

# The Value of a Statistical Life Year (VSLY)

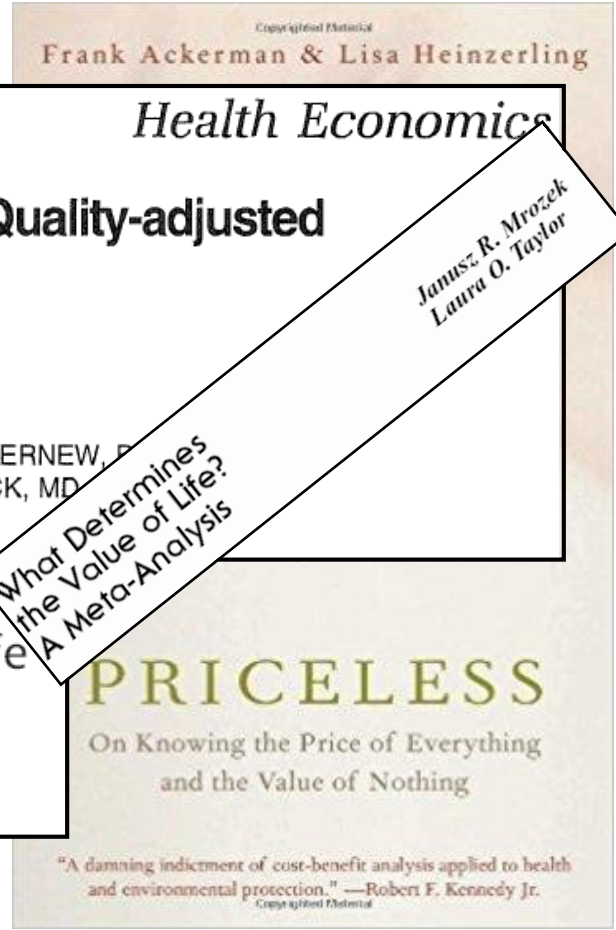
An Analysis of Empirical Economic Studies from 1995 to 2015

**Michael Schlander**, Oliver Schwarz, Diego Hernández, Ramon Schäfer

Presentation to 12th European Conference on Health Economics

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# The Value of (a Statistical) Life (Year)



**Willingness to Pay for a Quality-adjusted Life Year:**  
**In Search of a Standard**

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EDWARD MILLER, MA, A. MARK FENDRICK, MD,  
WILLIAM G. WEISSERT, PhD

COLLECTION REVIEW

**A Systematic Review of Studies Eliciting Willingness-to-Pay per Quality-Adjusted Life Year: Does It Justify CE Threshold?**

Khachapon Nimdet<sup>1</sup>, Nathorn Chaiyakunapruk<sup>2,3,4,5\*</sup>, Kittaya Vichansavakul<sup>1</sup>, Surachat Ngorsuraches<sup>1</sup>

# Benchmarks for Cost Effectiveness

## → Examples of international *de facto* benchmarks:

### → **New Zealand** (PHARMAC):

NZ-\$ 20,000 / QALY<sup>1</sup>

### → **Australia** (PBAC):

AUS-\$ 42,000 / LYG to AUS-\$ 76,000 / LYG<sup>2</sup>

### → **England and Wales** (NICE):

£ 20,000 – £ 30,000 / QALY

### → **United States** (some MCOs):

US-\$ 50,000 – US-\$ 100,000 / QALY<sup>3</sup>

### → **Canada** (proposed “grades of recommendation”):

CAN-\$ 20,000 – CAN-\$ 100,000 / QALY<sup>4</sup>

### → **WHO** (recommendation): 1-3 times GDP/capita / DALY<sup>5</sup>

## → **No scientific basis**

<sup>1</sup>C. Pritchard (2002); QALY: “quality-adjusted life year”; <sup>2</sup>George et al. (2001); LYG: “life year gained”

<sup>3</sup>D.M. Cutler, M. McClellan (2001); <sup>4</sup>A. Laupacis et al. (1992); <sup>5</sup>DALY: “disability-adjusted life year”

# In Search of a Scientific Basis

## → Demand-Side Analyses

- Health Care Programs (or Interventions):  
individual (or “social”) WTP, holistic
- Characteristics of Health Care Programs (or Interventions):  
individual (or “social”) WTP, attributes (and their interaction)
- Quality-Adjusted Life Years (Individual or Social WTP-Q):  
QALY maximization hypothesis; constant proportional trade-off...

