Value of Life, Economics of

Glenn C Blomquist, University of Kentucky, Lexington, KY, USA

Abstract

For practical purposes placing an economic value on life is straightforward. People make tradeoffs between small changes in their probability of survival and finite amounts of valuable time and money. Estimates of these values of changes in mortality risks, or values of statistical lives, come from analysis of jobs, consumption, and direct questioning. Evidence indicates typical values for adults are from \$2 million to \$12 million (2011 US dollars). Heterogeneity is expected rather than a single, universal value. Evidence that values are lower for seniors is mixed, but for young children values are 1.5–2.0 times higher. Altruism can be relevant and is greatest for children in the household. These theoretically preferred values have mostly displaced cost-of-illness. Gradual displacement of quality-adjusted life years for valuing changes in length of life has facilitated moving beyond cost effectiveness analysis. Deontological and estimation issues aside, economic values of life based on tradeoffs are likely to continue to be useful in policy decisions.

Thinking about the Economics of Value of Life

The economics of the value of life is about what individuals and societies are willing to sacrifice to get longer expected lifetimes. Value of life is about private choices that individuals make implicitly and explicitly about their own health and safety. Value of life is also about collective, public choices that societies make concerning expenditure, tax, and especially regulatory programs that affect mortality risks. Inferences from individual choices inform public decisions about such things as traffic safety and air quality regulations and are a vital input into benefit–cost analysis. Although ethical and estimation concerns exist, these values are useful in policy decisions about health, safety, and the environment.

The Term 'Value of Life'

Value of life typically refers to monetary values of things that individuals are willing to trade for small changes in probabilities of their own survival. These situations are typically what individuals face in life and what decision makers face in making public policy. Value of life is about tradeoffs involving small changes in risk; it is not about willingness to pay to avoid certain death.

Value of a Statistical Life

The typical situation is illustrated by thinking about an individual who is one of a group of 10 000 people. Everyone in the group is identical and knows that during the next year nine people in the group will die. Everyone also knows that the number of people who are going to die could be reduced to eight if sufficient funds can be raised. If somehow it is known that each individual is willing to pay \$600 for the reduction of one death in the group, then the value of life is \$600 per person times 10 000 people, or \$6 million. Sometimes this amount is referred to as the 'value of a statistical life' (VSL) because the identity of the individual who would have been the ninth death, yet lives, is unknown at the beginning of the period when the decision is made.

Value of a Change in Mortality Risk

The numerical example illustrates another way of interpreting value of life. The reduction in the number of deaths implies that the probability of death faced by each individual decreases from 0.0009 to 0.0008. The \$600 that the individual is willing to pay reduces the probability of his or her death by 0.0001. Because information is available from similar situations with small changes in the risk of death, but the changes are not exactly the same, for convenience, the value is standardized to a unit change (1–0). The standardized 'value of a change in mortality risk' is \$600 times the 10 000 needed to standardize 0.0001 to 1, or \$6 million. Both the 'value of a statistical life' and the standardized 'value of a change in mortality risk' represent what is typically meant by value of life. It is the rate at which individuals are willing to trade small amounts of money and risk.

Characteristics of Values of Life, Values of Changes in Mortality Risks

The nature of value of life as defined above can be described further by considering a simple equation of individual expected utility. Let

$$E(U) = PU(C) \qquad [1]$$

where $E(U)$ is expected lifetime utility for an individual. U is a well-behaved utility function with marginal utility $U'>0$ and diminishing marginal utility $U''<0$. C is consumption and P is the probability of survival. Differentiating eqn [1] keeping the individual at the same level of $E(U)$, and solving for $\mathrm{d}C/\mathrm{d}P$ yields the rate at which the individual is willing to trade off current consumption for a small change in the probability of survival:

$$-\mathrm{d}C/\mathrm{d}P = U(C)/PU' \qquad [2]$$

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Equation [2] says that the (negative of the) rate at which an individual is willing to trade consumption for a small change in mortality risk equals the utility of consumption divided by the expected marginal utility of consumption. The amount is positive because the tradeoff itself is negative, i.e., less C for more P. If consumption is expressed in monetary terms, U' is the marginal utility of income, and PU' would be expected marginal utility of income. This would mean that the value of a change in mortality risk, $-dC/dP$, would be the expected monetary value of the utility of consumption; it is willingness to pay for risk reductions. For small changes eqn [2] suggests that it makes little difference whether the individual is paying for small reductions in mortality risk or accepting compensation for small additions to mortality risk. For example, for small, equal (and opposite) changes in mortality risk, the amount the individual is willing to pay for a slightly safer job is approximately the same as the amount the individual is willing to accept for a job which is slightly riskier.

