



# Risk in Perspective

## IS THERE A "CANCER PREMIUM?"



JAMES K. HAMMITT, PH.D.



JIN-TAN LIU, PH.D.

*"...we estimate that respondents are willing to pay about one-third more to reduce a risk of environmentally-related cancer than for a comparable reduction in the risk of a similar chronic, degenerative disease. We also find that people are willing to pay more to reduce an immediate risk than a latent one."*

Many environmental regulations are intended to reduce the risk of cancer and other diseases, but most of the empirical literature on valuation of health risk relies on estimates of the wage differentials that workers receive for bearing risks of traumatic injury in the workplace (Viscusi, 1992). The applicability of these wage-differential estimates to environmental health risks, is uncertain.

Environmentally-induced diseases differ from fatal occupational injuries in several ways that may affect people's preferences between them. One difference is that the environmentally-caused disease is often cancer, and cancer may evoke dread and other qualitative factors that lead to greater fear than fatal workplace injuries (Revesz, 1999; Sunstein, 1997). Another difference is that environmentally-caused diseases often have an extended latency period between the time a person is exposed to the pollutant and the onset of symptoms. Since decisions about preventive measures must be undertaken before exposure occurs, comparing the benefits and costs of reducing exposure requires an estimate of people's willingness to pay now to reduce the risk of fatality in a future period.

We recently conducted a contingent-valuation study to investigate how people's willingness to pay (WTP) to reduce mortality risk depends on

whether the risk is associated with cancer or some other disease, and how WTP depends on whether the risk is immediate or latent. (For the full study, see Hammitt and Liu, 2004). Our survey of approximately 1,200 randomly selected respondents in Taiwan suggests that there is a cancer premium. Although the effect is not quite statistically significant in our preferred model, we estimate that respondents are willing to pay about one-third more to reduce a risk of environmentally-related cancer than for a comparable reduction in the risk of a similar chronic, degenerative disease.

We also find that people are willing to pay more to reduce an immediate risk than a latent one. We estimate that WTP to reduce the risk of a fatal disease with a 20 year latency period is about one-quarter smaller than WTP to reduce an immediate risk of the same disease, which implies that WTP falls at a rate of about 1.5 percent per year of latency. The value that respondents place on risk reduction also appears to depend on the affected organ, environmental pathway of the exposure, or payment mechanism: estimated willingness to pay higher prices for consumer goods to reduce the risk of lung disease from air pollution is about twice as large as estimated willingness to pay higher water utility rates to reduce the risk of liver disease from contaminated drinking water.

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## The “Cancer Premium”

Consistent with risk perception research that finds elevated fear of particularly dreaded risks, the value of preventing a fatal cancer is often considered to be greater than the value of preventing fatal trauma in a workplace or transportation accident (Revesz, 1999; Sunstein, 1997). Cancer is also frequently viewed as more threatening than other degenerative conditions, such as heart disease (Jones-Lee et al., 1985). However, it is not obvious that peoples’ WTP to reduce cancer risk exceeds their WTP to reduce accident risk, since some might perceive that dying of cancer is not as bad as dying in a fatal accident, because cancer includes a period of illness during which one may prepare for death by reconciling with family or putting financial affairs in order.

Despite the plausibility that there may be a cancer premium, empirical support is limited. We are aware of no prior studies that compare individual WTP to reduce one’s own risk of cancer and other fatal risks, although several studies are suggestive.

Jones-Lee et al. (1985) asked respondents to choose between public programs that would reduce the number of people dying in the next year by 100 from one of three causes (motor vehicle crashes, heart disease, and cancer), and to indicate how much they would voluntarily contribute to reducing the number of deaths from the cause they chose. A majority of respondents (76 percent)

chose to reduce cancer deaths and the mean voluntary contribution was larger for cancer than for the other causes. If the mean contributions are interpreted as estimates of WTP to reduce own risk, the implied value per statistical life (VSL) is about \$40 million for cancer, \$20 million for heart disease, and \$10 million for motor vehicle accidents. (These values are substantially larger than conventional estimates of VSL which are around \$5 – 9 million for the United States; Viscusi and Aldy, 2003)

McDaniels et al. (1992) estimated WTP for programs to reduce a wide range of health risks using a small contingent-valuation study with only 55 respondents. The programs were described as public goods that would reduce risks to the relevant populations, not only to the respondent. The authors also elicited risk perception variables, such as dread. They found that dread had a positive association with WTP.

Savage (1993) asked survey respondents to allocate a hypothetical \$100 contribution to research intended to reduce risks of stomach cancer, household fires, commercial airplane accidents, and automobile accidents. He found that respondents would allocate the largest amount to stomach cancer (\$47) with much smaller amounts (\$15 – \$21) to the other risks. Although this study suggests greater WTP to reduce cancer risks, it does not measure individual WTP to reduce one’s own risk.

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## Effects of Latency on WTP

Standard economic theory suggests that the appropriate procedure to account for latency between exposure and risk of fatality is to value the risk using the value of statistical life that represents the individual’s WTP to reduce fatality risk at the time he may die, and to adjust for the fact that money can be invested at the time of exposure to yield a larger amount at the time the risk may prove fatal.

An individual’s future WTP to reduce future risk (i.e., his future VSL) is not necessarily equal to his current WTP to reduce current risk (his current VSL). His future VSL may differ from his current VSL because of two factors: he will be older, and the date will be later. Age affects VSL because the individual’s life expectancy, health, earnings, savings, opportunities for spending on other goods, and other factors vary with stage of the life cycle. Time or date affect VSL through secular changes

in productivity, the ongoing development of medical and other technologies that affect longevity, and other factors. A number of theoretical and empirical studies have examined the effects of age on VSL, with equivocal results, and the effect of date has received little attention.