## → Supply-Side Analyses

- Efficiency Frontier Approach using PROs (CCA; e.g., IQWiG):  
flexible benchmarks, contingent on therapeutic area  
and rationality of prior pricing and reimbursement decisions
- Quality-Adjusted Life Years (CEA; Shadow Prices; e.g., York, 2013):  
universal benchmark, (in addition to assumptions above)  
also contingent on rationality of health care budget

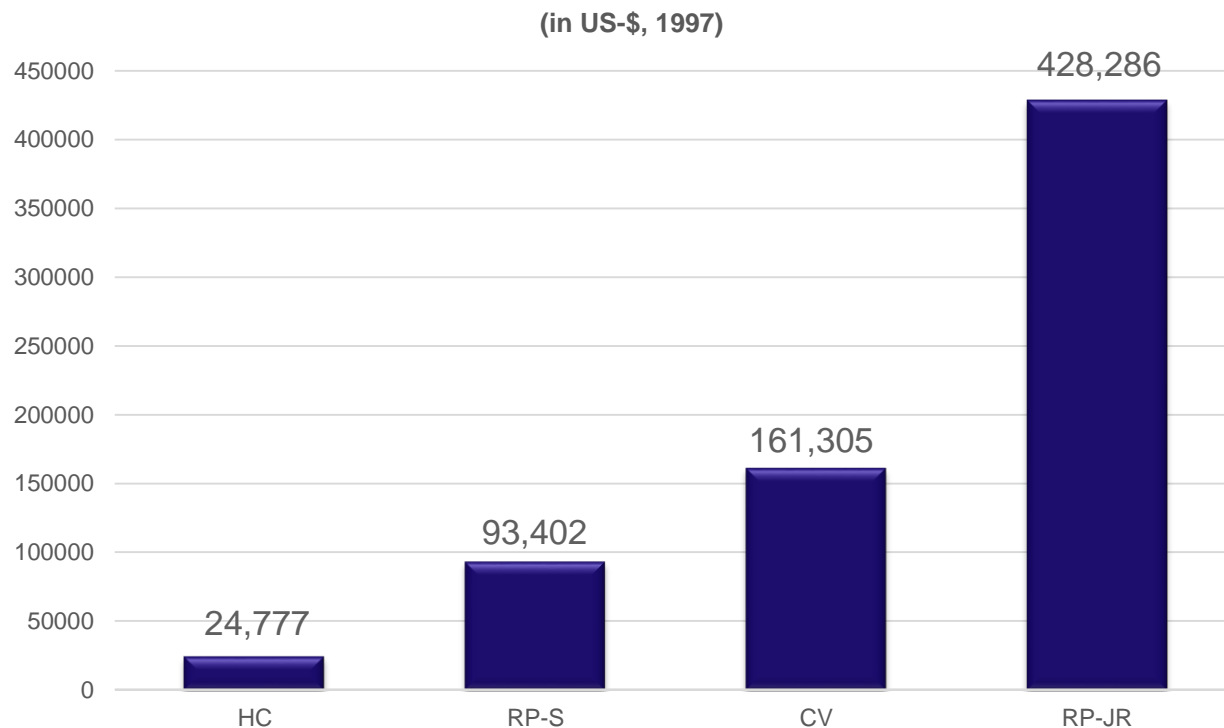
# Answers Proposed by [Health] Economics

## A Typology:

- **Value of a Statistical Life Year (VSLY)**
  - **Human Capital (HC) Approach:**  
resting on productivity, *rejected by modern welfare economics*
  - **Revealed Preferences (RP) Approach:**  
observed human behavior (job risk or non-occupational safety)
  - **Stated Preferences (SP) Approach:**  
direct elicitation of preferences
    - **contingent valuation (CV):** direct or referendum style questions
    - **discrete choice experiments (DCEs):** choice alternatives,  
where the different goods or programs are defined by their attributes
- **Willingness-to-Pay for a QALY (WTP-Q)**
  - With adjustment for reduced average quality of life in later years, WTP-Q may be ~10% greater than VSLY (Hirth et al., 2000)
  - WTP-Q exists only if QALY maximization hypothesis is accepted and normative and empirical grounds for concern are disregarded

## In Search of a Standard (Hirth et al., 2000<sup>1</sup>)

### WTP-Q: Willingness-to-Pay for a QALY



<sup>1</sup>R. Hirth et al. (2000): median based on 35 estimates based on WTP approaches, US-\$ (1997) 265,345. A total of 37 studies (28 of which came from the U.S.) yielded 42 VSL estimates suitable for inclusion in the analysis.

