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IZA DP No. 16867

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ABSTRACT

A Tale of the Tails: The Value of a Statistical Life at the Tails of the Age Distribution*

The considerable literature on the value of a statistical life (VSL) documents the wage-mortality risk tradeoffs for the working population. Regulatory analyses often must monetize risks to populations at the tails of the age distribution. Because of the longer life expectancy for children, there have been proposals to add a premium to their VSL, which would generate an inconsistency with revealed preference estimates of the VSL trajectory over the life cycle. The shorter life expectancy among older people has led to various arbitrary senior discounts for seniors' life expectancy. Application of the value of a statistical life year (VSLY) can address valuation of small changes in life expectancy. Examples of inappropriate age adjustments that we discuss include practices by the Consumer Product Safety Commission and the Environmental Protection Agency.

JEL Classification: J17, J28, I18, H40, K32

Keywords: circular A-4, Value of a Statistical Life, age, children, elderly, Value of a Statistical Life Year, VSL, VSLY

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1. Introduction

The end of 2023 brought with it a landmark in the Federal regulatory process in the United States. For the first time in 20 years the guidelines for regulatory benefit-cost analyses have been revised (Circular A-4, 2023). A controversial change explicates the need for distributional considerations in net benefit calculations. A key passage says, “It is generally not sufficient for your analysis to merely state that the chosen regulatory alternative does not reduce net benefits for relevant groups; it is important to analyze and describe the benefits and costs of different regulatory alternatives for relevant groups.” (p. 65). Our concern here is to clarify the economic efficiency and equity issues for regulatory policy going forward in the United States at the two extremes of the age distribution, children and the elderly.

As a starting point, we note that the Census Bureau for the first time in its history called the United States an aging nation (U.S. Department of Commerce, U.S. Census Bureau, 2017, “An Aging Nation”). In particular, there is a dramatically changing pattern of the relative importance of the young versus the elderly. In 2016 the number of children (under age 18) was 50 percent larger than the number of older adults (ages 65+). The Census Bureau projects that in 2034 the number of children and elderly adults will be equal, and that by 2060 the number of elderly adults will be 18 percent higher than the number of children in the United States. Somewhat surprisingly, the regulatory guidelines presented in the newly revised Circular A-4 take little account of the population aging happening in the United States. Table 1 shows that the new Circular A-4 mentions children 14 times and senior citizens or the elderly only once. If the time between the current and next version of Circular A-4 is again 20 years, then the elderly will be dramatically under-considered for many years. Our focus here is to explicate and clarify the importance of the imbalance in regulatory attention between the two tails of the U.S. age distribution with the intent of offering simple solutions that could be implemented quickly in regulatory analyses.

In Section 2 we begin our examination of the regulatory process in the United States by explaining why the tails of the age distribution matter so much. Section 3 presents the most important aspects of the estimated revealed preference for saving lives of various ages in the United States, which is known as the value of a statistical life, or VSL. Section 4 introduces the concept of the value of a statistical life year, or VSLY, which is helpful in understanding the policy benefit of a relatively small life extension. Section 5 presents revealed preference estimates of the values of activities to prevent premature childhood deaths. Section 6 illustrates the life-cycle pattern of VSL to further clarify the role of the age of the target population in policymaking. Section 7 considers the consequences of quantity-of-life adjustments to regulatory decisions. Section 8 considers the relevance of human capital investments over the life-cycle for the policy process, which is most impactful in wrongful death court cases. Section 9 touches on the possible importance of parents' stated preference estimates of saving children's lives. Section 10 illustrates how the Consumer Product Safety Commission may ignore Circular A-4 guidance in issuing regulations concerning children and the economic consequences for policy outcomes. Section 11 explains and presents calculations of how the anti-pollution regulations of EPA that can affect asthmatic children and asthmatic elderly may not be evaluated satisfactorily by the agency. Section 12 concludes.

2. Why the Tails of the VSL Distribution Matter

Government policies sometimes have highly concentrated impacts on particular age groups. The Environmental Protection Agency's (EPA) Clear Skies initiative in 2003 was based on estimates in which the principal beneficiaries of the mortality risk reduction from the air pollution regulation would be children and adults over age 65. The agency's assessment that the mortality risks for seniors should be less highly valued than the average value of a statistical life (VSL) created a political firestorm that ultimately led to the abandonment of the senior discount approach, which did not resurface until 2022. In the Clear Skies analysis of the mortality risk reduction for the very young, EPA applied no comparable reduction in the VSL that was pertinent for risks to children. Nor was there any advocacy of a VSL premium for the risks to the lives of children. Persons at the tails of the age distribution tend to be particularly vulnerable to many kinds of risks. However, these are also the age groups for which reliable evidence on the value of a statistical life (VSL) based on revealed risk preferences tends to be lacking. Here we explore how one should use the available evidence to establish meaningful monetization of mortality risks at the tails of the age distribution.

The pertinence of potential age-related variations in the VSL arises in a variety of contexts. The impetus for the Department of Transportation's rear camera and mirror regulation was a fatality caused when a father backed up his vehicle over his young son. The tragic nature of the incident led to questions about whether lives of children should be more highly valued in the regulatory impact analysis (Sunstein 2019). The Consumer Product Safety Commission (CPSC) has not been reluctant to advocate a different, higher VSL for risks to children, proposing in 2023 that there should be a doubling of the VSL for children (Boniface et al. 2023). The CPSC also speculated that there might be a rationale for possible downward adjustments to the VSL for senior citizens. Suggestions that the lives of older people should be devalued became prominent during the Covid pandemic. Senior citizens constituted the overwhelming share of Covid-related deaths, making possible age-related variations in the VSL a prominent concern in assessments of the mortality costs of the pandemic and access to medical care in contexts where there is rationing of care (The Great Barrington Declaration 2020, Viscusi 2020, Kniesner et al. 2022-2023).

Government agencies generally use a VSL for the average adult population to value mortality risk reductions. The approach of broadly applying the VSL for the average adult is consistent with an equitable risk tradeoffs approach that equalizes the VSL across all age groups, which is an approach that we believe is applicable in most contexts (Kniesner and Viscusi 2023b, Circular A-94, p.16). Even if there is substantial heterogeneity in the VSL, using an average VSL is reflective of society's willingness to pay for the risk reduction if the effects are spread broadly across the population. As estimates of the heterogeneity of the VSL have been refined over time, there has been increased interest in using more population-specific VSL estimates when the policy impacts are more narrowly framed.

3. Age Variations in Revealed Preference Estimates of the VSL Based on Labor Market Data

Figure 1 illustrates the nature of the potential controversy regarding the VSL at the tails of the age distribution. The VSL values depicted are based on the cohort-adjusted VSL estimates by age using the revealed VSL levels implied by workers' occupational risk decisions.[1] The VSL trajectory over the life cycle displays an inverted-U shape that follows a pattern similar to that of life-cycle income levels. Because the focus is on the working population, the age range in this study excludes very young (younger than 18) and very old (older than 62) individuals. At age 18, the VSL has a low value of $6.1 million (2022 USD). The estimated VSL then rises, reaching a peak of $14.3 million at age 46, and then tapering off to a value of $9.4 million at age 62.

Current government policy analysis practices do not make age adjustments but instead use an average VSL in the $10 million to $12 million range. To reflect the average VSL statistic, there is a horizontal dashed line in Figure 1 at $12.0 million. The source of the Figure 1 average VSL estimate is the bias-adjusted estimate reported in Viscusi (2018) for the average VSL for labor market studies using the Census of Fatal Occupational Injuries (CFOI) data. The $12 million value is based on a meta-analysis of studies rather than a single study, which was the source of the VSL estimates by age. Estimates based on the meta-analysis sample without adjustments for publication selection bias are somewhat higher. As Figure 1 indicates, the age-specific labor market VSL levels are below the average labor market VSL at the tails of the population.

