How to value a life

W. Kip Viscusi

Abstract The tradeoff between money and small risks of death is the value of statistical life (VSL), which has become the standard for assessing the benefits of risk and environmental regulations. Labor market estimates of the VSL average about $7 million. This valuation amount rises with age and then declines, closely tracking the pattern of consumption over the life cycle. The VSL for those at age 60 is higher than for people in their 20s. Application of this methodology to assess the mortality costs to smokers indicates a personal mortality cost on the order of $200 per pack for men and $100 for women using a 3% discount rate, but based on smokers' rates of time preference the costs are reduced by about an order of magnitude.

1 Framing our thinking about the value of life

When non-economists hear that economists are placing a value on risks to human life, they typically assume that such economic measures involve some sort of morally offensive accounting exercise, such as equating the value of an individual life with the present value of his or her future earnings. Such measures do, of course, have prominence in personal injury litigation, as they serve as a principal reference point for the financial loss that a family has incurred after a wrongful death to a family member. However, the economic approach to valuing life, or more specifically, valuing risks to life, is quite different and more legitimate than an accounting procedure based on one's income.

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To see how economists conceptualize value of life issues, it is useful to start with a thought experiment. In particular, how much would you be willing to pay to eliminate a one-time only risk of death of 1/10,000? To conceptualize this risk, it is helpful to imagine that you are attending a sporting event in a crowd of 10,000, where one of you will not survive. Suppose you have to pick from one of the following dollar categories as the most that you would be willing to pay to get out of this risk: infinite amount, above $1,000, $500–$1,000, $200–$499, $50–$199, and under $50. For concreteness, I will interpret an infinite amount as equal to your present and future resources, leaving enough left to subsist. Which amount would you select?

As with most people whom I have tested with this question, no attendees at the 2008 annual meeting of the Academy of Economics and Finance indicated that they were willing to pay an infinite amount to escape the risk. Their responses indicate that the idea of placing a finite value of risks to life is in fact quite reasonable even though many people's initial instincts might have been that life is "priceless." Most responses are in the $200–$1,000 range, which is quite reasonable. Responses under $50 generally indicate that the person did not take the risk of death seriously or else is well suited for an extremely dangerous job.

Suppose that each person is willing to pay $500 to eliminate the risk of one death to the group of 10,000 exposed to the risk. Then this pattern of responses means that to avert the one expected death it would be possible to raise $500 per person $\times$ 10,000 people, or $5 million. The value of a statistical life, or VSL, is consequently $5 million. Alternatively, one can calculate the VSL by dividing the willingness to pay amount by the probability reduction, or $500/(1/10,000)=$5 million. What the VSL is capturing is people's rate of tradeoff between money and very small risks of death. It is not the amount that a person would be willing to pay to avoid certain death, nor is it the amount that a person would require to be compensated for facing certain death. Matters involving the certainty of life and death will have a quite different value than the value of reducing these very small risks.

While one could construct VSL levels based on stated preferences for risk reduction, most of the economics literature has focused on tradeoff rates implied by actual decisions. The dominant approach in the literature has been to use the implications of wage-risk tradeoffs to calculate an implicit value of life. As indicated by Adam Smith's theory of compensating differentials, controlling for other aspects of the job, workers should receive extra pay to face extra risk. Estimates from the U.S. labor market indicate that a worker currently would require an annual wage premium of $700 to face a fatality risk of 1/10,000, which implies an average VSL of $7 million. As one would expect, this number varies across different studies and different samples. Workers with a lower VSL, for example, should gravitate toward the very high risk jobs. More affluent workers will demand a greater wage premium to face any given risk. While such differences exist, whether they should be recognized when assessing risk reduction benefits in policy contexts remains controversial.

2 Policy practice

The VSL literature has taken on substantial policy importance as it now provides the basis that is used throughout the federal government for valuing the benefits of risk

and environmental regulations. In early government studies, the human capital measure given by the average present value of the lost earnings of those affected by a policy served as the measure of the economic benefits of reductions in fatality risks. This measure is easy to calculate, is used in court cases to compensate for wrongful death, and looks very much like what one would envision as an economic benefit.