# Research Question

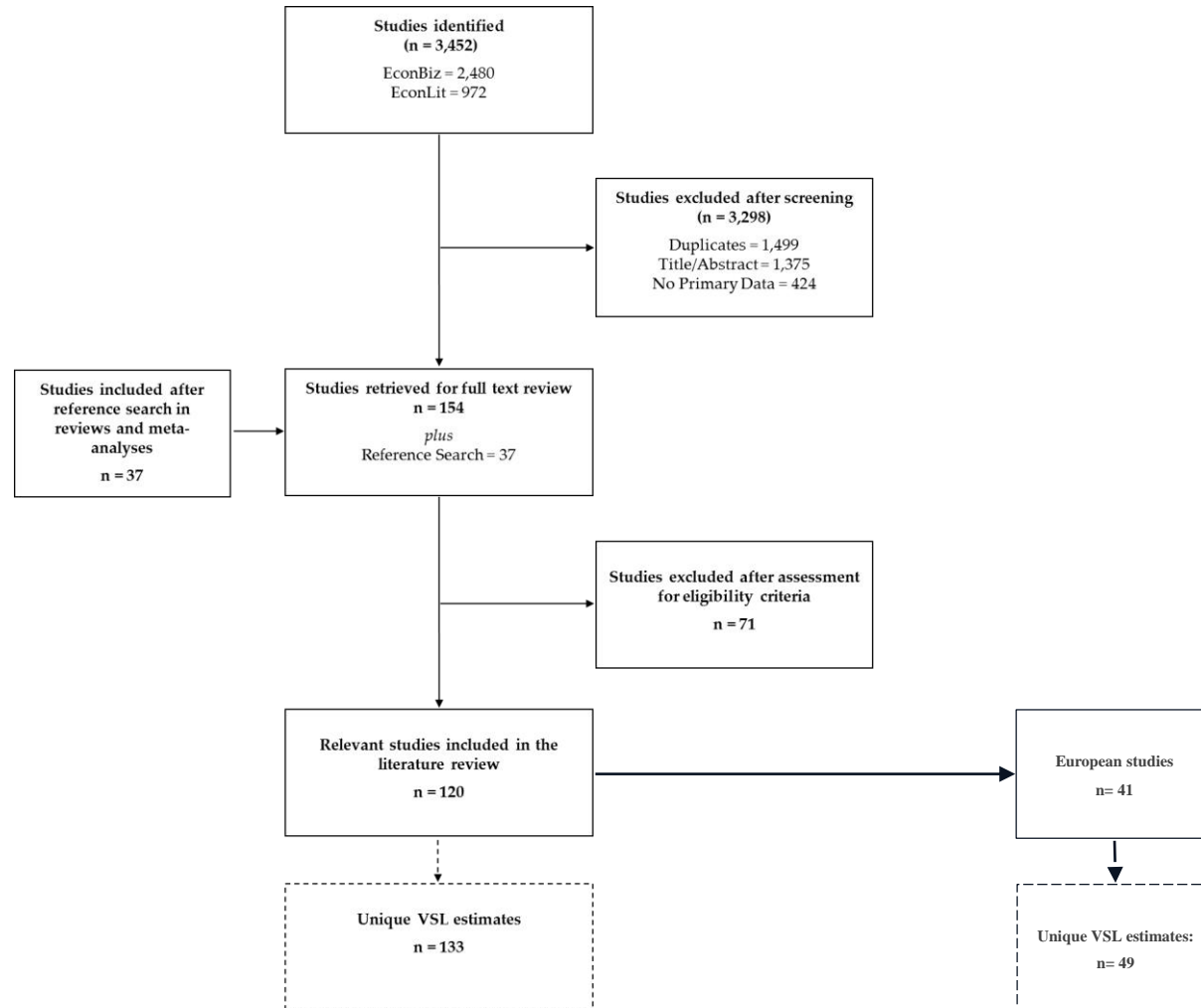
- **What can we learn about the Economic Value of a Statistical Life Year (“VSLY”)**

from empirical studies reporting original data on the Value of a Statistical Life (“VSL”) over the last two decades (1995-2015)?