[1] The data in Figure 1 are based on the cohort-adjusted estimates of the age-varying VSL reported in Aldy and Viscusi (2008). Kniesner, et al. (2022-2023) subsequently updated these estimates to 2021 prices to account for changes in prices and income. The estimates reported in this paper update these 2021 estimates to adjust for inflation. Except when noted otherwise, all dollar values discussed are in 2022 USD.

There are several possible approaches one might adopt to monetizing mortality risk reductions for different age groups. The current practice, which is consistent with an equitable risk tradeoffs approach that we support, is to use the same VSL for all age groups. Adopting the $12.0 million average value shown in this figure consequently would overstate the population-specific VSL at both tails and would understate the VSL for those in the middle age range extending from those over age 30 to under age 60. If one wished to tailor the VSL to reflect the population-specific heterogeneity of the VSL, one could use the estimated age-specific values from age 18 to 62. For populations outside of the Figure 1 range, one could extrapolate the life-cycle pattern, which would lead to extremely low values approaching zero for very young children and less precipitous declines in the projected VSL after age 62. In each case, there is no empirical basis for assuming that the VSL trajectory continues beyond the endpoints depicted in Figure 1. A less extreme adjustment tied to the age-related labor market estimates would be to assign a VSL of $6.1 million to those age 18 or below and $9.4 million to those age 62 or above. Instead, we suggest other approaches that agencies might take to address the tails.

4. The Value of a Statistical Life Year

For mortality risk reductions that affect people with extremely short life expectancy, it is more appropriate to account for the amount of the remaining life extension. Making such quantity adjustments is most pertinent for policies such as new drug therapies that will provide short extensions of life to patients with terminal illnesses. The Food and Drug Administration (FDA) has used such measures in regulatory impact analyses.

The quantity-adjusted counterpart to the VSL is the value of a statistical life year (VSLY), which is the concept developed by Moore and Viscusi (1988). Suppose that the willingness to pay for a risk reduction yielding one additional expected year of life has a constant value over time, which is the VSLY. The VSL corresponds to the discounted expected value of the stream of VSLY amounts over the person's remaining life. Thus, the VLSY equals the VSL divided by the discounted expected remaining years of life.

Because of the influence of discounting, this procedure will yield a higher value per expected life year than simply dividing the VSL by the remaining life expectancy. The two additional pieces of notation needed to construct the VSLY after obtaining estimates of the VSL are the age-specific remaining life expectancy L and the discount rate r. The VSLY estimates below are based on an assumed discount rate of 3%. The general formula for calculating the VSLY is given by

$$VSLY = \frac{rVSL}{1-(1+r)^{-L}} \ . \tag{1}$$

The VSLY counterparts to the VSL estimates shown in Figure 1 are given by the VSLY figures in Aldy and Viscusi (2008). The VSLY displays an inverted-U shape similar to that of the VSL except that it peaks at a later age. After converting the estimates to 2022 USD, the average VSLY is $516,000. The highest estimated VSLY is for those at age 54, for whom the VSLY is $686,000. The VSLY tapers off less with age than does the VSL, so that the estimated VSLY at age 62 is greater than that at age 39.

Other estimates of the VSLY indicate even more dramatic increases in the VSLY with age. Viscusi and Hersch (2008) estimated the VSLY by gender for smokers. The VSLY steadily increases with age, reaching a peak for the oldest age group in the sample, age 55-64. The older age group had a VSLY that was 1.8 times as great as the sample average for men, and 1.5 times as great as the sample average for women. The estimated VSLY amounts for persons age 55-64 were $1.2 million for men and $735,000 for women.

An alternative to basing the VSLY on revealed preference methods is to elicit the stated preference values for increases in life expectancy. Using a survey method in which the mortality risk trajectory was manipulated, Hammitt and Tunçel (2023) found that respondents had an average VSLY of $500,000. As in the case of the labor market estimates, this value was not a constant over the lifetime. The VSLY varied depending on the timing of the mortality risk change.

There are three principal lessons from the VSLY literature. First, the VSLY is not a constant value, but it varies of the life cycle. Second, the VSLY is quite substantial, and if applied on an age-adjusted basis in lieu of using the VSL to value mortality risk reductions it will yield fairly high value if the age-adjusted values of the VSLY are considered. Third, in the case of extremely short life extension, the VSLY provides an alternative to the VSL in valuing increases in the probability of life extension.[2]

5. Revealed Preference Evidence for Children

Society does not permit children to make life-endangering decisions such as driving, smoking, drinking, and purchasing firearms. Revealed preferences based on risky decisions made by children with respect to such activities would not be instructive in imputing the VSL for a child. Instead, efforts to derive a revealed preference value for mortality risks to children has focused on how parents value their children's lives in transportation safety contexts. The VSL estimates derived from parents' behavior to reduce their children's risk are sometimes used as a proxy for children's VSL based on the assumption that the values by the parent reflect the WTP values that are pertinent to value risks to the child. As indicated below, the evidence regarding the relative valuation of parents' lives and the lives of their children is mixed and does not offer clear guidance for how risks to children should be valued.

Carlin and Sandy (1991) analyzed the imputed and out-of-pocket costs incurred by parents for child safety seats coupled with estimates of the risk reduction provided by the seats to estimate the VSL. They constructed the implicit VSL parents expressed for their children based on the time and monetary costs associated with car seat purchases and use for children under the age of 5. They found a VSL of $1.4 million (USD 2022), which is a value in which they included the costs of raising a child to reflect what the authors view as the full value of the child.

Blomquist, et al. (1996) focused on the usage of a variety of protective devices for motor-vehicles, using the tradeoff between the reduced fatality risk and the time and disutility costs to impute an implicit VSL. The estimated VSL for seatbelt usage ranged from $3.8 million (all figures in 2022 USD) to

[2] For additional theoretical and empirical discussion of VSL and VSLY over the life-cycle see Kniesner and Viscusi (2024) and St-Amour (2024).

$17.2 million based on different assumptions about time and disutility costs. The estimated VSL range for use of child safety seats was $6.4 million to $11.5 million, which is bounded from both above and below by the endpoints for the adult seatbelt usage. Motorcyclists revealed the lowest VSL of $2.9 million based on motorcycle helmet use.

Mount et al. (2000) focused on price-risk tradeoffs with respect to valuations of occupant safety by linking data on fatality risks by age and vehicle type with information on vehicle purchase prices. Their study found that the VSL for motor-vehicle fatality risks to children and adults were similar based on automobile purchase data. In particular, the midpoint of the range of estimates for adults and children indicated that the risks were equally valued. Seniors may have fared worse based on the VSL levels implied by vehicle purchase price since they have a higher mortality rate conditional on a collision.

Using information based on purchase of bike helmets, Jenkins et al. (2001) found a lower VSL for children than for adults. The highest VSL was for adults, ages 20-59. The next highest point estimates for the VSL were for children aged 5-9, and the estimates for children aged 10-14 were similar for the case in which users wore the helmet less than 100% of the time. Results for other age groups were not reported. The VSL estimates based on purchase of bicycle helmets may be misleading with respect to the relative VSL for children and adults because the price of adult bike helmets is greater. Moreover, there is not a continuum of price-safety choices because the risk decisions did not involve choice among helmets with different safety levels but rather binary choices regarding helmet purchase and use (100% of the time, less than 100% of the time).

