Chapter 5

Conclusions and policy implications

While it is clear that there is no single ratio which can capture differences in risk preferences for children and adults, there is some evidence that the VSL for a child is greater than that of an adult. This has implications for policy evaluation and prioritisation, perhaps resulting in certain policy interventions passing benefit-cost tests when this would not have been the case with the use of an undifferentiated VSL. However, it is clear that further work is required.

Introduction

The primary objective of the VERHI project has been the estimation of a value of a statistical life for children[1] and (for reasons of comparison) adults in a context which could be said to be "environmental" in nature. The combination of these three factors (child, mortality and environment) complicates the task of the researcher significantly.

Why do policymakers care about the evaluation of mortality risk preferences for children? There are a number of related reasons:

- While the evidence is relatively limited, that which is available indicates that children are potentially particularly vulnerable to some environmental hazards – both due to relatively high levels of exposure and their greater susceptibility to health impacts for given levels of exposure.[2]
- There is a general perception that precaution should be exercised with respect to children's health, and this is reflected in policy measures in a number of areas in addition to the environmental sphere – *e.g.* product safety.
- The health of children can be seen as a public good in some sense – with the good health of children having positive spillovers both for their parents and for society-at-large.[3]
- While the interests of children themselves are defended by parents (and other caregivers), policymakers in OECD governments have always had a special role in protecting the interests of children (sometimes from their parents).[4]

Estimates of the VSL for children, however, are in short supply. Economic theory and existing empirical work do not offer unambiguous conclusions about whether they are the same as for adults. For this reason, one of the goals of this research project was to estimate the VSL for children and adults in contexts that are appropriate and relevant for environmental policy, and to assess whether the value of reducing such risks for children is greater than for adults, and if so, what does this mean for policymakers? It is the latter questions which are the focus of the concluding chapter.

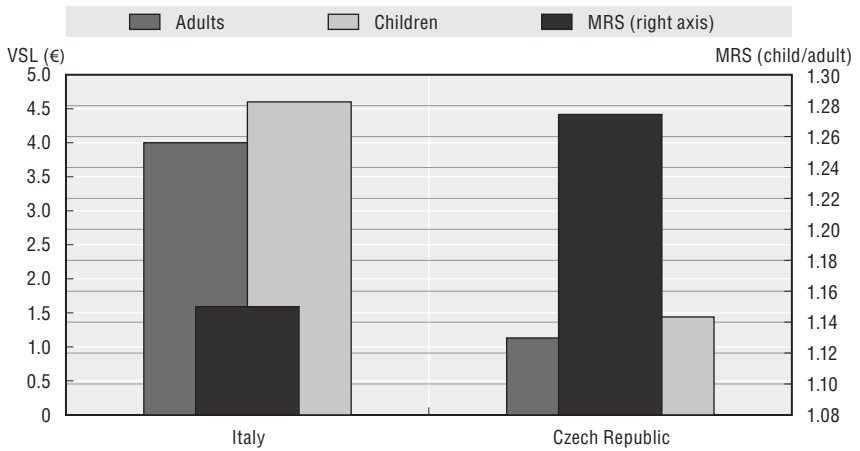
Is the VSL for children greater than for adults?

While the project generated a number of policy-relevant results which related to the valuation of mortality risks more generally, the principal policy-relevant objectives of the VERHI project was to determine whether, the value of risk reductions for children was greater than for adults – *i.e.* is the

marginal rate of substitution of risk reductions for children to adults greater than unity? As noted, the estimated "adult" VSL obtained in the VERHI study is derived from a sample of parents only. As a consequence, the VSL for all adults (all those above 18 years of age) could be different than that obtained in the study, resulting in a different estimated "premium" for child VSL.

At the aggregate level, the results are somewhat ambiguous. In the case of the conjoint choice experiment implemented in Italy the VSL for an adult (EUR 4.0 million) is not statistically different from a child (EUR 4.6 million). In the Czech Republic the values are statistically different at the 10% level, with values of CZK 24.5 million for the child and CZK 19.2 million for the adult. Figure 5.1 presents these figures,[5] alongside the marginal rate of substitution *i.e.* the ratio of these two values).