While the simple equation above captures the essence of the risk-dollar tradeoff, formal models of consumer and worker behavior include behavior which affects the probability of survival, budget constraints, insurance, workers' compensation, bequests, multiple periods, multiple risks, and risk perception. See Jones-Lee (1976), Rosen (1981), Cropper and Freeman (1991), and Freeman (2003).

Labor Earnings

Within the context of intense interest in economic growth and national income accounting and from an emphasis on manufacturing and machinery following World War II grew an appreciation for the potentially high returns from investment in human beings. In a special conference issue of the *Journal of Political Economy*, Mushkin (1962) articulated the case for investment in human beings through promoting better health. She argued that the return would be through future increases in labor earnings. If one more person were to live because of an investment in health, then national income would be greater by the amount that person would earn in the labor market. Expected future labor earnings became a standard measure of the value of life. Notwithstanding the fundamental contribution made by establishing human health as an important factor in economic growth, eqn [2] yields no clear, precise connection between the value of life and labor earnings. P may be close to 1, and C may be positively related to labor earnings, but the primary difference is that the value of $U(C)$ is not likely to equal C. Assuming that $U(C)$ equals C means that no allowance is made for either consumption which occurs outside the formal market or for the value of living. Instead, in eqn [2] what matters is the tradeoff between consumption and mortality risk to the individual who is affected. Schelling (1968) argued this point persuasively at a Brookings conference more than 40 years ago. The value to the individual influences behavior and should be the starting value for public decisions which affect risks to the individual's life. This point is a reminder that gross national product, or national income measured with traditional accounting, is a highly imperfect indicator of well being.

Costs of Illness

In valuing investments in health, Mushkin (1962) added to earnings the saving of future health expenditures. The sum of these health expenditures saved (direct costs) and the labor earnings not forgone (indirect costs) became known as the 'cost of illness' avoided. Cost of illness was used extensively because of the wide acceptance of the importance of investment in human beings and because estimation was manageable. The shortcoming that homemakers would be valued at zero was overcome by estimating the value of the services performed or the amount of earnings the person would have had if the individual had worked in the labor market. Low values for infants whose future earnings were heavily discounted and zero values for retirees who are not in the market remain awkward implications. The most troublesome aspect of cost of illness, however, is the lack of a theoretical basis which should include the individual's own value of living. Tolley et al. (1994) provide a comparison of the cost of illness and the value of life based on an individual's willingness to trade money and risk.

Ex Ante and Unidentifiable

Equation [2] displays another characteristic which is inherent in the relevant situations. The value of a statistical life with one fewer person of 10 000 people dying and the value of reduction in mortality risk by 0.0001 share an *ex ante* perspective. The situation is confronted, the life lottery must be played, but the outcome is not yet known. The identity of the individual who would have been the ninth death among the 10 000 is not known. Alternatively, whether the individual facing a lower probability of death survives or dies is not known. Decisions which must be made by individuals and societies about risks to their health, safety, and environment are often made in a similar manner.

Situations in which the individual is identifiable are inherently different. If the individual is thrust into a life-threatening situation by an unforeseen natural event, such as a tornado which causes entrapment in a collapsed building, the individual and society will often spend whatever is available or do whatever is possible to save the life. The situation involves a potentially large change in survival for a known individual whose probability of survival has fallen greatly. Saving the individual's life from almost certain death is usually valued highly. If the trapped person is saved, all may end well. If the person cannot be found in the collapsed building after some time, then the probability of saving the person becomes small and the rescue effort decision is transformed into one involving the more typical value of a change in mortality risk. Medical situations involving identifiable patients with known diagnoses have some similarities.