However, if we go back to first principles, the economic value of the benefit of any policy outcome is society's willingness to pay for the benefit. The benefit in this instance is the reduced probability of death. The policy benefit is not the value of the identified lives who will be saved after the fact, because the identities of those who will be saved are not known. Moreover, given the stochastic nature of risk, it may be that nobody in fact would have died even though *ex ante* there may have been a substantial risk of death. As a consequence, to value changes in risk levels rather than identifiable risk outcomes it is the risk-money tradeoff or VSL that is the appropriate measure.

Although the VSL literature began to be established in economics in the late 1970s and early 1980s, policymakers long viewed the idea of placing a value on human life as being immoral so instead they used the human capital measure based on earnings losses. This practice continued until the debate in the Reagan administration over the proposed Occupational Safety and Health Administration (OSHA) hazard communication regulation.[1] OSHA proposed an expensive regulation that for the first time would require hazard warning labels for dangerous chemicals in the workplace. As part of obtaining approval for any major regulatory proposal, the U.S. Office of Management and Budget (OMB) required that agencies calculate the benefits and costs of the regulation and show that the benefits exceeded the costs under Executive Order 12291, which has since been superseded by Executive Order 12866 that was initiated under the Clinton Administration. OSHA claimed that life was too sacred to value and instead calculated what it termed the "cost of death," which was the human capital measure for lost earnings and medical expenses. The result of this benefit assessment based on this low cost of death value of life is that costs exceeded benefits in OMB's view, and the proposed regulation was rejected.

OSHA appealed the decision to then Vice-President Bush, who concluded that it was a technical issue rather than a political issue. I was called in to settle the dispute between the two agencies. To assess the risk reduction benefit, I used my VSL estimates, which were $3 million at that time. Doing so increased the benefits by a factor of 10, as compared to what the benefits were under the cost of death approach. With this change, benefits now exceeded costs, and the regulation was issued. Other agencies soon adopted this approach as well. The VSL methodology not only was the correct economics approach, but also boosted the assessed benefits of agencies' regulatory proposals, which undoubtedly contributed to its rapid acceptance.

Although many agencies selected VSL levels consistent with the economics literature, the major outlier was the U.S. Department of Transportation (DOT). Because of the long history of valuing life in auto accident cases by the human capital method, DOT was at the vanguard of agencies that placed a value on human life. However, this effort predated the economics literature on VSL, so that the only available economics reference point for the early DOT efforts was the human capital

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[1] For further discussion of this policy debate, see Viscusi (1992) and Pete Earley, "What's a Life Worth? How the Reagan Administration Decides for You," *The Washington Post Magazine*, June 9, 1985.

value. After the VSL literature developed, DOT was slow to update its valuation approach, remaining anchored in the low human capital values. As a consequence, the DOT used values of $1 million or less through the early 1990s. Use of a uniformly low VSL for regulatory policy assessments led to less stringent safety regulation than those that would pass a benefit–cost test based on more plausible VSL levels.

In a survey of the VSL literature that I prepared for the Federal Aviation Administration (FAA), I concluded that the average VSL in the literature at that time was in the vicinity of $5 million.[2] In addition, there was a positive income elasticity of VSL, as people with higher incomes valued such fatality risks more highly. Thus, there were two policy recommendations for FAA. First, DOT should use a VSL of $5 million rather than $1 million. The practical consequence of raising the VSL amount is that doing so would lead to much more stringent safety regulations. Second, because airline passengers are more affluent than the typical worker whose VSL is being estimated in labor market studies of wage–risk tradeoffs, the FAA should be permitted to use a higher value of life for valuing airline safety regulations than, for example, the level that is used to value improved guardrails on highways. Because the costs of airline safety regulations are borne by passengers through higher ticket prices, the safety equity issues are not as pronounced as they would be if government funds were being allocated to promote safety. The result of this effort is that in 1993 DOT raised its VSL level to $2.5 million as a uniform level throughout the agency. The auto industry strongly favored keeping the VSL at a low level because a higher VSL would lead to more expensive regulations and possibly benefit foreign imports. The $2.5 million VSL level can be viewed as a political compromise between my recommended VSL amount and the retention of the $1 million amount favored by the auto industry.