Figure 5.1. **VSL and MRS in Italy and Czech Republic Based on CCE**



Using the chaining exercise, the estimated values of risk reductions for children and adults are markedly different. We can first compare responses to the CV question in which respondents are asked what they would be WTP in order to avoid a poor health state. For a temporary poor health state, the MRS is 1.8, and for a permanent poor health state, it is 2.16. Given life expectancy, it is hardly surprising to find that the ratio is higher for the permanent health state, than the temporary one. As noted above, these values can then be "chained" with the standard gamble (SG) question to obtain a VSL. On this basis, the "best" estimate (*i.e.* using a single chain) for a child VSL in the United Kingdom is GBP 342 323, which is significantly greater than that of an adult GBP 121 411. The difference in the Czech Republic is less pronounced (EUR 128 736 and EUR 81 892), but statistically significant at the 5% level. However, there are concerns that there may be "double-counting" associated

with the chaining exercise, with the premium for child risk reductions applied twice. As such, in Figure 5.2 below the MRS is presented when the parents' own standard gamble response is applied to both themselves and children. However, the Czech values when the adult SG response is applied are not statistically different for children and adults.

The person trade-off exercise allows for direct estimation of the marginal rate of substitution, which is just ratio of adult persons to child persons stated by each individual in respective PTO consequent questions. From Table 5.1 below we see the distribution of individual MRS's is skewed; the MRS ranges between 3.4 to 6.2 for means, but the MRS derived from medians ranges between 1.7 to 2.2.

The MRS derived from the means in this case is 1.58 for the least severe illness outcome, T, whereas the MRS is around 2.0 for P and premature death. The MRS derived from geometric means are substantially larger; 1.91 for T, 2.6 for T and 2.67 for illness terminated in death. Each reported statistic confirms the parents prefer to treat ill children or save children if the decision in public context needs to be taken between children and adults.

In general, the results from VERHI are consistent with the literature, finding qualified evidence of a MRS greater than unity. However, this is by no means always the case. For example, the cancer VSL figures in Italy and the

Figure 5.2. **MRS for VSL based on the Chaining Exercise in UK and CZE**

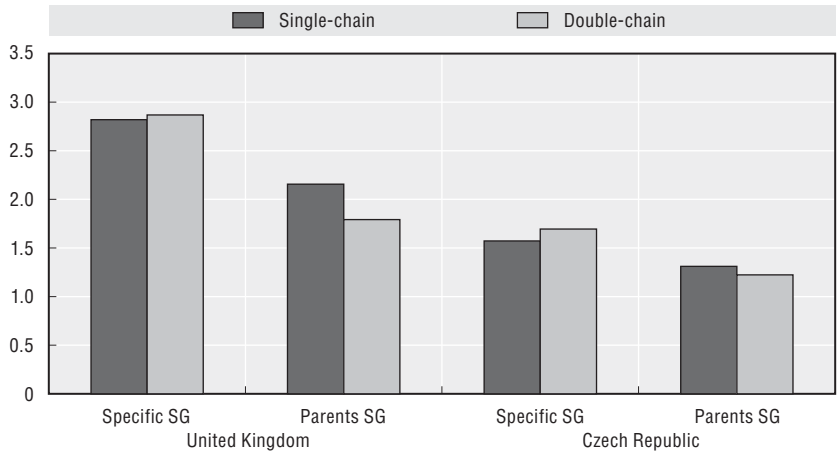


Table 5.1. **MRS derived from PTO means**

	Mean	Median	Geometric Mean
PTO1(T)	1.58	1.67	1.91
PTO2(P)	2.00	2.22	2.61
PTO3(death)	1.97	2.00	2.67

Czech Republic based on the conjoint choice experiments are higher for adults, raising the question whether the context or the baseline risk matter.