Intuitively, one might expect that WTP to reduce a latent risk must be smaller than WTP to reduce a current risk by the same amount, since reducing a current risk increases the chance of surviving both current and future periods, while reducing a future risk increases only the chance of surviving the future periods. This intuition is misleading. Preferences for reducing either current or latent risks depend on the utility associated with different periods of life. WTP to reduce future mortality risk can be less than, equal to, or greater than WTP to reduce current risk by the same amount.

Consider a person suffering a painful disease from which he will recover, with certainty, in 10 years. Suppose the disease is so painful that if he knew he would die before recovering from it, he would prefer to die sooner rather than later. In this case, the only benefit to the individual of reducing the chance that he will die this year is that it increases his chance of surviving at least 10 years. If an intervention to reduce his risk of

dying in the ninth year from now has a larger effect on his probability of surviving at least 10 more years, then he will prefer that intervention to an intervention that reduces his chance of dying this year. In this case, he would be willing to pay more now to reduce his mortality risk nine years in the future than to reduce his current mortality risk.

## Contingent-Valuation Survey

To estimate the effects of disease type and latency on WTP to reduce the risk of dying in a single year, we conducted a contingent-valuation survey. Respondents were questioned about their WTP to protect themselves and other household members from each of four environmental health risks; liver cancer, liver disease, lung cancer, and bronchitis. The risks varied among respondents and differed with respect to whether the disease was latent or acute, cancer or non-cancer. To enhance the credibility of the scenarios, the risks associated with liver disease were described as being produced by a contaminant in tap water, and the risks associated with lung disease were attributed to industrial air pollution. The payment mechanism differs accordingly. In the liver case, respondents were asked about their willingness to pay higher water bills to cover the cost of additional treatment at the water utility. In the lung case, respondents were asked about their willingness to pay higher prices for consumer goods in order to reduce air pollution. Because the affected organ, environmental pathway, and payment mechanism are confounded in our design, we cannot distinguish their individual effects on WTP. In addition, because the proposed interventions reduced risks to other community members in addition to those in the respondent’s household, estimated WTP may include some component of altruism.

The risk reduction is described as an intervention to reduce current exposure to environmental contaminants. Respondents asked about acute disease were told that if someone in their household develops the stated disease, symptoms will begin within a few months and they will live only about two to three years longer. In the latent case, they were told the person won’t know if he or she was sufficiently exposed to develop the disease until symptoms begin about 20 years in the future.

Our results indicate that WTP to reduce the risk of cancer is one-third larger than WTP to reduce the risk of

<b>Results</b>			
Estimated Value per Statistical Life (million US\$)			
<b>Disease type</b>	<b>Latency</b>	<b>Organ/pathway</b>	<b>VSL</b>
Cancer	Latent	Lung	1.6
Cancer	Acute	Lung	2.1
Non-cancer	Latent	Lung	1.1
Non-cancer	Acute	Lung	1.5
Cancer	Latent	Liver	0.7
Cancer	Acute	Liver	1.0
Non-cancer	Latent	Liver	0.5
Non-cancer	Acute	Liver	0.7

an alternative disease. WTP to reduce the latent risk is estimated to be about one-fourth smaller than WTP to reduce the acute (more immediate) risk, which implies respondents discount for latency at an average annual rate of about 1.5 percent. WTP to reduce the risk of liver disease from water pollution is estimated to be only half as large as WTP to reduce the risk of lung disease from air pollution.

WTP is significantly associated with some of the respondents’ socio-economic characteristics. Estimated WTP declines as the age of the respondent rises at a rate of about 2.3 percent per year. WTP increases with household income, and college-educated respondents are estimated to value risk reduction about 40 percent more than respondents with less education. In contrast, WTP is not significantly associated with the number of household members, nor is there any significant association between WTP and either gender or marital status.

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Harvard School of Public Health  
718 Huntington Avenue  
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The table reports estimates of VSL as a function of disease type, latency, and organ/environmental pathway/payment mechanism. These are calculated using the corresponding estimates of WTP from regression models to predict median WTP for the average respondent. The values are

smaller than typical estimates for the United States, presumably because of the smaller incomes in Taiwan, but are comparable to other estimates we have obtained for Taiwan (e.g., Liu et al., 1997; Liu and Hammitt, 1999; Fu et al., 1999).

## Conclusion

Environmental regulations are frequently intended to reduce risks of cancer and other fatal diseases. To date, there is little evidence regarding the extent to which individual WTP to reduce fatal risks differs by characteristics of the risk, including the type of disease or trauma and the latency period between exposure to the hazard and fatality.

In a contingent-valuation study in Taiwan, we find that WTP to reduce risks of fatal cancer due to environmental pollution is larger than WTP to reduce risks of another degenerative, fatal disease, and that WTP declines with latency between exposure and manifestation of disease.

For evaluating environmental regulations, our results suggest that benefits of mortality-risk reduction should be reduced at a small annual rate to account for the latency period between exposure and manifestation of disease. They further suggest the existence of substantial differences in VSL associated with specific diseases. In particular, people may consider reductions in the risk of fatal cancer more valuable than comparable reductions in risks of other fatal disease. Values of risk reduction may also be sensitive to the affected organ and environmental pathway. These results require confirmation and further refinement for use in policy analysis.

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