In 2008 DOT finally revamped its official VSL policy to bring it in line with the literature.[3] The agency raised the VSL to $5.8 million based on a review of several meta analyses of the VSL literature. In addition, it recognized that there is a positive income elasticity of the VSL, and the agency adopted the mean income elasticity of 0.55 from Viscusi and Aldy (2003) as the department's official income elasticity value. Whether the FAA will be able to avail itself of this income elasticity result and use a higher value of life for valuing airline safety than other DOT policies is unclear, but the department directive did indicate that VSL levels of $3.2 million–$8.4 million could be used.

3 Does VSL decline with age?

The experience over the past quarter century is that economic analysis has come to play a central role in the policy process. Agencies are still required to subject all

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[2] The results of the survey were subsequently published as Viscusi (1992, 1993).

[3] See Memorandum to Secretarial Officers, Modal Administrators, from Tyler Duval, Assistant Secretary for Transportation Policy, and D.J. Gribbin, General Counsel, "Treatment of the Economic Value of a Statistical Life in Departmental Analyses," February 8, 2008 and the companion document, "Revised Departmental Guidance: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses," U.S. Dept. of Transportation.

proposed major regulations to a formal examination of their economic benefits and costs. And the valuation of these risk reduction benefits is done with the aid of economic assessments of the VSL. The current frontier pertains to the refinement of the VSL levels to recognize the risk-taking preferences of different population groups. While the FAA's concern with the income levels of more affluent airline passengers is one example of heterogeneity, the most prominent political battleground has been with respect to differences in the VSL for different age groups.

Perhaps the most controversial issue pertaining to permitting differences in the VSL amounts to enter policy assessments is whether older people's lives are worth less. As you age, your remaining future life expectancy shortens. Individual health also tends to decline with age. In terms of the commodity being purchased with risk reduction policies, there is less quantity and less quality of life the older you get. Based on a methodology that is widely used in health care decision making, the value of one's Quality Adjusted Life Years (QALYs) is less so that saving the lives of older people has lower value. The QALY approach of shrinking the economic value of lives with age and declining health provides a potentially misguided technique to valuing risks to life and health. There is no theoretical basis for assuming that the VSL necessarily declines with age or that adjustments for changes in morbidity can be addressed with crude approximations such as estimating that you have 80% of your full health remaining, as is done within the QALY framework.

To get our thinking straight, it is useful to return to first principles. The correct economic approach to benefit assessment for any policy is society's willingness to pay for the benefit. Casual observation suggests that willingness to pay for risk reduction does not decline steadily with age. Older people are less likely to smoke, are more likely to use seatbelts, tend to buy safer cars, and live in safer neighborhoods. This greater willingness to expend funds and effort to reduce risk is a consequence of factors correlated with age and has the opposite effect on VSL of their reduced life expectancy. Most important is that individual income, wealth, and consumption all exhibit a life-cycle pattern that is not steadily declining with age but rather rises for much of one's life before eventually declining.

Given these theoretical ambiguities and the political sensitivity of age adjustments, it is striking that the U.S. Environmental Protection Agency (EPA) ventured forth as the first government agency to place a lower VSL on older individuals' lives. In its analysis of the Clear Skies initiative, EPA calculated the estimated lives saved for those over age 65 separate from the mortality risk to younger age groups. In a sensitivity analysis, the agency presented a benefit assessment for the post-65 group, valuing these lives at 37% less than the value for younger age groups. The introduction of distinctions by age set off a political firestorm. The AARP and other senior activist groups launched public protests with senior citizens featuring hats and signs: "Seniors on Sale. 37% Off."[4] The term "senior discount" took on new meaning in these critiques of EPA's policy valuations. Shortly after this public relations disaster, the Administrator of EPA resigned.

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[4] See "EPA Drops Age-Based Cost Studies," New York Times, May 8, 2003; "EPA to Stop 'Death Discount' to Value New Regulations," Wall Street Journal, May 8, 2003; and "Under Fire, EPA Drops the 'Senior Death Discount,'" Washington Post, May 13, 2003.