Court cases involving wrongful death of a specific individual are also inherently different because they too are *ex post*. Nothing can change the fact that the individual is dead. Nothing can be done to compensate the deceased for death. The value relevant to forensic decisions is the amount that can compensate the estate for the individual's death. The value depends on the deceased individual's contribution to the well being of the other members of the family, an amount that is related to labor market earnings. From an efficiency perspective, the value relevant for forensic situations should consider generating sufficient incentive to influence future decision makers who deal with similar risks. Viscusi (2007) compares the different concepts used in public policy and in court cases.

Criticisms of Value of Life

A value of life based on individual preferences as defined above is not without criticism. Criticism ranges from the ethical to the technical.

Deontology

One saying goes that economists know the price of everything and the value of nothing. In this spirit, one objection to the value of life as defined above is that it is vulgar and ethically wrong to place a monetary value on human life. Deontologists such as Plato or Kant espouse moral theory based on obligate moral rules independent of the desirability of the consequences of acting on the rules. If it is morally wrong that people are exposed to risks of death, then it is wrong to construct a value of life to be used to guide decisions involving risks of death.

In contrast, teleologists such as Bentham or Mill whose moral theory is based on the goodness of the consequences are highly interested in a value of life which might guide decisions so as to generate the greatest good for the greatest number. Teleology is the ethical basis for benefit cost analysis including analyses that use values of life (values of small changes in risk) in evaluating policy alternatives. Absolutist deontology can play a useful role in ruling out objectionable policies which many deem morally wrong. However, categorical criticism of applying individuals' values of changes in their own risks in analysis tends to reduce transparency by driving unavoidable tradeoffs from consideration rather than explicitly including them in the analysis. See Brandt-Rauf and Brandt-Rauf (1980), who analyze the ethical conflict over occupational safety and health.

Tension and misunderstanding associated with the value of life concept might well be reduced with terminology that emphasizes small tradeoffs for risks instead of dollars for life. Cameron (2010) makes the case that a term such as microrisk that describes the willingness to swap the value of alternative goods and services for small changes in risks would be a cosmetic change well worth making. Such change is probably unnecessary in countries that accept benefit cost analysis as routine. However, careful wording might calm policy discussion in others, such as the US, and avoid deontological mischaracterizations of changes as devaluation of life, see Viscusi (2009).

No Single Value

Equation [2] is useful for demonstrating that there is no single value of life which applies to all individuals in all circumstances. The amount an individual is willing to trade for a small change in his or her probability of survival depends on P, the base level of the probability. Because P is in the denominator, the value of life can be expected to increase as P decreases. For example, adult aging reduces the probability of survival and can be expected to increase the value of life, holding constant consumption. Automobile drivers who must travel alone at night on winding roads covered with snow and ice (facing lower P) can be expected to have higher values of life than at other times.

The value of life depends on idiosyncratic factors that are reflected in the utility function. $U(C)$ can vary among individuals with the same measured consumption, C, owing to differences in family, environment, or genes. Individuals enjoying close, supportive family relationships and living in clean, ecologically rich natural environments and societies with high-quality civil institutions and public services can be expected to have higher values of life.

Lastly, from eqn [2] the value of life depends upon C. Since C can be expected to increase with income, $U(C)$, and the value of life will be higher with higher income and consumption. Adult aging can be expected to reduce future consumption and, in turn, value of life. The negative effect of aging due to less future consumption (C) with a shorter time horizon and the positive effect due to lower probability of survival (P) make the net effect of aging on value of life theoretically ambiguous and something to be determined empirically. Given the various factors that determine tradeoffs for risks, there is no reason to expect to find a single value even with this simple model. More complex models consider the value of changes in expected health profiles over remaining life where profiles describe the timing, sizes, and sources of mortality risks change, types of morbidity, and recovery. In such models, there are additional reasons to expect differences in values changes in mortality risks, see Cameron and DeShazo (2012).

Quality-Adjusted Life Years

Early evaluation of medical outcomes was in terms of life years added. Desire to recognize quality of life and deontological objection to money values lead to adjusting a life year added by a quality weight to yield a quality-adjusted life year (QALY). The quality weight for a health state associated with an illness (or injury) can be determined by a direct questioning method. The questioning may be as straightforward as picking a point representing the health state on a straight-line scale between death and full health. It might be deciding what probability of full health in a standard gamble with full health and death as the possible outcomes is equivalent to the health state. QALYs place a value on the expected number of years of life.