6. Quantity-Adjusted VSL Based on Life Expectancy

The total willingness to pay (WTP) for most products increases with the amount of the product one is buying. In the case of WTP for reductions in a mortality risk, a younger person is in effect purchasing a larger commodity than a person with a shorter remaining life expectancy. This reasoning often underlies advocacy of linking the VSL to the increase in life extension that is being provided by the mortality risk reduction.

Based on remaining life expectancy the VSL should be steadily declining with age. Although a decline with age is not consistent with empirical evidence, it does recognize the amount of life that is being extended with mortality reduction policies. Another approach would be to use discounted remaining years of life as the quantity of remaining life measure. In our discussion of imputing values at the upper end of the age distribution, we will return to the discounting issue. Practitioners of the quality-adjusted life years (QALYs) approach also incorporate in their assessment a straightforward measure of the quantity of life that is remaining, augmenting this tally with weighting adjustments for assessed changes in the quality of life based on age and other health-related factors.[3]

What are the implications of adopting a quantity-based approach to applying VSL to regulatory decisions? Focusing solely on differences in life expectancy, the VSL for children would be 1.5 to 2 times greater than the VSL for adults. To put the life expectancy difference in perspective, consider a representative VSL study. For example, the average worker age in the article by Kniesner et al. (2012) was just under age 41. At age 40 there are 39 years of remaining life expectancy.[4] Life expectancy at age 20 is 58 years, which is 1.48 times as great as the life expectancy at age 40. Life expectancy at birth is 77 years, which is 1.97 times as great as it is at age 40. Based on the quantity adjustments just mentioned, there would be a premium in the VSL for people younger than age 40. Thus, one would adopt a VSL of about $23.6 million at birth if adjustments to the VSL were based on the number of years of life expectancy.[5]

[3] The QALY concept has recently fallen into disfavor because of its implicit financial penalty on persons with disabilities (National Council on Disability 2022). Alternatives to the QALY include simple life years gained and the more elegant utility function based Generalized Risk-Adjusted Cost-Effectiveness (GRACE) approach (Lakdawalla and Phelps 2023, Phelps and Lakdawala 2024).

[4] National Vital Statistics life expectancy data are from Arias et al. (2022).

[5] Note that the age adjustment procedure that we recommend is different than this simple quantity approach in that it entails deriving a VSLY for the age group based on that group's VSL and the discounted remaining years of life expectancy.

The at-birth $23.6 million VSL declines as the person ages, dropping to $17.8 million at age 20 based on a similar life expectancy comparison with those age 40. The constructed quantity-based VSL just mentioned exceeds both the average population VSL and is more than double the estimated age-specific VSL for this age group shown in Figure 1.

The quantity-based adjustments at the upper tail of the age distribution have the opposite effect. During the Covid pandemic, allocation strategies to ration access to medical care based on the quantity of remaining life was embraced by those advocating the so-called “fair innings” approach. Using an analogy to a baseball game, their view is that older people had already had their “turn at bat” and they should not be given access to ventilators or hospital beds when in scarce supply (Kniesner and Viscusi 2023, p. 22). Making such quantity adjustments in the VSL more generally would substantially reduce the estimated VSL level for seniors. Life expectancy at age 75 is 11.6 years, or 30% of the value at age 40, leading to a quantity-adjusted VSL of $3.6 million. By age 85, the remaining life expectancy declines to 6.1 years, or 16% of the value at age 40, yielding an implied VSL of $1.9 million.

The very blunt quantity adjustments just described can lead to VSL estimates that are below the labor market VSL based on revealed preference data. At age 60, the remaining life expectancy is 22.2 years, or 56% of the value at age 40, leading to a quantity-adjusted VSL of $6.7 million. The above quantity-adjusted values relative to the VSL at age 40 understate the labor market VSL estimates in Figure 1 for the older age groups, whereas the quantity-adjustment approach leads to overestimates of the VSL for younger age groups.

7. Consequences of Quantity-of-Life Adjustments for Regulatory Policies

The ramifications for regulatory policies of quantity-of-life adjustments would lead to an overhaul of regulatory priorities (Viscusi, Hakes, and Carlin 1997). Traumatic injuries would not be much affected by such adjustments because the length of life lost is high. Such trauma-based mortality risks include motor-vehicle crashes, drownings, firearms deaths, poisonings, and fire-related deaths.

Childhood diseases that cause fatalities, such as measles, would also have a large quantity of life at risk. Illnesses with a latency period or causes of death that are concentrated among older age groups would merit a lower VSL. Such fatal risks among the elderly include heart disease, cancer, strokes, and unintended falls.

A common summary measure of regulatory performance is the cost per expected life saved. Suppose that one calculated a cost per expected life saved measure based on the cost per normalized life saved using the amount of life lost in automobile crashes as the numeraire to make the normalization adjustment (Viscusi, Hakes, and Carlin 1997). The cost per normalized life saved for regulatory policies would not be much affected for occupational safety regulations, consumer product safety regulations, or transportation safety regulations. However, environmental regulations, which comprise the largest share of regulatory costs, would be particularly disadvantaged. Because of the shorter life expectancy that is being extended by environmental regulations, the cost per normalized life saved would more than double, and in some cases would triple. The cancer moonshot initiative would also be grounded because, on average, cancer-related deaths lead to a life years loss of less than 40% of the number of life years lost due to automobile crashes. If one also accounts for the latency period for cancer and the influence of discounting the disparity in the discounted values of the expected life years lost between cancer deaths and automobile related deaths would be even more pronounced.

8. Human Capital

People change in many ways after birth. They learn social norms, become educated and trained, and develop personal relationships. Parents make an investment in their children in terms of time and financial resources. As a result, the human capital loss associated with a fatality is greater for older children. Even if one does not adopt a human capital approach to valuing mortality risks, recognition of human capital investment influences may be pertinent to benefit assessment. The characteristics of a person change over time, potentially affecting both their attitudes toward mortality risks and the valuation that others express for their lives.

A common measure used to set compensation levels in wrongful death cases is the human capital measure tied to the value of a person's income. Note that the courts' focus on compensation rather than the value of risk reduction has a different function than the VSL, which is oriented toward valuing prevention of deaths. Compensation following fatalities is largely governed by the present value of lost earnings, possibly net of personal consumption and taxes depending on the jurisdiction. Estimates of the VSL tend to be about an order of magnitude greater than the present value of workers' lost earnings. Based on a strictly income-based measure, workers with high projected lifetime incomes would fare quite well. Retirees who have no earnings would tend to have lower damages claims. At the other end of the age spectrum, the wrongful death awards for babies who die in childbirth are quite low. Damages awards in these cases are more dependent on the financial losses and the loss of future services incurred by the parents due to the death of the child rather than the foregone lifetime income trajectory of the dead baby. Similarly, damages awards for children who are educated and have a higher human capital loss will tend to be greater than the awards for the very young.

9. Stated Preference Estimates

Stated preference approaches often provide the basis for establishing WTP values for commodities for which revealed preference estimates are not available, such as the valuation of environmental resources and illness risks such as cancer. Stated preference surveys have also been used to elicit WTP values for risks to populations not addressed in revealed preference data. Children are the most prominent population group for which risk-taking decisions cannot be observed to determine their WTP for mortality risk reductions because society does not permit children to make life-endangering decisions. Revealed preferences by children with respect to risky activities are not very instructive. Using survey methods to elicit the WTP of children to reduce mortality risks also have not proven to be particularly meaningful. Children are not accustomed to making risk-taking decisions and generally do not have independent financial resources or knowledge of their future income trajectory to make a stated WTP for risk reduction meaningful.

