved into reports with specific themes, such as cancer, nicotine addiction, and cardiovascular disease. None of these reports feature an assessed probability of particular health outcomes. Rather, the emphasis is on the total number of smokers who will incur particular ailments, e.g. 400,000 smokers will die every year because of their smoking activity. Thus, the government has highlighted the numerator of the risk, but not the denominator or the entire calculation that makes clear the probability of the different health effects. One would expect this informational approach to lead to an overestimation of the risk to the extent that highlighting the total number of deaths and other adverse effects creates concern with smoking hazards that is disproportionate to the underlying probabilities. Although the Surgeon

² See the U.S. Department of Health Education and Welfare (1964).

General's reports are not widely read by the public, the annual press releases from these reports do receive substantial national publicity.

The warnings themselves for smoking hazards have been mandated by acts of the U.S. Congress. Table I gives the evolution of the three eras of cigarette warnings that have been in place. The initial warning beginning in 1965 indicated that "Cigarette Smoking May Be Hazardous to Your Health." The 1969 warning decreased the probabilistic emphasis, indicating that "The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health." Thereafter, the warning approach led to a series of four rotating warnings concerning a variety of risks associated with smoking. The advantage of rotating warnings is that more diverse information can be conveyed without cluttering a label, while the disadvantage is that any particular warning will receive less exposure. By law cigarette companies were required to include the boxed warning information in all print ads. Radio and television ads for cigarettes were banned.

Although the warnings do not include any specific quantitative information indicating the level of the risk, a qualitative approach is not unusual in the hazard warnings field. People generally find it easier to process verbal information than a detailed list of statistics pertaining to the risk. Perhaps the most sophisticated group receiving warnings is that of physicians, all of whom have taken courses in pharmacology and related subjects as part of their medical training. However, even the warnings for prescription drugs that are compiled in the *Physicians Desk Reference* often do not include quantitative information pertaining to the level of the hazard posed by the drug. While it is doubtful that all current hazard warnings could be replaced by a quantitative approach, providing some limited quantitative information may nevertheless foster more accurate risk assessments.

Table 1 Cigarette Warning Content Summaries^a

Warning period	Warning content
Cigarette warning, 1965	"Caution: Cigarette Smoking May Be Hazardous to Your Health."
Cigarette warning, 1969	"Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health."
Cigarette warning, 1984	<ol style="list-style-type: none"> 1. "SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy." 2. "SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks To Your Health." 3. "SURGEON GENERAL'S WARNING: Smoking by Pregnant Women May Result in Fetal Injury, Premature Birth, and Low Birth Weight." 4. "SURGEON GENERAL'S WARNING: Cigarette Smoke Contains Carbon Monoxide."

^a All warnings wording is specified by legislation. See 15 U.S.C. §§ 1331-1341 (1982).

The objective of hazard warnings shouldn't be to deter smoking behaviour, irrespective of the truth. Overly alarmist warnings that distort the risks of smoking will undermine the credibility of the warnings effort and will potentially undermine the credibility of warnings efforts for other hazards. As I have written extensively elsewhere, hazard warnings are a valuable component of efforts to control risks in a wide variety of contexts, ranging from household chemical products to environmental exposures³. Honesty, credibility, and accurate dissemination of information are essential components of a responsible hazard warnings program. With these and similar efforts, it is essential to determine how consumers will process the risk information and whether warnings will in fact lead them to form accurate risk perceptions. These concerns become particularly acute with respect to the often shrill anti-smoking campaigns in the media. Likewise,

³ See Magat and Viscusi (1992), and Viscusi and Magat (1987).

cigarette advertising should also be held to the standard that the net effect of this advertising is not to lead consumers to underassess the risks of smoking.

Cigarette advertising itself has long been a source of information regarding smoking risks. Studies indicated that as far back as the 1920's there were substantial health claims made with respect to cigarettes, which were typically of the form that this particular brand was not as dangerous for one's throat or caused less coughs and irritation than other cigarettes⁴. These health mentions in effect serve to highlight the health hazards associated with smoking by giving them increased prominence among potential consumers.

Perhaps the most vigorous advertising campaign relating to cigarette safety took place during the great tar derby of 1957-1960. During that period, cigarette companies advertised their tar and nicotine levels and competed with respect to cigarette safety. The advertising for Kent cigarettes claimed that these cigarettes had "significantly less tar and nicotine than any other filter brand." Duke cigarettes proudly claim that they have the "lowest tar of all Low-tar cigarettes," and Marlboro cigarettes had improved so that "Today's Marlboro-22% less tar, 34% less nicotine." The result of this cigarette safety competition was that within this three year period, the average tar and nicotine of the cigarettes purchased dropped by one-third.