## [Demand Side Perspective]

- Methodology of empirical studies over the last two decades
- Heterogeneity of estimates, by method and by area of origin
- No adjustment for health-related quality of life; no attempt to derive WTP-Q estimates from VSLY estimates
- No specific review of the Quality-Adjusted Life Year literature
- **Two levels of analysis**
  1. European data
  2. Worldwide data

# Literature Search: Worldwide & European Results





# Computing the VS LY from Reported VSL Data

## Abbreviated calculation procedures:

- VSL (base case or mean for each experimental setting) from study
- Currency reconversion from US-\$ (or else) to LCU (exchange rates)
- VSL inflated to year 2014 using country-specific CPIs
- GDP / capita from year of data generation, inflated as VSL
- Conversion of LCU values for 2014 to Euro (PPPs)

## VS LY computation:

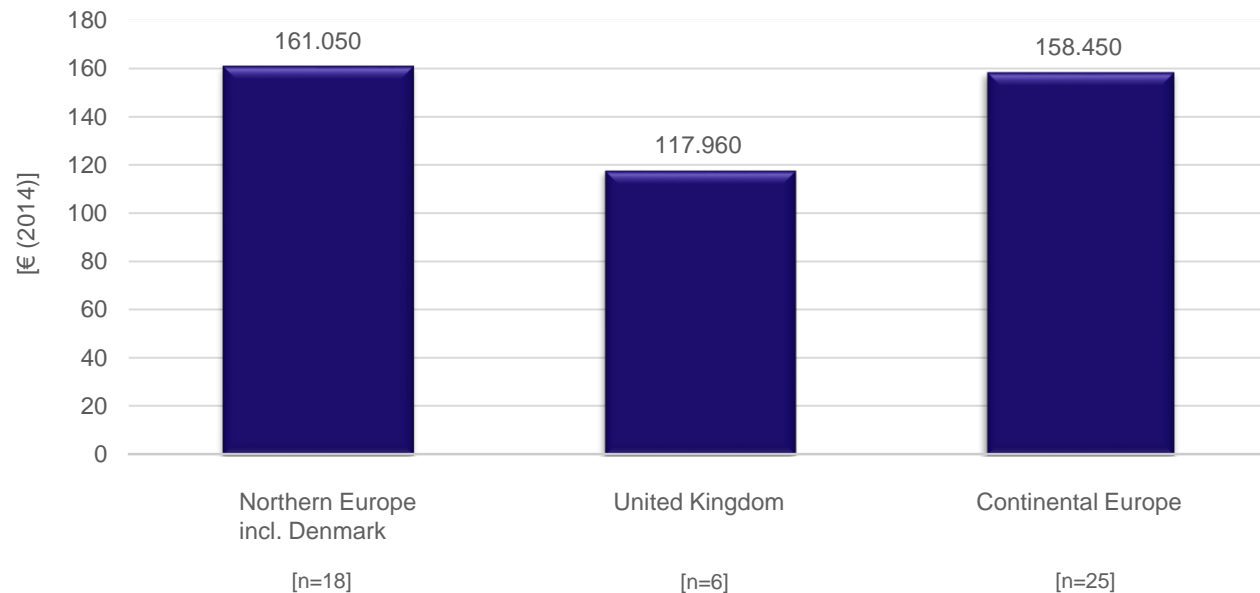
- Calculation separately for men and women, residual life expectancy data from WHO Life Tables by country
- Base case discount rate 3% (for sensitivity analyses, 0% - 10%)
- Formulas:  $VSLY = \frac{VSL \cdot (1 + r)^{t-1} \cdot r}{(1 + r)^t - 1}$  or (for  $r = 0\%$ ):  $VSLY = \frac{VSL}{t}$
- Calculating VS LY average (and range, if data were available), weighted by study population sex ratio

# Value of a Statistical Life Year (VSLY)



## Empirical Results from European Studies (n=41), 1995-2015

### Median VSLY Estimates by Region



Differences n.s.