Researchers have used two different approaches to explore the potential differences in the VSL for adults and for children. The first approach is to compare the WTP values for different samples of respondents. Researchers have often used two different samples—a sample of parents with young children, who were asked to value risks to the lives of their children, and a survey of the general population, who were asked to value risks to adults. Most of the other studies considered below, and which were the focus of reviews by Raich et al. (2018) and Robinson et al. (2019), considered survey populations consisting of parents of children in which respondents indicate WTP values for children and also for other adults in the household. Given the nascent nature of the line of inquiry and that the evidence from the stated preference studies is mixed, there are some reasons for caution in interpreting the stated preferences results.

Dickie and Gerking (2007) undertook a stated preference survey of parents to elicit the WTP for sunscreens to reduce the risk of skin cancer for children aged 3 to 12. Their survey also asked similar questions regarding skin cancer risks to the parent. The implied VSL was two times as great for risks to children as it was for the risk to parents. However, the concern with children's risks did not carry over to the morbidity risks of nonfatal skin cancer, as respondents valued these risks somewhat higher than the risks to adults.

A sequel to their 2007 study reported in Gerking et al. (2014) interviewed a sample of parents of children regarding sunscreens that could reduce skin cancer risks and vaccines that could reduce leukemia risks. With two illnesses (skin cancer and leukemia) and two classes of risk (morbidity and mortality), there were four different survey conditions in the study. Although the authors found a higher skin cancer VSL for children than for adults, overall the results were mixed. As the authors conclude: "At the margin, parents appear to be willing to pay an equal amount for an equal percentage reduction in a given risk, whether the risk affects the parent or the child, in 3 of 4 cases considered."

The survey by Hammitt and Haninger (2010) focused on the fatal cancer risks from consuming pesticides on foods. The expressed WTP to reduce the risks to the child aged 2-18 years was $12 million to $15 million, compared to a value of $6 million to $10 million for adults. (The survey year was not specified so the values reported in the article and are not updated for inflation.) Although the WTP for reduced pesticide risks was greater if the household included a child, it was not sensitive to the number of people in the household or whether there was another adult in the household. Introducing the possibility of latency periods of 10 or 20 years also did not affect the WTP values. The findings did not always pass what some might regard as reasonable consistency tests for stated preference surveys, though the authors suggest that risks with a long latency period need not be valued lower.

Hammitt and Herrera-Araujo (2018) repeated the pesticide risks survey using a sample in France. In the abstract, the authors place greatest emphasis on the estimates in which the parents expressed a VSL of €2 million for adults and €6 million Euros for children. (The survey year was not specified so that the values reported in the article cannot be updated for inflation.) However, based on the other results in their article, it is unclear whether there is any basis for concluding that there is a VSL premium for children. In one model that Hammitt and Herrera-Araujo analyzed, parents valued risks to the child at 2.6 times the risk to themselves, but they also valued risks to other adults in the household at 2.5 times the risk to themselves, so that risks to other adults were valued similarly to risks to children. In other estimates that they report, the VSL pertinent for other adults in the household was higher than the estimated VSL for children. It is not clear why respondents expressed a lower value for risks to themselves compared to risks to children or other adults in the household, but the results do not suggest that reducing risks to children are valued more highly than risks to all categories of adults. The responses to this survey also were not sensitive to the latency period or its length.

Alberini and Scasny (2011) undertook stated preference surveys in Italy and the Czech Republic that included fatal risks of cancer and road traffic crashes. The surveys used a split sample approach to elicit parents' values of risks to their children and a separate sample to elicit values of risks to adults. The pooled results that do not distinguish for the cause of death found no statistically significant VSL differences for adults and children in Italy, and a weak difference in the Czech sample. For particular disease types, more differences were evident. For road-traffic crashes, the child VSL premium was 40 percent in Italy and 60 percent in the Czech Republic. However, the VSL ratio for cancer deaths was 1 in both countries.

Finally, although most U.S. asthma related deaths are elderly persons, estimates reported by Blomquist et al. (2011) focused on the WTP values for asthma treatments that produced a lower probability of an asthma related-death at the tails of the age distribution. The first of their samples consisted of parents of children with asthma who were asked questions about asthma therapies for children. Parents' expressed WTP indicated high VSL levels (in 2022 USD) of $19.9 million for children age 4 and $18.0 million for children age 5. However, by the time children reached age 15, the implied VSL dropped below $9 million. For the general population adult sample consisting of respondents who did not necessarily have asthma, the VSL was in the $6 million to $10 million range from age 23 to 75, with the VSL reaching a post-age 15 peak of $9.4 million at age 66. Eventually, the VSL declines to $4.9 million at age 85 and $2.3 million at age 92.[6]

In summary, stated preference estimates of the value of statistical life using adult respondents sometimes find a substantially greater willingness to pay to reduce the risk of death among children. Less frequent is a finding of equal willingness to pay for risk reduction for a child versus other adults in the household. Based on the evidence in the literature, there is not a sufficiently large set of estimates or

[6] Recently emerging multi-country stated-preference evidence from seven OECD countries finds a similar pattern where parents say that they are willing to pay about twice as much for a given non-fatal asthma severity reduction in their children versus themselves (Appere, Dussaux, Krupnick, and Travers 2024).

a consistent pattern in these findings to adopt a VSL premium for children. The application of a double VSL for children versus adults has recently become a controversial issue for regulations issued by the Consumer Product Safety Commission, who since 2008 have not be required to conduct benefit-cost analyses as part of its decision-making process (Aiken 2019).

10. CPSC: Doubling the VSL for Children

The CPSC commissioned a review of the literature on the VSL for children, which included many of the studies discussed above. The literature review by Raich et al. (2018) and the related article by Robinson et al. (2019) focused primarily on single point estimates of the ratio of the VSL for children relative to adults based on stated-preference survey data. The CPSC cited these reviews as providing empirical support for increasing the VSL for children. It is noteworthy that the two literature reviews did not express all the concerns noted above regarding the robustness of the results with respect to different specifications, potential biases about asking parents about valuation of risks to themselves and their children in the same survey, and other limitations with respect to the consistency and rationality of the survey responses. The studies and the reviews in Raich and Baxter (2018) and Robinson et al. (2019) did, however, include caveats regarding the need for more research to estimate the child/adult VSL ratio.

Notwithstanding the limitations just noted, in 2023 the CPSC proposed VSL guidance whereby the adult VSL would be $11.6 million (2021 USD) and the child VSL would be double this amount, or $23.2 million (2021 USD)(Boniface 2023). The policy impetus for raising the VSL for children was the agency's evaluation of the proposed safety standards for operating cords on custom window coverings. The CPSC (2022a,b) regulatory impact analysis for the regulation then used a VSL that was double that for adults, leading to a substantial boosting of the economic desirability of the monetized benefits of the regulation. However, the regulation still fell short of passing a benefit-cost test. Tripling the VSL would be needed to put the regulation in the range where benefits exceeded costs. CPSC did finalize the regulation, as its policy actions are not required to pass a benefit-cost test.

Figure 2 illustrates the implausibility of adopting a VSL for children that is double the average estimated value for adults. For purposes of Figure 2, the CPSC values have been updated to 2022 USD. The dashed line up till age 18 indicates the VSL level of $24.6 million is to be used in valuing mortality risks for those under the age of 18. This amount is double the value of CPSC's adult VSL, which is $12.3 million in 2022 USD. The labor market VSL at age 18 is $6.1 million. The CPSC doubling of the VSL consequently leads to a 75% drop in the VSL at 18 compared to the VSL at age 17. If the stated preference studies had been repeated to distinguish the VSL for the two different ages, it is unlikely that they would have found a precipitous drop in the VSL at age 18.