Before examining the proper economic assessment of age-related differences in VSL, it is worthwhile to put EPA's initiative in context. More than any other Federal agency, the EPA has attempted to use VSL levels that were consistent with current policy research. For the Clear Skies initiative, EPA used a baseline VSL of $6.1 million. For years, EPA came under fire from its Science Advisory Board because it never distinguished the age distribution of the population benefiting from its air pollution regulations. This omission was consequential because these air pollution regulations tend to benefit people at the tails of the population distribution disproportionately. If a policy reduces the mortality risks to people with advanced respiratory ailments who would otherwise have less than 6 months to live, the benefit value may be quite different than for policies that affect people with a higher VSL. Consequently, even though the 37% senior discount approach may not have been correct, EPA should be commended for being the first Federal agency to grapple with these difficult issues.

One potential starting point for ascertaining the appropriate difference in the VSL by age is to inquire what is the "fair" approach to setting these values. Economists tend to have little to contribute to fairness discussions except to calculate who wins and who loses and to put these amounts in perspective. Nevertheless even a cursory analysis of fairness and VSL suggests that this line of thought does not settle the heterogeneity issue. A main complaint against EPA's senior discount is that using a lower VSL for the elderly is unfair to those with short remaining lifetimes. The underlying assumption is that a uniform VSL is equitable. Advocates of approaches that incorporate some age variation might frame the fairness argument quite differently. An alternative fairness concept is to place the same value on each statistical life year, appropriately discounted. Consequently, reducing risks to people with twice as many discounted remaining life years should receive a higher value than reducing risks to the shorter life expectancy group. What is viewed as equitable and what is not hinges quite critically on how one frames the fairness issue. The equitable benefit value also is indeterminate.

Analyzing actual age-related differences in the VSL provides a sounder basis for resolving the heterogeneity debate. For more than two decades, economists have analyzed age variations in the VSL implied by labor market decisions. Recent studies are more instructive as new fatality risk data from the U. S. Bureau of Labor Statistics Census for Fatal Occupational Injuries (CFOI) make it possible to construct fatality rates by industry, occupation, and age, whereas previously the measures could be constructed by industry alone using government data bases or by occupation using insurance data. The incidence of occupational fatalities by age is also of interest as job-related fatalities are not concentrated only among young workers in very dangerous jobs. Older workers are less likely to get injured, but if injured, they are more likely to die so that the fatality rates of workers in their 40s, 50s, and early 60s is quite high. Many of these deaths stem from motor-vehicle accidents.

Recent estimates of the VSL–age relationship show an inverted-U shaped pattern. The VSL rises with age, reaches a peak, and eventually tapers off. This pattern is consistent with theoretical models such as that in Shepard and Zeckhauser (1984) in which there is an absence of perfect annuities markets and perfect capital markets for shifting resources across time. If there were perfect annuities and capital markets, one could draw on future resources at birth, leading to a steadily declining VSL with

VSL (millions 2000$)
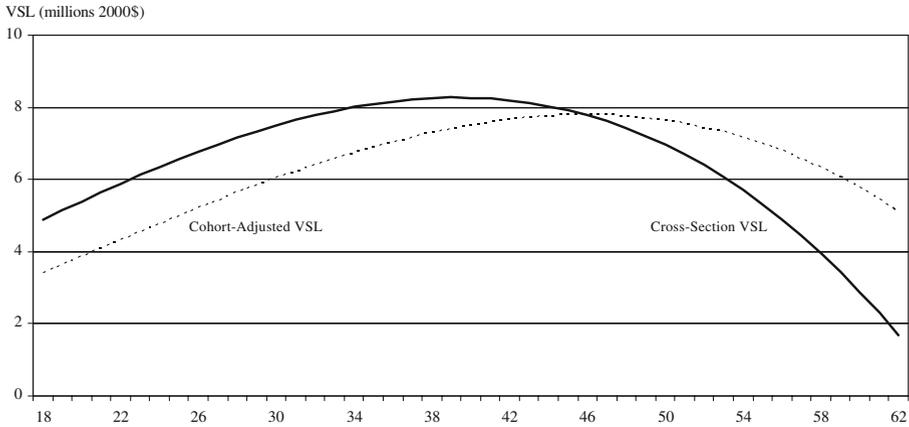
**Fig. 1** Cohort-adjusted and cross-section value of statistical life, 1993–2000. Source: Aldy and Viscusi (2008)

age if utility functions are time invariant. Such markets do not exist, in part because of moral hazard problems involved in lending a person at birth the expected present value of their lifetime earnings.