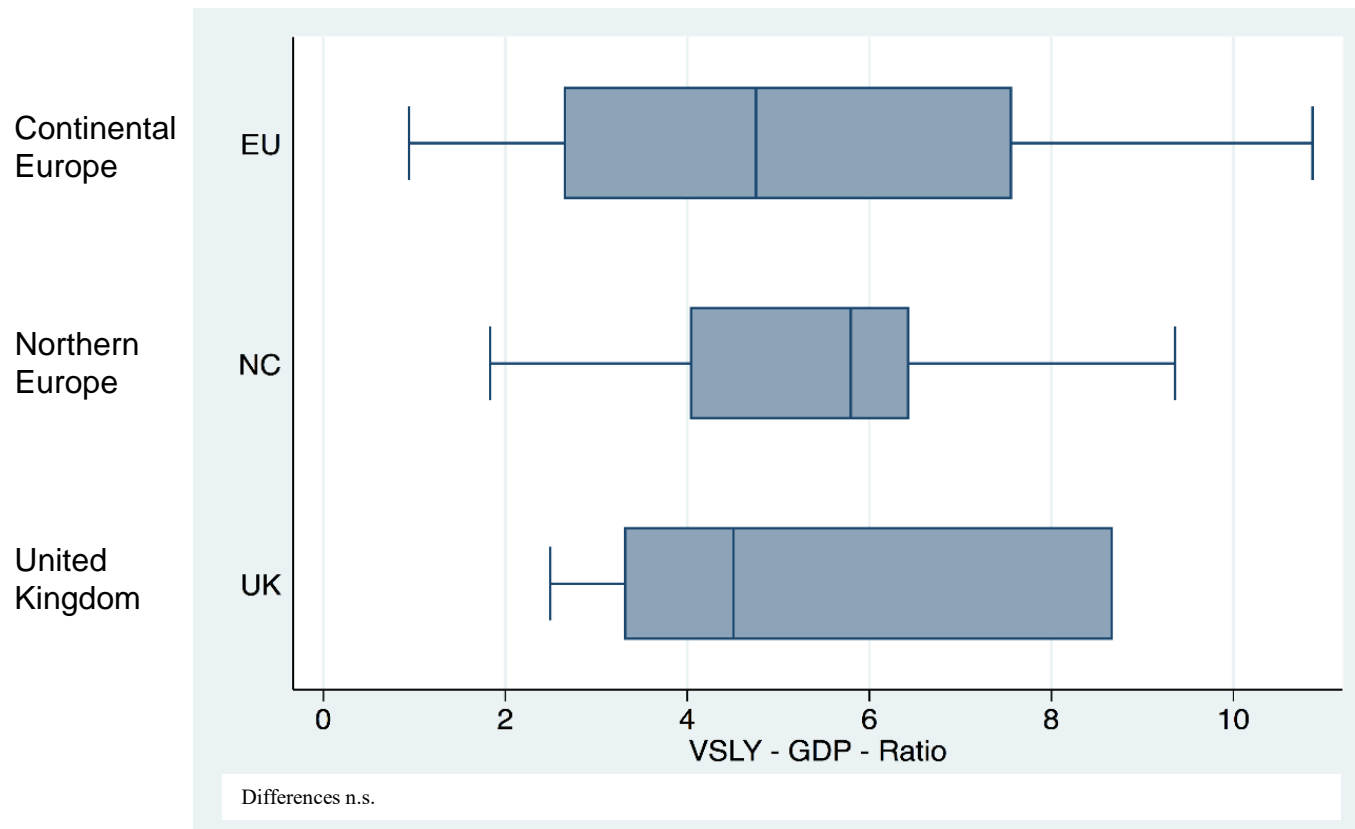
M. Schlander et al. (2017) – analysis based on 41 European economic VSL studies published from 1995 - 2015

# Value of a Statistical Life Year (VSLY)



## Empirical Results from European Studies (n=41), 1995-2015

### VSLY / GDP per capita by Region



M. Schlander et al. (2017) – analysis based on 41 European economic VSL studies published from 1995 - 2015

# Database for Analysis

## → Worldwide data:

### → 120 studies,

yielding a total of 133 unique VSL estimates

### → Regional origin of studies yielding VSL estimates:

Asia (30);

Europe (49);

North America (45), including US (38) and CAN (7);

Other (9), including Africa (2), Oceania (2) and South America (5)

### → Methodological basis of estimates:

HC (0);

RP/WR (49);

RP/NO/Other (11);

SP/DCE (18);

SP/CV (55)