11. VSL, Clear Skies, and Climate Change: Appearing, Disappearing, and Reappearing Senior Discounts

The first noteworthy attempt to assign a relatively low value to the lives of seniors was with respect to EPA's proposed Clear Skies initiative. Air pollution-related asthma risks tend to be concentrated among particularly vulnerable populations, such as senior citizens and children, although most of the 3,500 annual deaths from asthma in the United States are adults (Asthma and Allergy Foundation of America 2022). To account for possible age variations in the VSL the EPA prepared an analysis in which a lower VSL was assigned to mortality risks to senior citizens. However, the EPA did not use any of the procedures specified above, but instead drew on the results of a stated preference study in the U.K. Turning to survey results from the U.K. to monetize U.S. lives of seniors is problematic for a variety of reasons (Viscusi 2018). Income levels and VSL estimates in the U.K. are much lower than those in the U.S., and there is no reason to believe that the VSL trajectory over the life cycle is the same as in the U.S. There are also international differences in health insurance coverage, publicly provided pensions, private savings rates, and retirement policies between the U.S. and the U.K. Countries also may differ in attitudes toward mortality risks. The study serving as the basis for the adjustment also yielded a range of different estimates, not all of which showed statistically significant effects.

Notwithstanding the limitations just mentioned, the EPA adopted a flat discount rate for benefits to those over 65 of 37 percent. Table 2 summarizes the benefits of the policy under two different scenarios considered by the EPA, one of which focused on long-term exposures and one which focused on short-term exposures. The prominent role of impacts on senior citizens is evident for both long-term and short-term exposures. For both long-term exposures and short-term exposures the population over 65 accounts for 76 percent of total deaths. Given the elderly's dominant role, the downward adjustment that EPA applied to valuing mortality risks of those over 65 has a consequential impact on estimated benefits, as shown by comparing the second and third columns of entries in Table 1.

EPA's devaluation of the lives of senior citizens led to a public outcry by senior citizen groups and the media more generally. EPA subsequently abandoned the senior discount approach to VSL (Kniesner and Viscusi 2023a). Two decades after the Clear Skies debacle, the senior discount has returned but in a somewhat different context and based on a different formulation.

Efforts to address climate change are now at the top of the regulatory agenda, with mortality risks to senior citizens looming particularly large. The monetized value of mortality risks is playing an increasingly prominent role in the evolving efforts to monetize the costs of greenhouse gases. Mortality costs now comprise the largest component of the economic assessment of the social cost of greenhouse gases (SC-GHG). The approach used by Carleton et al. (2022), which in turn forms the basis of the SC-GHG analysis by EPA (2023), begins with EPA's standard average VSL of $10.95 million (2019 USD). When converted to 2022 USD to provide comparability with our other statistics, the figure becomes $12.59 million. The rest of the procedure to calculate the mortality costs of GHG uses a quantity-of-life approach. The impetus for the EPA procedure was that there is a disproportionate concentration of the mortality costs of GHG among the population over age 65. The authors do not specify the extent of the lost life expectancy or the particular ages that are most affected.

The procedure eventually adopted in the SC-GHG analysis involves calculating an age-adjusted VSL by multiplying the average VSL per year of life by the remaining life expectancy. The specifics of the calculation are as follows. To construct the average VSL per year of life, the VSL is divided by life expectancy at the median age. Although the focal age is not specified, the median age in 2019 was 38.1. Based on the life expectancy tables for age 40, the remaining life expectancy is 38.6 years. The resulting value per year of remaining life expectancy at age 40 is about $326,000.

The EPA evaluations differ from the VSLY in two ways. First, the value per life year is calculated by dividing the VSL by the number of remaining life years rather than the discounted value of the life expectancy, as in the economic formulation indicated above. The EPA procedure leads to an underestimation of the VSLY. The resulting average values per year of life are only about three-fifths of the average VSLY calculated correctly and based on labor market evidence. Second, the calculation is based on the average value per year of life at the median age rather than the age-dependent VSLY, in turn ignoring potential increases in the VSLY for older age groups.

To construct the SC-GHG VSL at any age using their approach, all that is required is to multiply their calculated VSL per year of life by the remaining life expectancy. Life expectancy at birth is 76.1 years. Multiplying this by $326,000 yields a VSL of $24.8 million. Following their method, the VSL peaks at birth and declines steadily thereafter. By age 20, the VSL has dropped to $18.6 million. By construction, the VSL at age 40 is $12.6 million. The calculated VSL drops to $7.2 million at age 60, $4.8 million at age 70, and $2.8 million at age 80.

Figure 3 presents the SC-GHG VSL estimates based on the years of remaining life approach using a dashed line, with the labor market estimates of the age-varying VSL shown using the solid lines as in Figures 1 and 2. The VSL trajectory based on the life expectancy approach bears no resemblance to the revealed preference values. The life expectancy estimates decline in a roughly linear way until flattening out at upper age ranges, whereas the market-based VSL displays the inverted-U shape. The general pattern is that at younger ages, the constructed life expectancy VSL greatly overestimates the VSL indicated by revealed preference labor market evidence, whereas from middle age and beyond the SC-GHG VSL substantially understates the revealed preference estimates from the labor market. The SC-GHG VSL of $18.6 million at age 20 is three times as great as labor market estimates of the VSL. The SC-GHG VSL begins to understate the revealed preference VSL in the late 30s, as the labor market VSL of $14 million at age 40 exceeds the baseline VSL of $12.6 million used in the SC-GHG calculations. Whereas the revealed preference VSL is $10.6 million at age 60, the SC-GHG estimates is $7.2 million. The SC-GHG value then drops to $4.8 million at age 70, $2.8 million at age 80, and continues to decline thereafter.

Even if there is a desire to make some kind of quantity-of-life adjustment to the pertinent valuation that is used for mortality risks affecting older populations, one should not equate the SC-GHG approach with the VSLY for two principal reasons. First, the correct calculation of the VSLY involves dividing the VSL by the discounted expected number of years of life lost rather than dividing the VSL by the undiscounted remaining life expectancy. Discounting the expected remaining years of life diminishes the calculated quantity of life at risk, boosting the calculated VSLY above what it would be if the there is no discounting (using $r = 0$). Second, whereas the life expectancy value per year of life is a constant, the VSLY does not remain constant over time. The empirical evidence indicates that the VSLY increases with age in a manner that will lead to understatement of the VSLY should one use a population-wide average. Potentially risky job choices by older populations workers indicate a higher VSLY than that for younger age groups.

12. Conclusion and a Look to the Future

Our objective here has been to clarify the differences between regulatory policy currently being applied in the United States to persons at the two tails of the age distribution, children versus elderly adults. Economists emphasize the importance of keeping straight the efficiency and equity considerations in policy issues. Equity, or distributional, consequences have now been given greater emphasis in the guidance for regulatory analysis provided by Circulars A-4 and A-94 as adjudicated by OMB-OIRA in the United States.

Despite the increasing importance of the elderly in the U.S. population mentioned earlier what seems to be emerging is a focus on regulations favoring children versus the elderly based on equity considerations. A powerful example is the recently released EPA policy plan for putting equity considerations into action (EPA 2024). In it there are 63 mentions of environmental policy equity planned for children and zero mentions of policy planned for the elderly despite the fact that most of possible pollution-related early deaths in the United States are among the elderly.[7] One possible reason for the absence of interest in the relative well-being of the elderly has been mentioned earlier when we discussed the so-called fair innings social welfare function that some have recently advocated. Another reason is that in an aging nation it would be easier to fund social well-being programs if the elderly retired from work later (Steurle and Kramon 2023). The intergenerational fiscal and social insurance policy implications may be what underlie the comingling of efficiency and equity considerations in U.S. regulatory policy discussions that produce confusion versus clarity and less efficiency and equity than may be possible.