The U.S. Federal Trade Commission banned this form of competitive advertising in 1960 in an effort that continues to reflect the government's general opposition to the use of market forces to promote cigarette safety and to permit the role of consumer choice to reduce the average riskiness of cigarettes. Indeed, the U.S. Public Health establishment recommended against smoking low tar cigarettes⁵.

It wasn't until the American Cancer Society recognised the ill-conceived nature of this policy that it was reversed. The Federal Trade Commission itself published tar and nicotine levels in 1967, and in 1971 it required that all cigarette advertising include tar and nicotine levels.

The general media also provides substantial coverage of the hazards of smoking. I have compiled a tally of articles in the *Reader's Digest* beginning in 1950. Although the articles dealing with health hazards have increased over time, there has been a continuing concern over the past half century with the health risks of cigarettes, as for example the number of articles

⁴ See Ringold and Calfee (1989).

⁵ See Calfee (1985).

published in the 1980's was just under double the number of health related cigarette articles published in the 1950's⁶. The hazards of smoking are the subject of substantial public attention.

The main issue I will focus on is whether in fact this prominence has led people to perceive the risk accurately. A well established result in the literature on risk perception is that people tend to have exaggerated perceptions of the most highly publicised risks. Consequently, one would expect that this prominence would tend to lead people to overestimate the risks of smoking as compared to the true risk level. The reason for such a relationship is that media coverage does not indicate specific probabilities of risk but rather indicates the character of the danger so the effect is to simply boost probability assessments rather than to make them converge to their true value.

PERCEPTIONS OF LUNG CANCER RISKS OF SMOKING

The starting point for analysing the accuracy of the lung cancer risk perceptions will be to develop scientific reference points for these risk levels. Unfortunately, there are no published probabilities of the major health outcomes associated with smoking. The approach I adopted instead was to use the total lung cancer and death risk estimates provided by the U.S. Surgeon General, coupled with statistics on the smoking population to estimate the associated risks of smoking⁷. Thus, it is worth emphasising that these risk estimates reflect the U.S. government assessments of the hazards of smoking and do not adjust in any way for the omission of health risk factors correlated with smoking from their statistical analyses. For the survey year 1985, the lung cancer mortality risk ranged from 0.05-0.10, and for the survey year 1991 the estimate ranges from 0.06-0.13. The total mortality risk to the smoker is more than double this amount, and my current estimate of this range is from 0.18-0.36. Some rough estimates show that the lifetime mortality risk of smoking could be as high as one-third, which is currently within my estimated range.

To assess whether risk perceptions are accurate, ideally one would like quantitative information that enabled one to make a judgement as to whether people underestimate or overestimate particular hazards of smoking. Much

⁶ See Viscusi (1992).

⁷ The Procedures for this calculation are described in Chapter 4 of Viscusi (1992).

available survey evidence is quite qualitative in nature. For example, one of the most detailed surveys undertaken by the U.S. government focused on whether a respondent believed that the product is somewhat or very harmful⁸. Close to 100 percent of the respondents believe that tobacco products are somewhat or very harmful, which exceeds the risk belief percentages for (in order of decreasing risk) alcoholic beverages, food additives, fatty foods, artificial sweeteners, over-the-counter-drugs, and dairy products. What can we conclude from such statistics or the annual series of Gallup polls that ask smokers whether cigarette smoking is harmful? Although not completely devoid of interest, such questions do not provide a meaningful basis for determining whether people have accurate risk perceptions. What, for example, is the quantitative risk counterpart to smoking being "somewhat harmful" or "very harmful?" Not only do such measures lack any corresponding quantitative reference point for any particular individual, but to the extent that people differ with respect to the quantitative risk level that they regard as harmful then pooling the responses and making comparisons across respondent groups will not be meaningful. In a recent analysis with Anil Gaba, we found using job risk data that white-collar workers and better educated workers were more likely to regard a job as "dangerous" for any given level of objective risk than were blue-collar or less educated workers⁹.

The first set of evidence regarding lung cancer risk perceptions comes from a national survey undertaken in the United States in 1985¹⁰. The survey was conducted by an international survey research firm, Audits & Surveys Inc. The survey was conducted using a random digit dial telephone method and included a sample of over 3000 respondents. The survey question posed the lung cancer risk question as follows: "Among 100 cigarette smokers, how many of them do you think will get lung cancer because they smoke?" Using a reference point of 100 is a convenient denominator for people to think in probability or percentage terms. I have used a similar type of population reference approach in a variety of studies of risk perception undertaken for the U.S. Environmental Protection Agency.