QALYs emerged to be used in cost utility, or cost effectiveness in evaluating medical interventions for several reasons. One reason was the deontological repugnance for health professionals of putting a monetary value on changes in health and, especially, life. Another was the relative paucity and suspected unreliability of estimates of individual willingness to pay in the 1980s when QALYs were being developed. Given the current abundance of good information about willingness to pay for changes in mortality risks and the tenuous theoretical grounding for QALYs, use of QALYs for benefit–cost analysis involving mortality risks is questionable. For morbidity risks (nonfatal illness or injury) the continued refinement of contingent valuation and the sizable stock of QALY estimates suggest future practice is likely to blend willingness to pay, QALYs, and related measures such as disability-adjusted life years (DALYs). See Gold et al. (1996), Johannesson (1996), Drummond et al. (1997), and Kenkel (2006). All are consequentialist in that they focus on the values of outcomes.

Estimates of Value of Life

Value of life is about private choices that individuals make implicitly and explicitly about their own health and safety. Bland, healthy diets are traded for tasty food and drink which increase blood pressure and cholesterol levels. Comfortable, safe dwellings are left for skiing and rock climbing. Jaywalking is done to save valuable time. Time and sweat are spent exercising to improve physical condition. Travel is modified to cope with treacherous conditions and increase the chances of a safe trip. Jobs are given up to pursue a safer, healthier lifestyle. For such tradeoffs, if the changes in risk and the values of whatever is traded are known by the individuals and can be known by researchers, then values of life can be estimated by analysis of observable behavior. Even with the insights and complexities that behavioral economics adds, these values can be useful for policy analysis, see Robinson and Hammitt (2011).

In addition, if realistic risk tradeoff scenarios can be constructed, then values of life can be elicited directly. Values of life have been estimated using these approaches at least since the early 1970s. The models upon which the estimation is based typically use a utility function which in some way resembles the one shown in eqn [1], make P endogenous so that individuals can change the probability of survival through their behavior, and finally introduce a resource constraint to reflect limited money and time. An implication of these models is that individuals will engage in risk-changing activity to the extent that the marginal value of the activity equals the marginal cost. Letting V be the value of life as defined in eqn [2], P' the change in the probability of survival, and K the cost of changing P, the condition of interest is

$$VP' = K \qquad [3]$$

If P', the change in risk, and K, the cost of changing P, can be determined, then V, the value of life implied by individual behavior, can be estimated. See Cropper and Freeman (1991), Freeman (2003), Johansson (1995), and Johannesson (1996).

Risk-Compensating Wages

The labor market has proven to be a fertile area for producing estimates of individuals' willingness to trade off safety and money. Faced with an array of jobs with different characteristics, workers will choose jobs that suit them best. If two identical workers are confronted with two jobs which are known to be identical except for risk of death associated with the job and pay, then equilibrium implies that the worker who chooses the riskier job must be compensated by a higher wage. This risk-compensating wage difference implies a value of life.

For example, if the estimated tradeoff is \$0.25 per hour in wage for an additional 0.0001 in annual mortality risk and the individual works 2000 h per year, the wage premium is \$500 per year. Multiplying by 10 000 to standardize to a unit risk change (for convenience) means the implied value of life is \$5 million.

Metaanalyses of the many wage-risk studies done for the US and countries around the world yield a range of estimates from \$2 million to \$12 million with an average nearer to the upper end, perhaps \$7 million. (These values are reported in 2011 US dollars as are all estimates reported below. Adjustments are made for inflation using the Consumer Price Index, but none is made for changes in real income over time.) Several concerns exist about the reliability of these estimates. The fatality rates used to measure risk may not reflect actual risks on the job. Worker information about the risks may be lacking or worker perception of the risks may not reflect actual risks. Risks of nonfatal injury risks may be correlated with fatality risks and may not be measured well or at all. Unmeasured and omitted job disamenities may be correlated with fatality risks. Estimates of values of life may not be representative because of self-selection. Recent studies that use risk data that more clearly match workers' jobs and panel data that control for unobserved worker risk ability and productivity characteristics address a number of these concerns. For a review of the *metaanalyses* and advances made in recent studies, see Cropper et al. (2011).