The practical guidance for agencies is straightforward. In the great majority of instances agencies should use the average VSL to monetize all mortality risk reductions. The VSL level based on revealed preference estimates from the labor market is about $12 million (2022 USD). Some policies may yield very short life extensions, as in the case of medical treatments that have a small effect on life expectancy or mortality risk reductions for those who are extremely old and have extremely short remaining life expectancy even though they are currently not gravely ill. For mortality risk reductions in situations in

[7] It is also worth noting that self-driving (autonomous vehicles would benefit the elderly most who are now in danger of losing their licenses due to age restrictions. Moreover, it has been estimated that autonomous vehicles could reduce crash fatalities in the United States by 75 percent (Kessler 2023). There would also be attendant benefits of having fewer cars, which would then be available on demand and would reduce urban congestion and pollution.

which using the VSL is not appropriate, agencies could apply a VSLY that is pertinent to that particular age group. Although the VSLY is above $500,000 overall, for those in more senior age groups the VSLY estimates are even higher.

References

Aiken, Deborah V. 2019. "When Benefit-Cost Analysis Becomes Optional: Regulatory Analysis at the Consumer Product Safety Commission in the CPSIA Era," *Journal of Benefit Cost Analysis*, 10(3): 404-433.

Alberini, Anna, and Milan Scasny. 2011. "Context and the VSL: Evidence from a Stated Preference Study in Italy and the Czech Republic," *Environmental and Resource Economics.* 49:511-538.

Aldy, Joseph E., and W. Kip Viscusi. 2008. "Adjusting the Value of a Statistical Life for Age and Cohort Effects," *Review of Economics and Statistics*, 90(3): 573-581.

Arias, Elizabeth, et al. 2022. "Provisional Life Expectancy Estimates for 2021," NVSS Vital Statistics Rapid Release Report No. 23.

Asthma and Allergy Foundation of America. 2022. Asthma Facts and Figures. https://aafa.org/asthma/asthma-facts/

Appere, Gildas, Damien Dussaux, Alan Krupnick, and Muriel Travers. 2024. "Valuing a Reduction in the Risk and Severity of Asthma: A Large Scale Multi-Country Stated Preference Approach," *Journal of Benefit Cost Analysis*, forthcoming.

Blomquist, Glenn C., Mark Dickie, and Richard M. O'Conor. 2011. "Willingness to Pay for Improving Fatality Risks and Asthma Symptoms: Values for Children and Adults of All Ages," *Resource and Energy Economics*, 33d: 410-425.

Blomquist, Glenn C., Ted R. Miller, and David T. Levy. 1996. "Values of Risk Reduction Implied by Motorist Use of Protection Equipment: New Evidence from Different Populations," *Journal of Transport Economics and Policy*, 30: 55-66.

Boniface, Duane, et al. 2023. Memorandum to the CPSC: Proposed Draft Guidance for Estimating the Value per Statistical Life. https://www.cpsc.gov/content/Briefing-Package-Proposed-Draft-Guidance-for-Estimating-the-Value-per-Statistical-Life

Carlin, Paul S., and Robert Sandy. 1991. "Estimating the Value of a Young Child's Life," *Southern Economic Journal*, Vol. 58: 186-202.

Circular No. A-4, "Regulatory Analysis," November 9, 2023. https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4.pdf

Circular No. A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," Revised Nov. 9, 2023. https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-94.pdf

Dickie, Mark, and Shelby Gerking. 2007. "Altruism and Environmental Risks to Health of Parents and Their Children," *Journal of Environmental Resources and Management,* 53: 323-341.

Gerking, Shelby, Mark Dickie, and Marcella Veronesi. 2014. "Valuation of Human Health: An Integrated Model of Willingness to Pay for Mortality and Morbidity Risk Reductions," *Journal of Environmental Economics and Management* 68: 20-45.

Hammitt, James K., and Kevin Haninger. 2010. "Valuing Fatal Risks to Children and Adults: Effects of Disease, Latency, and Risk Aversion," *Journal of Risk and Uncertainty*, 40: 57-83.

Hammitt, James K., and Daniel Herrera-Araujo. 2018. "Peeling Back the Onion: Using Latent Class Analysis to Uncover Heterogeneous Responses," *Journal of Environmental Economics and Management*, 87: 165-189.

Hammitt, James K., and Tuba Tunçel. 2023. "Monetary Values of Increasing Life Expectancy: Sensitivity to Shifts in the Survival Curve," *Journal of Risk and Uncertainty*, 67: 239-269.

Jenkins, Robin F., Nicole Owens, and Lanelle Bembenek Wiggins. 2001. "Valuing Reduced Risks to Children: The Case of Bicycle Safety Helmets," *Contemporary Economic Policy*, 19(4): 397-408.

Kessler, Andy. 2023. "Autonomous Cars Beat EV's," *Wall Street Journal*, November 12.

Kniesner, Thomas J. and W. Kip Viscusi. 2023a. "Is a Child's Life Twice as Valuable as an Adult's?" *Regulation*, 46(2): 11-12.

Kniesner, Thomas J. and W. Kip Viscusi. 2023b. “Promoting Equity through Equitable Risk Tradeoffs,” *Journal of Benefit Cost Analysis*, 14(1): 8-34.

Kniesner, Thomas J. and W. Kip Viscusi. 2023c. “Compensating Differentials for Occupational Health and Safety Risks: Implications of Recent Evidence,” *Research in Labor Economics*, 50: 83-116.

Kniesner, Thomas J., Ryan S. Sullivan, and W. Kip Viscusi. 2022-2023. “What Are 750,000 Senior Covid Deaths Worth?” *Regulation*, 25(4): 8-10.

Kniesner, Thomas J., W. Kip Viscusi, Christopher Woock, and James P. Ziliak. 2012. “The Value of Statistical Life: Evidence from Panel Data,” *Review of Economics and Statistics*, 94(1): 74-87.

Kulldorff, Martin, Sunetra Gupta, and Jay Bhattacharya. 2020. The Great Barrington Declaration, https://gbdeclaration.org/

Lakdawalla, Darius M. and Charles E. Phelps. 2023. “The Generalized Risk-Adjusted Cost-Effectiveness (GRACE) Model for Measuring the Value of Gains in Health: An Exact Formulation,” *Journal of Benefit-Cost Analysis*, 14:1, 44-67.

Moore, Michael J., and W. Kip Viscusi. 1988. “The Quantity-Adjusted Value of Life,” *Economic Inquiry*, XXVI(3), 369-388.

Mount, Timothy D., Weiling Weng, and William Schulze. 2000. Automobile Safety and the Value of Statistical Life in the Family: Valuing Reduced Risk for Children, Adults and the Elderly. Status Consulting report to the U.S. Environmental Protection Agency.

National Council on Disability. 2022. Policy Brief: Alternatives to QALY-Based Cost-Effectiveness Analysis for Determining the Value of Prescription Drugs and Other Health Interventions. https://www.ncd.gov/report/alternatives-to-qaly-based-cost-effectiveness-analysis-for-determining-the-value-of-prescription-drugs-and-other-health-interventions/

Phelps, Charles E. and Darius N. Lakdawalla. 2024. Valuing Health, *The Generalized and Risk Adjusted Cost-Effectiveness (GRACE) Model* (New York: Oxford University Press).

Raich, William, Jennifer Baxter, Lisa A. Robinson, and James K. Hammitt. 2018. Valuing Reductions in Fatal Risks to Children. Final Report by Industrial Economics to Consumer Product Safety Commission. https://www.cpsc.gov/s3fs-public/VSL_Children_Report_FINAL_20180103.pdf

Robinson, Lisa A., William J. Raich, James K. Hammitt, and Lucy O'Keefe. 2019. "Valuing Children's Fatality Risk Reductions," *Journal of Benefit-Cost Analysis*, 10(2): 156-177.