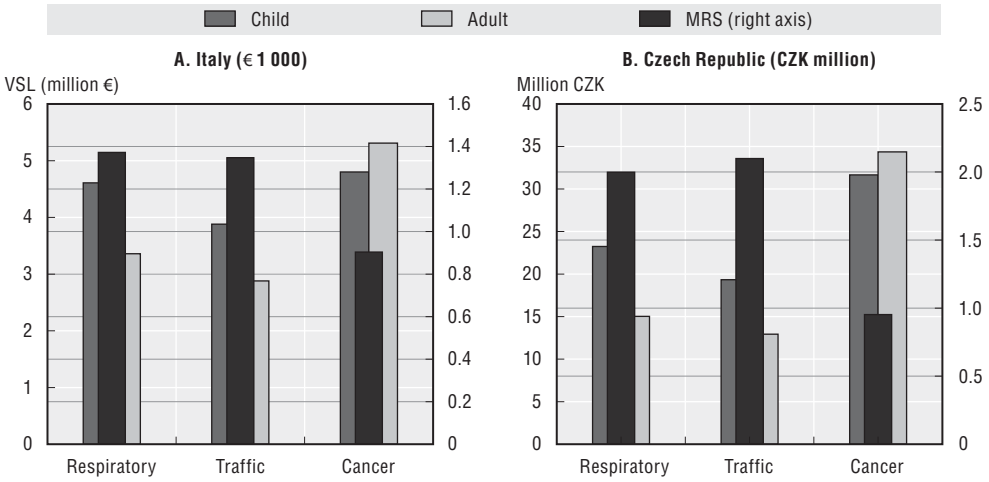
Why might values be different for similar risks?

The principal reason for the (qualified) finding that the MRS is greater than unity is likely attributable to general social preferences for risk reductions for children relative to adults, irrespective of the nature of the risk. It is also possible that the greater life expectancy of children (in general) relative to adults (in general) have a positive impact on the MRS for mortality risks.

A related risk factor, which may be particularly important for children, is that of latency. On the one hand, if the duration of latency exceeds the life expectancy of some adults, the VSL will be lower for the same reasons stated above. On the other hand, in the child valuation context, latency has particular implications when exposure is incurred in childhood, but the health impacts are realised much later as an adult. If risk preferences differ between children and adults, do these differences relate primarily to differences associated with exposure or with response? As such, latent impacts, which can manifest themselves long after the point of exposure, raise particular complications for the researcher (and policymaker).[6]

There is considerable empirical support for the view that context has an effect on VSL. Moreover, findings from VERHI indicate that relative VSLs for adults and children differ markedly by context (see Figure 5.3) While the MRS is actually less than one in Italy for cancer, it is in region of 1.3-1.4 for respiratory disease and traffic accidents. In the case of the Czech Republic, a similar pattern holds, but with relatively higher MRS (approximately 2) for the latter two contexts.

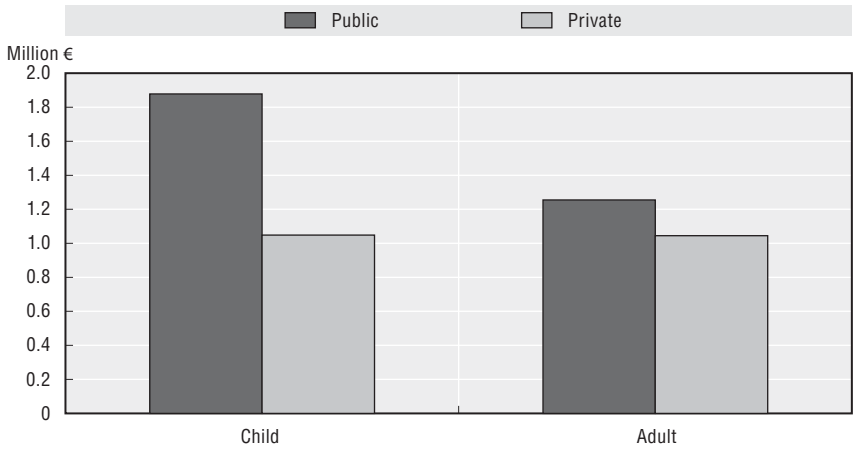
Figure 5.3. **VSL and MRS by Context Based on CCE**



In addition, the degree of "voluntarism" of a given risk may mean something very different for a 6-year old from for an adult. While respondents to a survey may perceive the risks associated with traffic to be voluntary for adults, the very same risks may be perceived as involuntary for children. Similarly, a risk, which is perceived as "controllable" for an adult, may be seen as uncontrollable for children. Even if a defensive expenditure is undertaken as a means to reduce risk, the parent may feel that they have "imperfect control" over it is to protect their child from a given risk.[7] This might explain some of the difference in MRS by context presented in Figure 5.4.