Risk Tradeoffs in Consumption

Markets other than the labor market and activities other than work have also produced estimates of individuals' willingness to trade off safety and other things they value. By estimating the effect of environmental quality on housing values and isolating the effect of environmental quality on mortality risks, the value of life implicit in the housing market can be estimated. By estimating the effect of the occupant fatality rate on the prices of automobiles, the value of life implicit in the automobile market can be estimated. These situations match well with eqn [3] in that numerous options are available from which the consumer can choose. Other consumption decisions are less continuous, but still imply values of life. Wearing a seat belt while driving in a motor vehicle involves a tradeoff between the gain in safety versus the time and discomfort associated with belt use. Installing smoke detectors involves a tradeoff between a reduction in risk of a fatal fire and installation costs. Blomquist's (2004) review suggests that value of life estimates from consumption studies tend to be less than the estimates from the labor market and fall in the range of \$2 million to \$9 million with a best estimate around \$5 million.

The concerns about the reliability of these estimates are similar to the estimates from the labor market. Some concerns can be readily addressed. For example, if risks are misperceived according to known relationships, the implied values of life can be adjusted. Two other concerns may not be addressed as easily. One is about the ability to separate the risk of fatality from other characteristics of the product. The other is the ability to estimate the value of disutility associated with the consumption.

Stated Preferences in Contingent Markets

Early in the emergence of value of life based on individual willingness to pay, Schelling (1968: pp. 143–144) and Mishan

(1971: p. 174) encouraged economists to employ a questionnaire method to estimate values of life. Since the early 1970s, economists working primarily in environmental, safety, and health economics have developed the stated preference methods. These methods elicit tradeoff choices through direct questioning of individuals who state their preferences about the situation confronting them. The hypothetical setting or market is described, the choice is presented, and information about the respondent is collected. The survey might be in person, by mail, by phone, or some combination. Individuals have been presented with more rapid-response ambulance service for higher taxes, changes in risk on the job for compensating changes in wages, safer highway travel for more money, and safer medications for more out-of-pocket expense. Risk–dollar, risk–risk, and hybrid risk–risk and risk–dollar tradeoffs have been designed to elicit values of life. Contingent valuation, choice experiments, and other stated preference methods have been used in laboratory and field settings for valuing changes in mortality risks due to pollution, travel, and medical treatment. *Metaanalyses* of the many stated preference estimates tend to fall in the range of $2 million to $8 million, somewhat less than the estimates from the labor market and closer to the estimates from tradeoffs in consumption.

A great advantage of contingent valuation is the ability to provide information and describe the tradeoff precisely. Concern exists about reliability. One is related to the challenge of successfully communicating small changes in risk. Another more worrisome concern is potential hypothetical bias due to not actually having to pay. Skepticism remains, but substantial progress has been made through internal validity checks and innovations such as cheap talk pleas for individuals to say what they would really do, convincing individuals that their responses matter and are consequential for policy, and adjusting responses by how certain they are. Future research should increase confidence in these estimates. For a review of the *metaanalyses* and issues, see Cropper et al. (2011).

Heterogeneity

Values for Various Types of Individuals

Benefit–cost analysis of environmental, health, and safety proposals value anticipated changes in mortality risks using the average of values of life for all members of society. In this way the values which individuals place on their own lives inform public policy. For public policies such as improvements in traffic safety which have broad effects across many types of individuals in society, average values of life are appropriate. However, some policies primarily affect specific types of individuals who may have values of life which differ from the typical individual. Whether it is socially acceptable to value changes in mortality risks differently is a sensitive issue. Using different values for differences in gender, race, and lifestyle is usually not considered. A consensus seems to be emerging in the US that it is unacceptable to use different values for groups which differ by income; an average value of life across all of society is normally used. However, adjustments to average values based on income changes over time and across countries are made. Robinson (2007) discusses income and age adjustments in the USA. While no consensus exists yet concerning what is politically acceptable regarding age, research has been done estimating values of life for individuals of different ages. An entire issue of the *Journal of Risk and Uncertainty* (Viscusi, 2010) is devoted to heterogeneity of the value of statistical life with respect to factors such as income and responsibility as well as age.