St-Amour, Pascal. 2024. "Valuing Life Over the Life Cycle," *Journal of Health Economics*, 93: forthcoming.

Steuerle, C. Eugene and Glenn Kramon. October 28, 2023. "The U.S. Needs Older Americans to Work More and Take Less," *The New York Times*, p. A22.

Sunstein, Cass R. 2019. "Rear Visibility and Some Unresolved Problems for Economic Analysis (With Notes on Experience Goods," *Journal of Benefit-Cost Analysis*, 10(3): 317-350.

U.S. Consumer Product Safety Commission. 2022. Safety Standard for Operating Cords for Custom Window Coverings, *Federal Register*, November 28, 2022, 87 (227): 73144-73195.

U.S. Consumer Product Safety Commission. 2023. Consumer Product-Related Injuries and Deaths Among Adults 65 Years and Older.

U.S. Department of Commerce, U.S. Census Bureau. 2017. An Aging Nation, Projected Number of Children and Older Adults. National Population Projection, 2017. www.census.gov/programs-surveys/popproj.html

U.S. Environmental Protection Agency. 2023. EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. Supplemental Material for the Regulatory Impact Analysis for the Final Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources, Oil and Natural Gas Sector Climate Review. https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf

U.S. Environmental Protection Agency. 2024. Equity Action Plan.
https://www.epa.gov/system/files/documents/2024-02/epa-2023-equity-action-plan.pdf

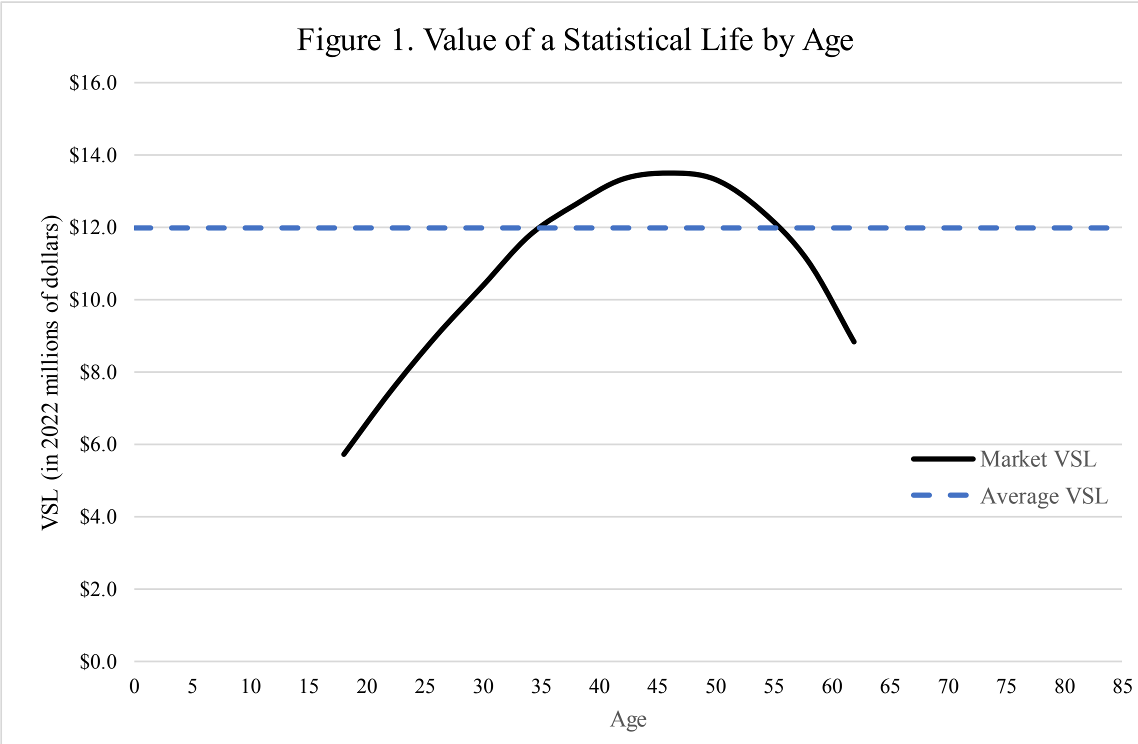
Viscusi, W. Kip. 2018. *Pricing Lives: Guideposts for a Safer Society* (Princeton: Princeton University Press).

Viscusi, W. Kip. 2022. "Pricing the Global Health Risks of the COVID-19 Pandemic," *Journal of Risk and Uncertainty*, 61(2): 101-128.

Viscusi, W. Kip, and Joni Hersch. 2008. "The Mortality Cost to Smokers," *Journal of Health Economics*, 27: 943-958.

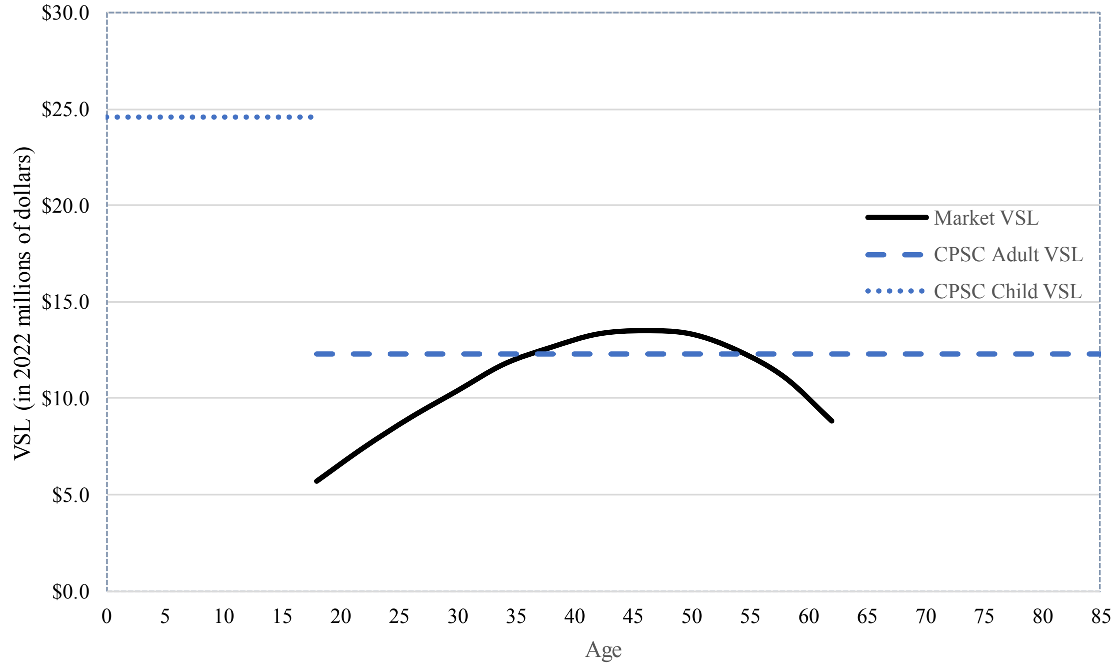
Viscusi, W. Kip, Jahn K. Hakes, and Alan Carlin. 1997. "Measures of Mortality Risks," *Journal of Risk and Uncertainty*, 14:213-233.

Figures



Source: Joseph E. Aldy and W. Kip Viscusi, "Adjusting the value of a statistical life for age and cohort effects," *Review of Economics and Statistics* , August 2008, pp. 573-581, figure 1.
Cohort-adjusted values displayed here. Original values updated for inflation and earnings.
See text for details.