Of course, both of these factors correlate with the distinction between private and public risk reductions. However, the difference in WTP for children under the two cases (private and public) may be somewhat different than for adults. Most importantly, the relatively greater difference between the VSL associated with a public programme relative to a private activity for children may be attributable to the relatively more important component of paternalistic altruism in total WTP for children than adults. Adults may not trust other parents to protect their children. This may also be due to the nature of the substitute private risk reduction, and the degree of control that they believe that they can exercise. If their control is relatively more imperfect for children than for themselves, public risk reductions will be preferred relatively more to a private alternative for children than for adults, even in the absence of altruism.

Figure 5.4. **VSL According to Private/Public Interventions in CZE based on CCE**



Implications for public policy

While it is clear that there is no single MRS, there is some evidence – from VERHI and the literature more generally – that the VSL for a child is greater than that of an adult. This result is not unequivocal, however, not even within the VERHI project. Moreover, while there is a growing empirical case for the use of a differentiated VSL for children in cost-benefit analysis, it must be recognised that the use of age-differentiated VSL (in general) in policy analysis is the exception and not the rule. Indeed, adjustments of any kind to a central value are not commonly applied, except in sensitivity analyses.

For instance, the US Environmental Protection Agency's recommended central estimate is USD 7.4 million (2006), to be used in all benefit analyses regardless of age, income or other population characteristics.[8] The only recommended adjustments that are made are due to expectations of increased income over time, latent impacts, and inflation.

In the European Commission DG Environment's "Recommended Interim Values for the Value of Preventing a Fatality in DG Environment Cost Benefit Analysis" (2000)[9] three values are provided – a best estimate of around EUR 1 million (2000), with a lower estimate of EUR 0.65 million and an upper estimate of around EUR 2.5 million. It is suggested that these should be adjusted for latency, carcinogenic pollutants (due to dread) and age. However, the specific case of children is not mentioned.[10]

In the more recent *Impact Assessment Guidelines* of the European Commission, it is indicated that "research undertaken in the past has resulted in values of 1 – EUR 2 million for VOSL and 50 000 – EUR 100 000 for VOLY in Europe. These ranges should be used for the purpose of an Impact Assessment if no more context specific estimates are available". No mention is made of adjustments to this value for age, much less children.

In those cases where age-differentiated VSLs have been applied in sensitivity analyses, there has sometimes been considerable controversy about their use. For instance, in the United States the use of age-differentiated weights in an EPA analysis of the Clear Skies Initiatives resulted in a spate of newspaper articles.[11] Specifically, a 37% lower VSL was applied for those over 65. Health Canada also commissioned a study (related to cigarette regulation) in which a lower VSL was applied for older members of the population (Hara Associates 2002).

It is likely that the introduction of a "premium" for children would raise less controversy than a "discount" for seniors. Since "children" were not included in those studies, which are usually used to determine baseline, VSLs, the "premium" could be simply added to the baseline estimate. Moreover, there is a stronger political case. While the interests of children are usually defended by parents (and other caregivers), policymakers in OECD governments

have always had a special role in protecting the interests of children with respect to risks in general. In some cases (*i.e.* negligence or abuse), this role may supersede that of their parents.[12] As such, there is, at least, a distinct obligation with respect to children's risks to determine whether or not a premium should be applied.

However, the costs associated with undertaking valuation studies prohibits their implementation for each and every policy proposal.[13] As a consequence, for practical purposes it is important to identify cases in which it is particularly important to undertake mortality risk valuation studies. The EPA's *Children's Health Valuation Handbook* (2003) gives three examples of rules which have been analysed in the past and for which it would have been particularly helpful to have had specific values for children available:

- In the case of the Heavy – Duty Engine/Diesel Fuel Rule, a CBA used adult VSL values even when some of the impacts valued (*i.e.* acute bronchitis, lower respiratory problems, upper respiratory problems) focussed on children.
- The Food and Drug Administration's analysis of regulations related to the "safe and sanitary processing" of fruit and vegetable juices used the same COI values for adults and children. Since COI, values are derived from medicine and treatment costs, as well as productivity losses it is unlikely that an adult COI would be equal to a child COI.[14]
- In a cost-effectiveness analysis of the National Highway Traffic Safety Administration standards for airbags, the total number of fatalities are summed – *i.e.* the effectiveness of the regulation is expressed in terms of lives saved per USD million, with no distinction made between whether the lives are of children or adults.