Figure 1 shows an example of recent estimates of the VSL–age relationship for workers drawn from Aldy and Viscusi (2008).[5] The bold line shows the VSL estimates based on a series of cross sections using the Current Population Survey data from 1993–2000. To adjust for the fact that workers at different times are drawn from different cohorts, the dashed line accounts for the cohort effects. This adjustment flattens out the VSL with age. As a result, despite their shorter life expectancy, workers at age 60 have a larger VSL than do workers at age 20.

The estimated pattern of VSL with age in Fig. 1 is very reminiscent of the age-related pattern of consumption as shown in Kniesner et al. (2006). Figure 2 shows analogous sets of results based on a single cross section, but which also takes into account the influence of the life-cycle pattern of consumption. Figure 2a shows the life cycle pattern of fitted consumption levels, while Fig. 2b shows the imputed VSL based on an econometric model in which the effect of consumption levels on wages is recognized. Both nonparametric equations were estimated using a similar set of explanatory variables, and consumption enters the model using an instrumental variables approach to account for the endogeneity of wages and consumption. What is especially striking about these results is their close age-related pattern. Both total consumption and VSL rise moderately through one's early 50s then taper off a bit and then remain at the level that prevails for workers in their mid-40s. Both total consumption and VSL for those up to age 64 exceed the counterpart values for workers in age groups in the mid-40s and younger.

The general result is that VSL and individual consumption follow almost identical age-related trajectories. Older people have perhaps surprisingly high VSLs because they have higher consumption levels and spend more on safety as well, leading to a

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[5] Both series are based on equally weighted minimum distance estimator with a third-order polynomial in age. The cohort-adjusted VSL also includes indicator variables for year of birth.

a   With Industry Controls

b

   IV With Industry Controls
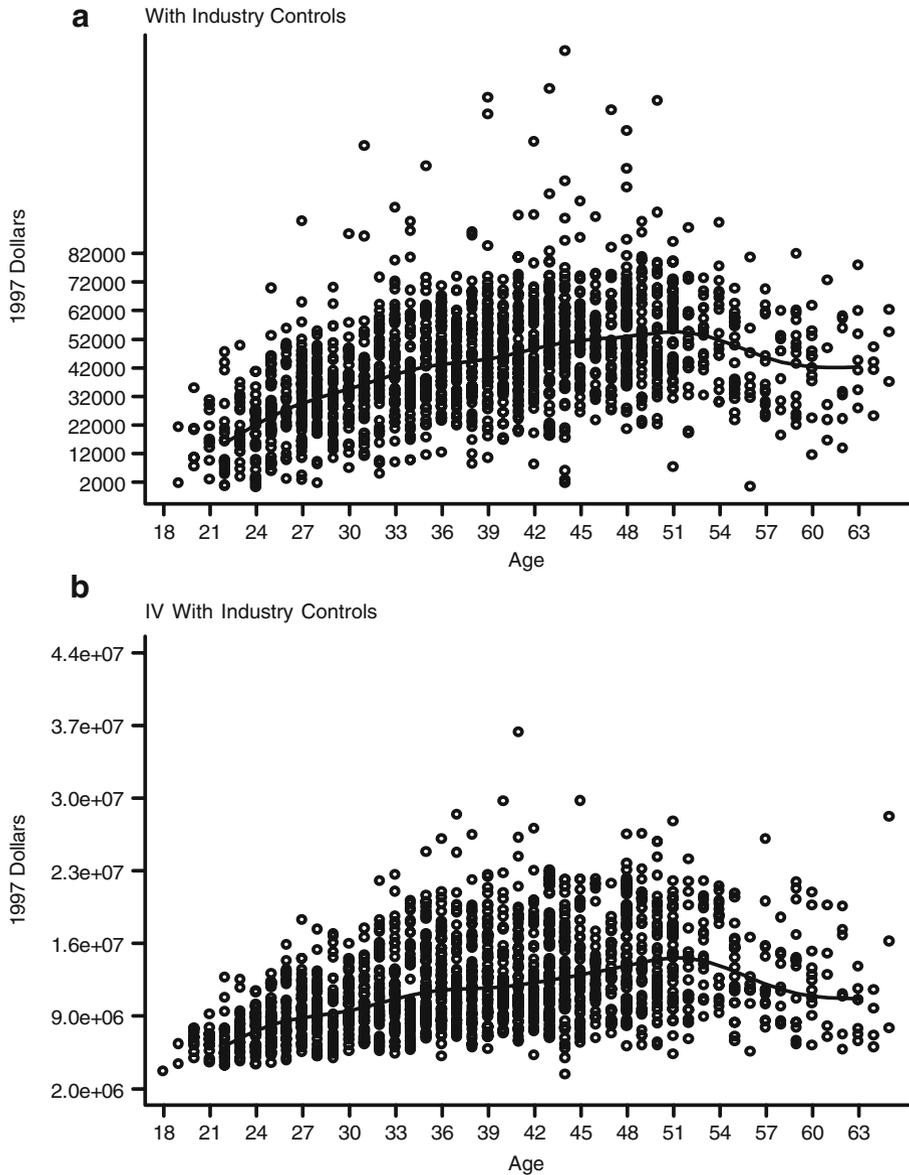
Fig. 2 **a** Age profile of fitted total consumption. **b** Age profile of implied value of life, total consumption. Source: Kniesner et al. (2006)