Figure 2. Value of a Statistical Life by Age



Source: Joseph E. Aldy and W. Kip Viscusi, "Adjusting the value of a statistical life for age and cohort effects," *Review of Economics and Statistics* , August 2008, pp. 573-581, figure 1.
Cohort-adjusted values displayed here. Original values updated for inflation and earnings.
See text for details.

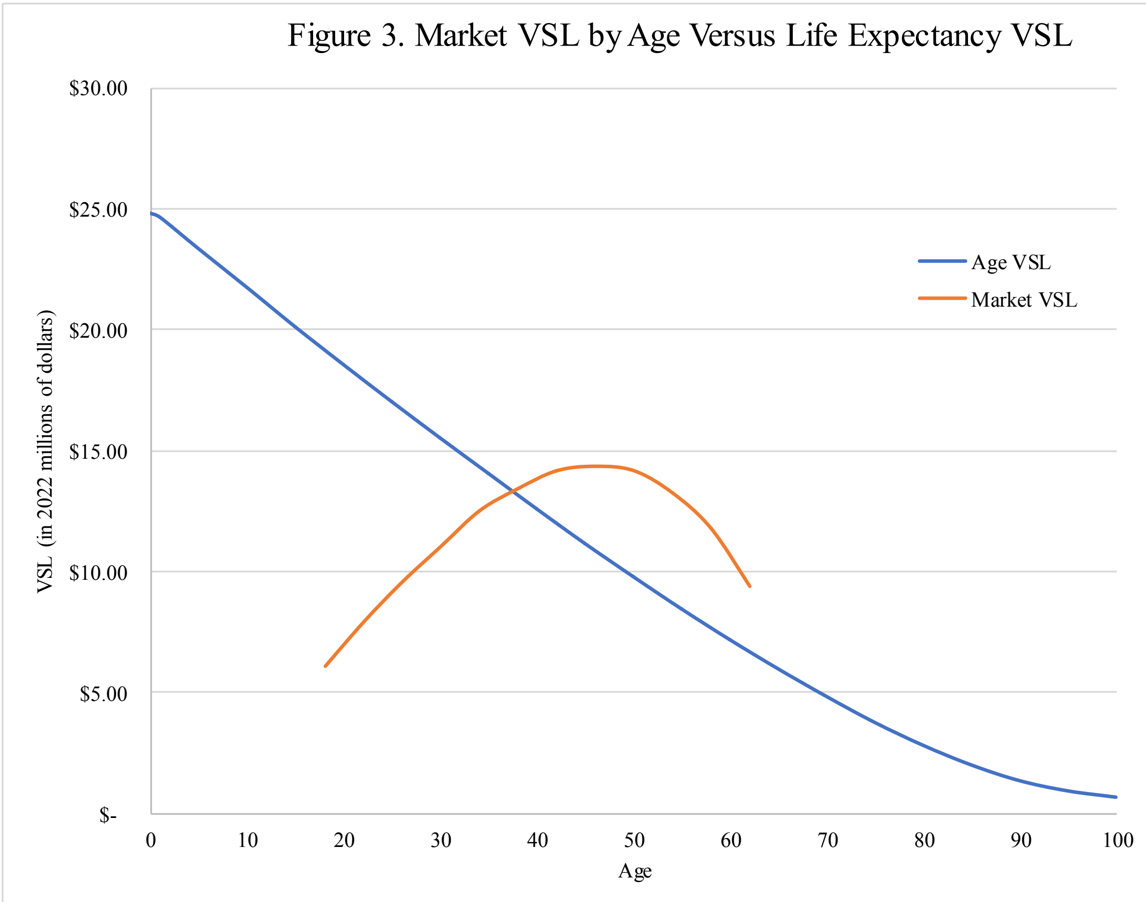


Figure 3. Market VSL by Age Versus Life Expectancy VSL
$30.00
$25.00
$20.00
$15.00
$10.00
$5.00
$-
VSL (in 2022 millions of dollars)
0
10
20
30
40
50
60
70
80
90
100
Age
Age VSL
Market VSL

Tables

Table 1 Circular A-4 2023, Mentions of Elderly and Children

Elderly or senior citizens: 1 Mention p. 50 Longevity may be only one of a number of relevant considerations pertaining to a regulation. You should keep in mind that regulations with greater numbers of life-years extended are not necessarily better than regulations with fewer numbers of life-years extended. In any event, when you present estimates based on the VSLY method, you should adopt a larger VSLY estimate for **senior citizens**.
Children: 14 Mentions p. 45 For a regulation that affects the safety of young **children**, for example, it is possible to use market transactions or survey evidence to estimate the WTP or WTA of others (such as parents) but generally not of the **children** themselves; for that reason, traditional WTP or WTA measures may yield incomplete estimates. p.50 iii. Valuation of Reductions in Health and Safety Risks to **Children** The valuation of health outcomes for **children** and infants poses special challenges. It is rarely feasible to measure a **child's** willingness to pay for health improvement, and adults' concern for their own health is not necessarily relevant to valuation of **child** health. For example, the wage premiums demanded by workers to accept hazardous jobs are not necessarily appropriate to use for regulations that accomplish health gains for **children**. Some studies suggest that parents may value **children's** health more strongly than their own health. Although this parental perspective has been a promising research strategy, it may need to be expanded to include a societal interest in **child** health and safety. p. 51 Where the primary objective of a regulation is to reduce the risk of injury, disease or mortality among **children**, you may develop a benefit-cost analysis to the extent that valid monetary values can be assigned to the primary expected health outcomes. For regulations where health gains are expected among both **children** and adults and you decide to perform a benefit- cost analysis, the monetary values for **children** should be at least as large as the values for adults (for the same probabilities and outcomes) unless there is specific and compelling evidence to suggest otherwise. p. 88 g. Environmental Health or Safety Impacts on **Children** Under Executive Order 13045, "Protection of **Children** from Environmental Health Risks and Safety Risks," each agency must, with respect to its rules, "to the extent permitted by law and appropriate, and consistent with the agency's mission," "address disproportionate risks to children that result from environmental health risks or safety risks." For any substantive rulemaking action that "is likely to result in" a rule that may be significant under Section 3(f)(1) of Executive Order 12866 (as amended), and that may concern "an environmental health risk or safety risk that an agency has reason to believe may disproportionately affect **children**," the agency must provide OIRA "an evaluation of the environmental health or safety effects of the planned regulation on children," as well as "an explanation of why the planned regulation is preferable to other potentially and reasonably feasible alternatives considered by the agency," unless prohibited by law.

Source: https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4.pdf

Table 2. Age Group Effects on the Benefits from the Clear Skies Initiative

Age Group	Reduced Annual Fatalities in 2010	Benefits of Reduced Mortality ($ billion undiscounted) Constant Value of Life	Value with Senior Adjusted
Base estimates—long-term exposure			
Adults, 18–64	1,900	11.6	11.6
Adults, 65 and older	6,000	36.6	23.1
Alternative estimate—short-term exposure			
Children, 0–17	30	0.2	0.2
Adults, 18–64	1,100	6.7	6.7
Adults, 65 and older	3,600	21.9	14.7

Source: The reduced annual fatalities figures are from the EPA's *Technical Addendum: Methodologies for the Benefit Analysis of the Clear Skies Initiative* (Washington, DC: U.S. Environmental Protection Agency, 2003), Table 16. The 37 percent senior discount is from the EPA's *Technical Addendum: Methodologies for the Benefit Analysis of the Clear Skies Initiative* (Washington, DC: U.S. Environmental Protection Agency, 2002), p. 35. The $6.1 million figure per life is from the EPA's *Technical Addendum: Methodologies for the Benefit Analysis of the Clear Skies Initiative* (Washington, DC: U.S. Environmental Protection Agency, 2003), p. 26.