Are there general rules, which can be applied to determine cases in which children-specific values would be most helpful? The EPA (2003) notes that a separate analysis of children's VSL is not required for CBA if the household rather than the individual is the relevant unit of analysis. This would be the case if the policy intervention in question mitigates a bad to which the whole household is subject. For instance, this would be the case for a hedonic property price model related to hazardous waste siting. The opposite case, where such an estimate is particularly important, would be in the presence of intra-household externalities. An example of such a case would be health effects for second-hand smoke from tobacco consumption.

More generally, in cases where the policy intervention particularly affects children due to nature/scope of policy (*e.g.* pesticides in school grounds) or because children are particularly vulnerable to this particular hazard (*e.g.* lead in drinking water), then child-specific values are likely to be helpful in ensuring that resources and policy efforts are allocated efficiently.

In conclusion, the VERHI project has provided a large body of evidence on the conditions under which the VSL for children is likely to be most different from that for adults. For instance, it is clear that context matters, but it plays a different role in the case of children and adults. There is less variation across context for children than for adults. Conversely, private interventions and public programmes are valued differently, with a premium placed on the latter for children relative to adults. Exploring such issues in future work is important for efficient policymaking.

Notes

1. In Article 1 of UNICEF's Convention on the Rights of the Child (*www.unicef.org/crc*) it is stated that "a child means every human being below the age of eighteen years unless, under the law applicable to the child, majority is attained earlier". The qualifying clause is in fact of some practical importance. A study by Melchiorre (2004) compares the age at which children can be employed, married, leave the education system, and be taken to court in different countries. It is interesting that there is wide variation, even within OECD countries (*www.right-to-education.org/sites/r2e.gn.apc.org/files/age_new.pdf*).
2. Recent projects include "The German 'Environmental Survey for Children'" (GerES IV), which surveyed almost 1 800 children aged 3 to 14 years of age – obtaining values on environmental exposure and health burdens. In addition, Sweden implemented a national survey of environment-related health issues amongst 30 000 children aged 8 months, 4 years and 12 years. While exposures and burdens were not measured directly, the survey sought perceptions of exposure from the respondents themselves. In the US, the National Children's Study will examine the effects of environmental influences on the health and development of more than 100 000 children across the United States, following them from before birth until age 21. (*www.nationalchildrensstudy.gov/about/overview/Pages/default.aspx*).
3. "The obligations and concerns of others in society toward children are different than those toward other adults" (Hoffmann 2007).
4. In legal parlance, this is referred to as parens partriae. See Hoffmann (2007).
5. Czech values obtained on basis of purchasing power parity exchange rate of 16.9 CZK/EUR.
6. There may be a significant interaction effect between length of latency and age of child, which is not reflected in the estimates of one or the other variable. This can be tested.
7. Interestingly, Dickie and Gerking (2006) argue that one of the reasons why the literature on inter-household financial transfers to adults does not find evidence of paternalistic altruism may be that they do not have control over the consumption decisions of older children.
8. *http://yosemite1.epa.gov/ee/epa/eed.nsf/pages/MortalityRiskValuation.html*.
9. *http://ec.europa.eu/environment/enveco/others/pdf/recommended_interim_values.pdf*
10. Adjustments based upon health status are not suggested given continued uncertainty in this area. Interestingly adjustments for differences in average income across member states are not recommended for both methodological

(uncertainty) and political (subsidiarity) reasons. However, lower values can be used for what were Accession States at that time.

11. See Viscusi and Aldy (2007) for a discussion.

12. In legal parlance, this is referred to as parens partriae. See Hoffmann (2007).

13. Agee and Crocker (2004) discuss the very restrictive conditions under which values might be transferred from adults to children.

14. Indeed, given the widespread use of COI methods in policy evaluation it would be interesting to know if the difference is likely to be greater or less than any difference there might be for WTP figures.

References

European Commission (2009), *Impact Assessment Guidelines* available at (*http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_annex_en.pdf*).

United States Environmental Protection Agency (2003), *Children's Health Valuation Handbook*. Washington DC, EPA.