higher revealed willingness to pay. As with the cohort-adjusted results, VSL rises with age, reaches a peak, and then remains relatively flat.

Although not all age-related VSL issues have been resolved, particularly for age groups that are largely outside the labor force, many of the fundamental issues have been clarified. The expected remaining duration of life is not the sole factor driving the age-related pattern of VSL. Thus, VSL does not peak and birth, then plummet as

we age. Instead, VSL follows a life-cycle pattern quite similar to the inverted-U shape of life-cycle consumption. Because the early age increase in VSL is steeper than the decline in later years, workers at age 60 have a higher VSL than workers at age 20. The practical implication of these results is that taking into account age variations in VSL may not have as substantial an impact on benefit assessments as one might think, provided that the analysis is done correctly.

A principal economic ramification of these results pertains to the valuation of individual years of life. One can conceptualize the VSL as the present discounted value of a series of values of statistical life years. Based on the age-related pattern of VSL, the value of a statistical life year (VSLY) at different ages is not a constant. Rather, for older members of the population, this value may be much larger than for younger age groups. While VSLY analyses are often useful as an empirical approximation, if the requisite data are available, estimating the age variation in VSL is a more accurate approach to valuing risk reduction benefits.

4 The mortality costs to smokers

An interesting application of the VSL methodology is to use it to assess the mortality cost incurred by smokers. This matter is quite distinct from the financial externalities that smokers impose on society generally. By way of comparison, in Viscusi (2002) I found that on balance smokers save society $0.32 per pack based on calculations that used a discount rate of 3%. For some cost components, smokers do generate positive financial externalities. In terms of per pack costs, they have higher medical costs of $0.58, foregone taxes on earnings that are not paid due to their premature mortality of $0.43, higher life insurance costs of $0.14, and higher costs of fires and sick leave on the order of $0.01 to $0.02 each. Offsetting these costs are the reduced retirement and pension costs of $1.26 and lower costs of nursing home care of $0.24. As we will see below, these cost components will be dwarfed by the value of the mortality costs incurred by smokers themselves.

In joint research with Joni Hersch, we examined the mortality cost to smokers themselves by incorporating smoker-specific estimates of VSL. Previous studies of the mortality costs were based on rough estimates, including the assumption that each year of life is worth $100,000 based on the average VSL estimate reported in Viscusi (1993) coupled with an estimate of the number of years of life at risk for the typical worker. These studies also assumed that the lost period of life due to premature smoking-related mortality occurs at the end of one's life. This approach produced loss estimates of $22 per pack by Cutler (2002), $30 per pack by Gruber and Köszegi (2001), and $20 per pack by Sloan et al. (2004).