⁸ These statistics are from the U.S. Bureau of Alcohol, Tobacco, and Firearms, Final Report On The Research Study Of Public Opinion Concerning Warning Labels On Containers Of Alcoholic Beverages, Dec 1988, Vol. 1, Table 2.

⁹ See Gaba and Viscusi (1998).

¹⁰ For fuller discussion of this particular survey, see Viscusi (1992).

Table II *Distribution of lung cancer risk perceptions for cigarette smoking, 1985^a*

Distribution of lung cancer risk perceptions (RISK)	Fraction with risk perceptions in interval	
	Full Sample	Current smokers
Risk < 0.05	.052	.092
0.05<=Risk<0.10	.046	.051
0.10<=Risk<0.20	.117	.130
0.20<=Risk<0.30	.136	.146
0.30<=Risk<0.40	.090	.114
0.40<=Risk<0.50	.052	.050
0.50<=Risk<0.60	.239	.228
0.60<=Risk<0.70	.070	.056
0.70<=Risk<0.80	.084	.050
0.80<=Risk<0.90	.042	.027
0.90<=Risk<0.99	.041	.028
Risk = 1.00	.030	.026
Mean risk	.426	.368
(standard error of mean)	(.005)	(.009)
Sample size	3,119	779

^a Among 100 Cigarette Smokers, how many of them do you think will get lung cancer because they smoke? ("if don't know," PROBE: "Just your best guess will do").

Table II reports the distribution of the responses for the sample overall as well as current smokers. Overall, the lung cancer risk perceptions are quite substantial – with an average lung cancer risk of 0.43 for the population overall and 0.37 for current smokers. People overestimate the lung cancer risk of smoking by several times. Moreover, there appear to be very few individuals who are in categories that one might regard as being uninformed. For example, only 5 percent of the population and 9 percent of all smokers believe that the lung cancer risk probability is under 0.05.

Elsewhere I have analysed in detail the age differences in these smoking risk beliefs. Respondents in the younger age groups assessed the risks as being greater than do the older respondents. Although the findings are fairly similar for the overall different smoking status populations, let us focus on the sub-group of greatest interest, that of current smokers. Smokers in the age group 16-21 believe that the lung cancer risk probability is 0.45, as

compared to 0.23 for smokers ages 22-45 and 0.33 for smokers aged 46 and over. These findings are of particular pertinence to the extent that there are policy concerns with ensuring that the younger groups are informed of the hazards of smoking. Moreover, the findings are of economic interest since they are reflective of the changing informational environment with respect to cigarette smoking risks.

Although the assessed risks of smoking are considerable, one might nevertheless question the meaningfulness of these responses. For example, one might speculate that although people believe that smoking would cause lung cancer, they may not believe that such lung cancers would be fatal. To test for this hypothesis, I undertook a local telephone survey of 206 respondents in 1991. For the full sample, the lung cancer fatality risk probability was 0.38, and for current smokers it was 0.31. This sample was not nationally representative. Indeed, it was undertaken in a leading tobacco-producing state in the United States, North Carolina, which should lead to underestimation of the risk. Nevertheless, there appeared to be substantial lung cancer mortality risk perceptions.

A potential shortcoming of these results is that they pertain only to lung cancer. Lung cancer was the first risk highlighted by the government, and it is likely that people tend to have a more of an exaggerated sense of the lung cancer risk perception than they would of any other less publicized hazards of smoking. Thus, a more comprehensive perspective on smoking risks would be obtained by focusing on the overall assessed mortality associated with smoking as opposed to the risks of any particular disease.

PERCEPTION OF THE MORTALITY RISK OF SMOKING

To determine if people have a more comprehensive perspective on smoking risks, I developed a risk question that would be the analogue of the lung cancer risk question discussed previously. In my 1991 North Carolina survey I pose the mortality question as follows: "Among 100 cigarette smokers, how many of them do you think will die from lung cancer, heart disease, throat cancer, and all other illnesses because they smoke?" The wording of this question should be sufficient to elicit a more comprehensive perspective on the hazards of smoking without the potential upward biases that could be generated by eliciting mortality risk perceptions for each individual disease specifically. The comprehensive approach also focuses on what is of paramount importance, which is the overall probability of death, rather than whether people understand each particular risk. For example, if

subjects underestimate the risk of death from throat cancer, but overestimate the risk of death from lung cancer, the main policy issue of concern is whether the overall mortality risk assessment is accurate. It is unlikely that any productive role would be served through a hazard warnings effort that enabled people to better distinguish the components contributing to the mortality risk probability assuming that they correctly understood the overall risk associated with smoking.