Values for Children, Working-Age Adults, and Seniors

Values for seniors (age over 65) and children (age under 18) are of special interest because they are vulnerable groups. Life-cycle models of value of life often imply that value of life will vary with age, in part, because of discounting. Discounting future risks can be relevant to people of all ages, but it can matter greatly for the very young, for whom the distant future is discounted greatly. For senior adults there are fewer future periods. A possible offsetting factor for seniors is that they often have accumulated more economic resources. Early contingent valuation studies in the USA and Sweden which address age and discounting find lower values of life for the elderly and that future changes in mortality risks are discounted substantially. See Cropper et al. (1994) and Johannesson et al. (1997). For adults, the issue evolved into a question about discounting the value of life years (VSLYs) and whether VSLY remains constant over the life cycle, see Hammitt (2007).

The vast literature on wage-risk tradeoffs provides estimates of how values of life vary with age for workers. The most recent labor market studies use age-specific fatality rates, estimate by age cohorts, and account for life cycle consumption patterns. The review by Aldy and Viscusi (2007) finds that VSL increases with age peaks at midworklife and declines with the decline flatter than the increase. Stated preference studies have the advantage of including individuals of all ages and those not working in the labor market. Characterizing the effect of age depends on how quality is judged and how much weight is put on different studies, but the review by Krupnick (2007) finds the value of mortality risks appears to be fairly constant during adult life until declining moderately for seniors. The labor market studies point to a value of mortality risks for seniors that is less than the value for midcareer workers, and the stated preference studies give a hint that seniors older than 70 have a value that is only slightly less. A notable recent study by Cameron and DeShazo (2012) that estimates values of mortality risk reductions implicit in values of changes in complex life health profiles finds that values for age 75 are less than half of values for age 65. Currently, no senior discount is made in the US or Europe.

The literature for valuation of mortality risks for children is not as developed as it is for adults, but there has been recent activity. US EPA (2003) developed a special handbook on valuation of children's health risks, but did not suggest different values due to the paucity of estimates. Early estimates based on parents' provision of travel safety for their children hinted at values that were at least equal to parents' value of their own mortality (and morbidity) risks and probably greater, see Blomquist (2004). The Organization for Economic Cooperation and Development (OECD) devoted an entire book (Scapecchi, 2006) to economic evaluation of health risks to children. In that book Dickie and Gerking (2006) model ways in which distributions of resources within households can influence parents' values of children's risk. They estimate values of reduction in cancer risks for children and find that values for children are markedly greater than parents' values of changes in their own risks. Two other recent, stated preference studies elicit parents' values of reducing fatal risks from consuming pesticide residue in food and from adverse reactions to asthma medication. Both Hammitt and Haninger (2010) and Blomquist et al. (2011) find parents' values of mortality risk reductions are roughly 80% greater than their values of risk reductions for themselves. A calibrated model of valuation of changes in life expectancy in which parents are altruistic and fertility is endogenous produces a similar result; see Birchenall and Soares (2009). OECD (2012) is now willing to recommend no age adjustment for adults, but values of life for children that are 1.5–2.0 times the average adult value. In the US valuing reductions in mortality risks for children more than for adults for policy might be better received than the senior discount. More research on value heterogeneity with respect to age will be valuable. For example, parents values of children's health risks may well depend on resource allocation in the household, characteristics of the parent or child, or opportunities for reducing health risks for each child. Much is known about values for typical adults, but much less about values for the very young and very old.

Values of Others' Lives – Altruism

Values which individuals place on changes in their own probabilities of survival may be less than the value to all of society because the values that others place on the individual's life are not counted. The strongest case for including others' values is within the individual's immediate family. Since people sort themselves into households based on mutual caring it makes sense that interdependencies are greatest within the household. Bonds within the household are thought to be strong enough that decision making is sometimes modeled at the household level and transfers are made within the household. Models of parents' values of children's risks are based on altruism within the household. Beyond the household it is not clear that the values others have for an individual's change in the probability of survival should be included in benefit–cost analysis. In a general model of a society constrained by limited resources, it can be demonstrated that the value of a statistical life is the same with universal pure altruism with caring about the overall well being of others and universal pure self-interest with no caring at all for others. In other words, the individual's value of his or her change in risk need not be supplemented for benefit–cost analysis. This result follows from the recognition that adding others' values causes the individual to consume more health and safety and less of other desirable things than the individual would choose to consume. The individual's value is sufficient as long as there is no substantial concern with the distribution of income. With impure, safety-focused, paternalistic altruism, however, it can be appropriate to augment the individual's value by others' willingness to pay. How much, if at all, altruism outside the household should augment individuals' values of their own mortality risk is a fascinating question that remains a topic for future research. For further readings, see Jones-Lee (1992), Johansson (1995), and Bergstrom (2006).