In contrast, in Viscusi and Hersch (2008) we departed from these studies in four principal ways. We estimated the VSL by smoking status, age, and gender rather than using a $100,000 per year of life lost figure. Second, we estimated the increased probability of death due to smoking at each year over a smoker's lifetime. Third, to convert the estimates into a cost per pack, we estimated the age-specific number of packs smoked. Finally, we did all calculations on a gender-specific basis, which accounts for gender-related differences in mortality rate patterns, differences in smoking behavior, and differences in VSL.

The demographic reference point for the analysis is that of a committed smoker at age 24 who will continue to smoke until they die. More specifically, for these committed smokers we focused on the risks to what economists have termed the "nonsmoking smoker." Smokers differ from nonsmokers in many ways other than smoking that affect their overall mortality risk, such as differences in education, income, health care, and other risk-taking activities. Ideally, the analysis should isolate the incremental effect of smoking rather than capture the influence of factors correlated with smoking status. While this approach may appear compelling to economists, most smoking cost studies undertaken by public health groups fail to account for such confounding influences. In addition, the norm in such public health studies is to use a zero rate of discount and to calculate the gross costs of smoking rather than the net incremental costs. There continues to be a substantial divide between the correct economic approach, which is widely accepted throughout the pertinent economic literature, and the smoking cost estimates by anti-smoking advocacy groups.

The key component of any VSL estimate is the fatality risk measure. For this study, we constructed the fatality risk by two-digit industry and by gender for five different age groups.[6] Refinements of this type were made possible by using the unpublished CFOI data, which provides information on each individual workplace fatality. These risk measures were then matched to workers in the Current Population Survey based on their reported industry, age, and gender. The average risk for workers in the sample is 1/25,000, which is reflective of the average risk in the U.S. workforce. In contrast, in my initial studies of VSL three decades ago, the average U.S. fatality risk was 1/10,000. This reduced job riskiness over time reflects the role of increased affluence in the U.S. boosting the demand for safety. The incentives provided by the increased costs of workers' compensation and, to a lesser extent, OSHA, have also contributed to the reduction in fatality risk levels.

The VSL estimates by smoking status are very much in line with average VSL estimates generally. Smokers and nonsmokers have similar VSL levels, on the order of $7 million for each group. Smokers have a VSL of $8 million or higher for males and $6 million for females, where this difference stems from the lower wage levels for women. While the VSL point estimates differ by age, there are no statistically significant declines in the VSL for smokers through age 64. This flat pattern of VSLs implies that the premature deaths of smokers are going to impose a quite high cost. While male smokers lose 4.4 years of life expectancy on average and female smokers lose 2.4 years, if the premature death occurs at an early age, as it does for many smokers, the losses valued using the VSL will be quite substantial.

Table 1 summarizes the key finding of the study. Valued at a 3% discount rate, smoking imposes a cost per pack of $214 for men and $91 for women. These figures dwarf previous estimates of the costs, where the differences stem in almost equal parts from the higher value attached to the mortality losses of smokers and the incidence of smoking-related mortality before the end of one's normal life expectancy.

Taken at face value the existence of such costs does not imply that there is a market failure, only that the costs of smoking appear to be quite high. Smokers' beliefs concerning their life expectancy loss due to smoking actually are greater than

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[6] The risks were weighted by hours of employment in different industries by age and gender.

Table 1 Smoking mortality costs per pack at different interest rates

| | Cost per pack | | |
| | Interest rate | | |
	3%	14%	16%
Men	$214	$24	$18
Women	$91	$6	$4

Source: Viscusi and Hersch (2008)

the estimated actual smoking-attributable loss. National survey evidence reported in Viscusi (2002) and Viscusi and Hakes (2008) indicates that male smokers estimate they will suffer a loss in life expectancy due to smoking of 7.9 years, while female smokers estimate their lost life expectancy to be 12.3 years. These perceived health costs of smoking outweigh the actual estimated life expectancy losses of 4.4 years and 2.4 years. Smokers also engage in a consistent pattern of risk-taking behavior, such as being more likely to be injured at home or on the job, and less likely to undertake protective personal health actions such as using automobile safety belts.[7]