The mortality risk assessments in the 1991 regional survey paralleled those of the lung cancer risk perceptions, but did not reflect the same extent of risk overestimation. Overall, the full sample had an average mortality risk assessment of 0.54, with current smokers believing the mortality risk was 0.47. The other population segments all believe that the risk of death was at least a 50-50 proposition. Current nonsmokers assessed the risk as 0.56, former smokers assessed the risk at 0.50, and those who had never smoked assessed the risk as being 0.59. Comparison of these estimates with the risk range in Table III indicate that the mortality risk assessments are typically twice as great as the midpoint of the estimated mortality risk to smokers and also considerably higher than the upper bound mortality risk to smokers. Indeed, all these estimates are at least as high as the estimated overall mortality risk to society, which includes outcomes such as fetal death and injuries due to fires.

Table III Actual smoking risk ranges in 1985 and 1991 for cigarette smoking

Survey Years	Lung cancer mortality risk	Total mortality risk to smoker	Total mortality risk to society
1985	.05-.10	.16-.32	.21-.42
1991, 1997	.06-.13	.18-.36	.23-.46

Source: Viscusi (1992), p. 70.

PERCEPTIONS OF LIFE EXPECTANCY LOSS

Even if smokers understand the probability that they may die because of their cigarette smoking, they may nevertheless fail to appreciate the extent of life that will be lost. To examine this possibility, I explored the degree to which individuals would perceive a life expectancy loss as a result of their smoking behaviour.

Table IV reports the results for the life expectancy analysis that I undertook in the 1991 North Carolina survey. The particular question I devised was the following: "The average life expectancy of a 21 year old male (female) is that he (she) will live for another 53 (59) years. What do you think the life expectancy is for the average male (female) smoker?" Thus, the question attempts to normalise the respondents based on a specific reference individual. In addition, it gives them information regarding the remaining life expectancy, so in answering a life expectancy question for smokers, the respondent does not have to simultaneously estimate what the normal life expectancy is and also determine how much of that life expectancy would be lost. Rather, the respondent can focus on the single matter of concern, which is the incremental effect of smoking behaviour. Since smokers tend to be less well educated than nonsmokers and might have a less accurate assessment of normal life expectancy, providing this information will eliminate a source of error that will not be symmetric across the smoking and non-smoking populations.

Table IV Respondent's assessed life-expectancy loss due to smoking, 1991

Sample	Mean (standard error of the mean)		
	Males	Females	Total
Full sample	8.5 (0.9)	13.2 (0.9)	11.5 (0.7)
Current smokers	6.9 (1.2)	10.9 (3.0)	9.0 (1.7)
Current nonsmokers	9.1 (1.2)	13.7 (0.9)	12.3 (0.7)
Former smokers	6.5 (2.4)	13.2 (1.6)	10.8 (1.1)
Never smoked	10.8 (1.1)	13.9 (1.1)	13.0 (0.8)

In terms of a reference point of the life expectancy loss, available scientific evidence indicates that it is in the range of 3.6-7.2 years¹¹. As the estimates in Table IV indicate, both the full sample of males and females overestimate even the upper bound of the assessed life expectancy loss, with an average life expectancy loss estimate overall of 11.5 years. Current smokers assess

¹¹ For a detailed discussion of the underlying scientific evidence regarding life expectancy loss, see p. 80 Viscusi (1992).

an average life expectancy loss of 9.0 years, with the estimated life expectancy loss for male current smokers being 6.9 years and for female smokers 10.9 years. Current nonsmokers have a higher assessed life expectancy loss, with people who have never smoked having the highest life expectancy loss assessed, as one would expect.

CONCLUSION

U.S. public policy towards smoking in many respects resembles particularly unimaginative offensive strategies for sports teams. Irrespective of the success of particular plays, a team may continually run the same offensive strategy whether it works or not. In much the same way, for over three decades the principal public health strategy has been to inform smokers that cigarette smoking is risky. While smoking is enormously risky, this fundamental message is almost universally understood. It is not private information possessed only by anti-smoking zealots and the public health community.

What has been absent from the government strategy in the United States has been an effort to exploit these forces by publicising the differential hazards of alternative cigarettes and promoting innovative cigarette designs. The attitude toward such efforts is reflected in the opposition to tar and nicotine advertising when it was first begun by the industry. Since that time, the Surgeon General has attacked the smokeless cigarette, and innovations such as the de-nicotined cigarette and smoking boxes have been greeted with indifference, ridicule, and spirited opposition. The policy approach that I am advocating here and have advocated elsewhere is that the government instead should adopt a stance of rating the comparative hazard of cigarettes so that smokers can best match the riskiness of their smoking decisions to their own willingness to bear risk. This approach will not only exploit the powerful potential role of the market, but also will reflect the legitimate right consumers have to make informed risky decisions.

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