Executive summary

The idea of associating a monetary value with human life is very challenging and can seem insensitive or harsh. Life is indeed priceless, at least when considered from the complex perspective of an individual. However, policy makers are regularly devising policies and regulations that affect people's risk of death and that seek to protect lives in society, and require methodologies for comparing the costs of reducing risk with the expected benefits in terms of lives saved.

The benefits of prevented mortalities can be expressed in terms of a "Value of a Statistical Life" (VSL), which represents the value a given population places *ex ante* on avoiding the death of an unidentified individual. VSL is based on the sum of money each individual is prepared to pay for a given reduction in the risk of premature death, for example from diseases linked to air pollution.

It is important to keep in mind that even if these mortality risk changes are not valued explicitly, they will still be valued implicitly through the policy decisions that are ultimately made. For example, if a policy that has a cost of USD 5 million per prevented fatality (and this is the only benefit) is implemented, this implies a VSL of at least USD 5 million. However, such implicit values tend to vary a lot from case to case, depending on the level of information among the decision makers and the specifics of the political processes. Whilst people object sometimes on ethical grounds to explicit valuations, the use of implicit values is pervasive and is the default situation, even if it is not so visible. Explicit values derived from carefully conducted valuation techniques will improve the information base for decision makers and can yield more consistent policy making and lead to more efficient allocation of scarce resources across sectors.

One important tool to promote consistency in policy making is cost-benefit analysis (CBA). CBA compares the total expected costs of a given action against the total expected benefits, to see whether the benefits outweigh the costs, and by how much. The effects of a policy or business decision on human life are obviously a major concern: car air bags, speed limits, water quality standards and vaccinations are just a few of the cases where costs of improving safety are measured against the number of lives saved.

CBA is now an important element in project and policy evaluations in many OECD countries, including the United States, Canada, Australia, the United Kingdom and the Nordic countries, as well as the European Commission. CBAs are widespread in the transportation, energy and environment sectors. Such analyses have, for example, been made of the European Commission's Clean Air for Europe programme, and of the Clean Air Act Amendments in the United States.

However, the method used to establish a VSL number for policy making vary widely between countries, and even between agencies within a country. The main difference is the reliance on Revealed Preference (RP) methods in terms of wage risk studies in the United States (where most such studies have been conducted), while Europe, Canada and Australia

rely more on Stated Preference (SP) methods, eliciting people's willingness-to-pay (WTP) for changes in mortality risks. The focus in this report is on VSL values derived from SP studies.

The report summarises the results of a four-year effort to compile and analyse the largest database to date containing all SP studies that have been prepared around the world and that estimate adult VSL in environmental, health and transport risk contexts. The objective is to summarise this literature to answer two broad questions of relevance for both policy and research communities:

1. What are the main factors explaining people's WTP for reductions in mortality risks in the environmental, health and transport contexts, and the VSL derived from SP studies?
2. Based on the current knowledge, which VSL estimates should be used in analysis of environmental, health and transport policies?

The methodological approach used to answer the two questions is a meta-analysis (MA). MA is a body of statistical methods that have been found useful in reviewing and evaluating empirical research results from a variety of sources. It is used here to show how, and explain why, VSL estimates vary with different characteristics of the SP valuation methodology employed, characteristics of the change in mortality risk (*e.g.* type of risk, latency, cancer risk etc.), socio-economic characteristics of the respondents, and other variables.

Deriving a VSL value from a willingness-to-pay survey

VSL can be derived in the following way from a SP survey: The survey finds an average WTP of USD 30 for a reduction in the annual risk of dying from air pollution from 3 in 100 000 to 2 in 100 000. This means that each individual is willing to pay USD 30 to have this 1 in 100 000 reduction in risk. In this example, for every 100 000 people, one death would be prevented with this risk reduction. Summing the individual WTP values of USD 30 over 100 000 people gives the VSL value – USD 3 million in this case. It is important to emphasise that the VSL is not the value of an identified person's life, but rather an aggregation of individual values for small changes in risk of death.