If the mortality costs of smoking are as high as the estimates suggest and smokers are aware of these risks, what could account for such behavior? These quite high mortality cost estimates are highly dependent on the rate of discount used for the calculations. If smokers make decisions using a rate of discount higher than 3%, then the costs are diminished. In a separate paper, Scharff and Viscusi (2008) estimate the rate of time preference by smoking status as revealed in the wage-fatality risk tradeoffs in the labor market. Based on these labor market decisions, the overall estimated rate of time preference that smokers have for years of life is 14%. At that rate, male smokers face a per pack cost of $24 and female smokers face a per pack cost of $6. The greatest concentration of smokers is among the blue-collar population. These workers have an estimated rate of time preference for years of life of 16%, which produces a cost per pack of $18 for men and $4 for women. Together these studies provide evidence pertaining to smokers' rate of time preference and how these different rates can account for smoking decisions and their attendant mortality costs.

The cost estimates are consistently higher for men than for women for three reasons. First, men have a higher VSL than women. When estimates are based on a log wage equation, the VSL is a linear function of the wage rate. Because men have higher wages than women, their estimated VSL will be higher as well for identical constant coefficients. Second, men face higher risks from smoking than do women who smoke. Their loss in life expectancy from smoking is almost twice as great as it is for women. Third, the temporal distribution of losses is different than for women, as men experience an earlier incidence of premature mortality from smoking than do women.

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[7] See Viscusi and Hersch (2001) and Hakes and Viscusi (2007).

How one should interpret the mortality cost estimates for cigarettes based on VSL estimates is instructive in terms of the general applicability of these values for policy purposes. The VSL provided evidence on local rate of tradeoffs for very small risks. Whether one is concerned with willingness to pay amounts or willingness to accept amounts, if the risk change involved is small, the VSL indicates the tradeoff rate. Thus, a person with a $7 million VSL would be willing to pay $700 to eliminate a risk of 1/10,000 and would require compensation of $700 to face an added risk of 1/10,000. Cigarettes pose a fairly substantial lifetime premature mortality risk on the order of 1/6th to 1/3rd. As a consequence, because the risk levels are not marginal changes in the risk level, the mortality cost per pack estimates will overstate how much smokers would be willing to pay for an otherwise identical risk-free cigarette.

5 Conclusion

Much of the continued controversy over the value of statistical life is due to a misunderstanding of what the economic value of life is. Despite the role of economics in these values, the economic literature on the value of life did not simply adopt a naïve approach such as the human capital value. Rather, the VSL concept is based on individual willingness to pay for reductions in small risks and not on the present value of future earnings. Thus, use of VSL amounts to assess policy benefits is firmly grounded in standard willingness to pay principles from the public finance literature. Although many non-economists continue to attack the entire concept of monetizing risks to life, these implicit tradeoffs are reflective of how people themselves value the risks and respect consumer sovereignty in much the same way as do prices in other economic markets.

Current economics research has extended the domain of VSL research beyond obtaining single average VSL estimates. Considerable attention is now being devoted to the heterogeneity of VSL. Chief among these areas of research has been the exploration of the age-related dependency of VSL. But there has been emerging research with respect to other variations as well, such as the dependency of VSL on income levels, smoking status, race, and gender.

The extent to which such heterogeneity should be taken into account may depend on the policy context. In situations in which the beneficiaries of the government policy will be paying for the safety improvement themselves, the justification for recognizing the heterogeneity seems to be strong. If the risk reduction policy is being funded through general revenues, making distinctions across different groups in the population has proven to be more controversial. Ultimately, the extent to which this heterogeneity is recognized may depend in part on the source of the heterogeneity and whether people are compensated for the risk. Workers who knowingly engage in high rise construction work and who receive compensating differentials for these risks may have a low estimated VSL because they have sorted themselves into high risk jobs. Similarly, low income residents located near a newly discovered toxic hazard likewise may have a low VSL because of their low income status. However, the political support for protecting those who are exposed to the risk involuntarily and without compensation for the risk will surely

be greater than for the voluntary risk takers. As economic estimates of VSL get more refined, policymakers and economists will have to grapple with difficult valuation distinctions such as these.

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