Public Expenditures and Social Burden

Another reason for considering adjusting the individual value of life is the impact that an individual's death has on others through public tax and expenditure programs. Bailey (1980) argued for the use of individual value of life for guiding policy decisions. One adjustment he made was for the individual's contribution to the public tax and insurance system. The amount of adjustment is potentially greater the more extensive is the welfare state in the society to which the individual belongs. More recently, the observation that lifestyle impacts government expenditures on health has led to something which might be called social burden analysis. The monetary impact on others of individuals who smoke cigarettes, drink heavily, or have sedentary lifestyles has been estimated. Such social burden calculations are not estimates of value of life in that they do not represent values of small changes in mortality risks. They are not individual's values, but are an external effect. Interestingly, if there is a net expenditure burden and it were considered as an adjustment to individual values of life for benefit–cost analysis, adjusted values would be lower than average values of life; benefits of an environmental program would be less than if it affected groups with healthier lifestyles. However, the social burden notion is rarely used this way. Also interesting is the inconsistency with which impacts on government revenues and expenditures are included in the burden analysis. For example, a RAND Corp. study by Manning et al. (1991) estimates that smokers, roughly speaking, pay their own way because of the excise taxes they pay on cigarettes and the amounts they bequeath to survivors through net contributions to pension plans because smokers die younger. Others who do burden analysis, including those who determine what is admissible in court, are more selective in what they are willing to accept as relevant. They will count increases in some medical costs financed by others such as those associated with hospitalization but exclude other medical costs which would be saved, such as costs of long-term care. Social burden analysis awaits a theoretical grounding to put it on equal footing with benefit–cost analysis. Social burden aside, changes in government surplus (revenue-expenditure) can be theoretically appropriate to include along with changes in consumer and producer surpluses in benefit-cost analysis of policies that change mortality risks. Such a benefit–cost analysis would not arbitrarily exclude relevant changes in expenditures and revenues; see Boardman et al. (2011).

What Is Known

What may seem on the surface to be impossible, placing an economic value on life, for practical purposes is straightforward. People, individually and collectively, make choices all the time in which they implicitly make tradeoffs between small changes in their probability of survival and finite amounts of valuable time and money. For more than 40 years economists have recognized these values as conceptually preferred. Estimates of these values of statistical lives, or, alternatively, values of changes in mortality risks, come from analysis of jobs with different wages and risks, consumption decisions involving changes in risk and time and money, and from direct questioning involving risk-money tradeoffs in constructed markets. The evidence from a large number and wide variety of studies suggests the typical value of life for adults falls in a range from \$2 million to \$12 million (2011 US dollars) with estimates from consumption and contingent valuation tending to be less than estimates from the labor market. This range may seem wide, but it has proven useful in many policy analyses which often turn on other factors. Theoretically no single value of life is expected. Age is expected to be a relevant characteristic, but possibly in a complex way. Evidence that values are lower for seniors is mixed, but the evidence for children suggests values for young children are 1.5–2.0 times the values for typical adults. Altruism is thought to be the greatest for children in the household where ties are close. The fact that these theoretically preferred, willingness-to-pay values have displaced the early measure, cost-of-illness, matters because they are typically greater although the relationship is not exact. The displacement of QALYs for valuing changes in length of life has allowed moving beyond cost effectiveness analysis among alternative health interventions. Deontological and estimation issues aside, the economic values of life based on tradeoffs for small changes in mortality risks is likely to continue to be useful in policy decisions about health, safety, and the environment.

See also: Children, Value of; Cost–Benefit Analysis; Health Economics; Safety, Economics of; Wage Differential and Structure.

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