The VSL is often used in CBA of policies as follows: the analyst first estimates the number of deaths expected to be prevented in a given year by multiplying the annual average risk reduction by the number of people affected by the programme. Then the VSL (either a single number or a range) is applied to each death prevented in that year in order to estimate the annual benefit. Annual benefits are then summed over the life time of the policy as a present value, using the national social discount rate.

There is a large and growing literature of SP studies worldwide valuing small changes in mortality risks. However, few syntheses of the results from these studies have been available. Such syntheses can help researchers and policy makers to better understand people's preferences for small mortality risk changes. On the basis of an improved understanding of people's preferences, one can better select appropriate VSL numbers for use when assessing the benefits of prevented mortalities in public policy analysis.

While in some cases, a new primary valuation study, tailored for the specific policy in question, might be needed in order to carry out an appropriate CBA, in many situations benefit transfer (BT) can be used instead. Benefit transfer is where VSL values that have been estimated in one context are – with appropriate adjustments – used in policy

assessments in another context. This will generally be less time- and resource-consuming than undertaking new primary valuation studies. To facilitate BT, the report outlines an eight-step procedure for how to transfer VSL estimates from existing SP studies for use in a regulatory policy analysis or CBA. A simple unit value transfer, with income adjustment in terms of GDP per capita, is recommended when transferring VSL estimates from other countries to establish a domestic VSL base value.

The book proposes a range for the average adult VSL for OECD countries of USD (2005-USD) 1.5 million – 4.5 million, with a base value of USD 3 million. For EU-27, the corresponding range is USD 1.8 million – 5.4 million (2005-USD), with a base value of USD 3.6 million. These base values and ranges should be updated as new VSL primary studies are conducted.

Table 0.1 summarises the recommendations for when the values for a country (or group of countries) should be adjusted or not. These recommendations should be updated as new primary valuation studies become available, providing further evidence on these potential adjustments.

Table 0.1. **Recommendations for adjusting VSL base values**

Adjustment factor	Recommendation
	Population characteristics
Income	No adjustment within a country or group of countries the policy analysis is conducted for (due to equity concerns). For transfers between countries VSL should be adjusted with the difference in Gross Domestic Product (GDP) per capita to the power of an income elasticity of VSL of 0.8, with a sensitivity analysis using 0.4 (see equation (1) in chapter 2.1.)
Age	No adjustment for adults due to inconclusive evidence. Adjust if regulation is targeted on reducing children´s risk. VSL for children should be a factor of 1.5 – 2.0 higher than adult VSL.
Health status of population and background risk	No adjustment (due to limited evidence)
	Risk characteristics
Timing of risk (Latency)	No adjustment (due to limited evidence)
Risk perception (source or cause)	No adjustment (due to inconclusive evidence). Sensitivity analysis for lower values in the environment sector than in health and traffic.
Cancer or dread (Morbidity prior to death)	No adjustment if the regulation is targeted on cancer risks and/or risks that are dreaded due to morbidity prior to death. Morbidity costs prior to death should be added separately.
Magnitude of risk change	No adjustment. However, since the magnitude of the risk change clearly affects the VSL, a sensitivity analysis based on VSL calculated from a risk change similar in magnitude to the policy context should be conducted. A risk change of 1 in 10 000 annually is suggested for calculating a VSL base value.
	Other adjustments
Altruism and Public vs. Private risk	No adjustment (due to limited evidence and unresolved issues). Use “Private risk” to calculate a VSL base value. Provide illustrative adjustments in sensitivity analysis.
Discount for hypothetical bias in SP studies	No adjustment (due to limited evidence).
Correction for inflation	Adjustment based on the national Consumer Price Index (CPI).
Correction for increased real income over time	Adjust VSL with the same percentage as the percentage increase in GDP per capita.