# Value of a Statistical Life Year (VSLY)

## Empirical Results from Economic Studies (WW, n=120), 1995-2015

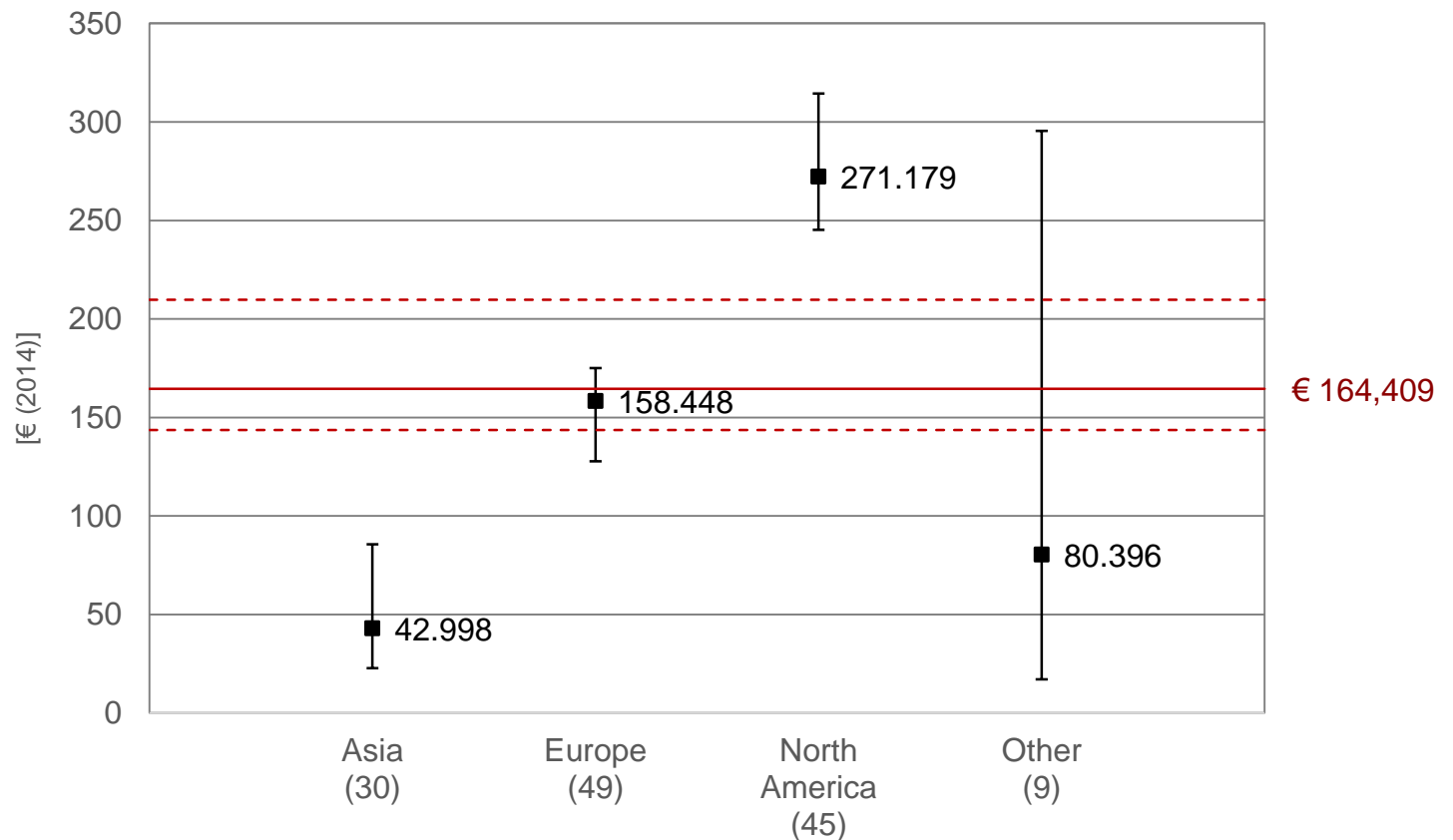
	<b>Mean</b> [€ 2014]	<b>95% Confidence Intervals</b> (nonparametric bootstraps)	
		<b>Lower Bound</b>	<b>Upper Bound</b>
<b>VSL</b>	<b>€ 5,143,050</b>	<b>€ 4,270,455</b>	<b>€ 6,231,312</b>
<b>VSLY</b>	<b>€ 223,428</b>	<b>€ 182,042</b>	<b>€ 272,092</b>

	<b>Median</b> [€ 2014]	<b>95% Confidence Intervals</b> (nonparametric bootstraps)	
		<b>Lower Bound</b>	<b>Upper Bound</b>
<b>VSL</b>	<b>€ 3,827,509</b>	<b>€ 3,125,307</b>	<b>€ 4,847,382</b>
<b>VSLY</b>	<b>€ 164,409</b>	<b>€ 137,413</b>	<b>€ 204,121</b>

# Value of a Statistical Life Year (VSLY)

Empirical Results from Economic Studies (WW, n=120), 1995-2015

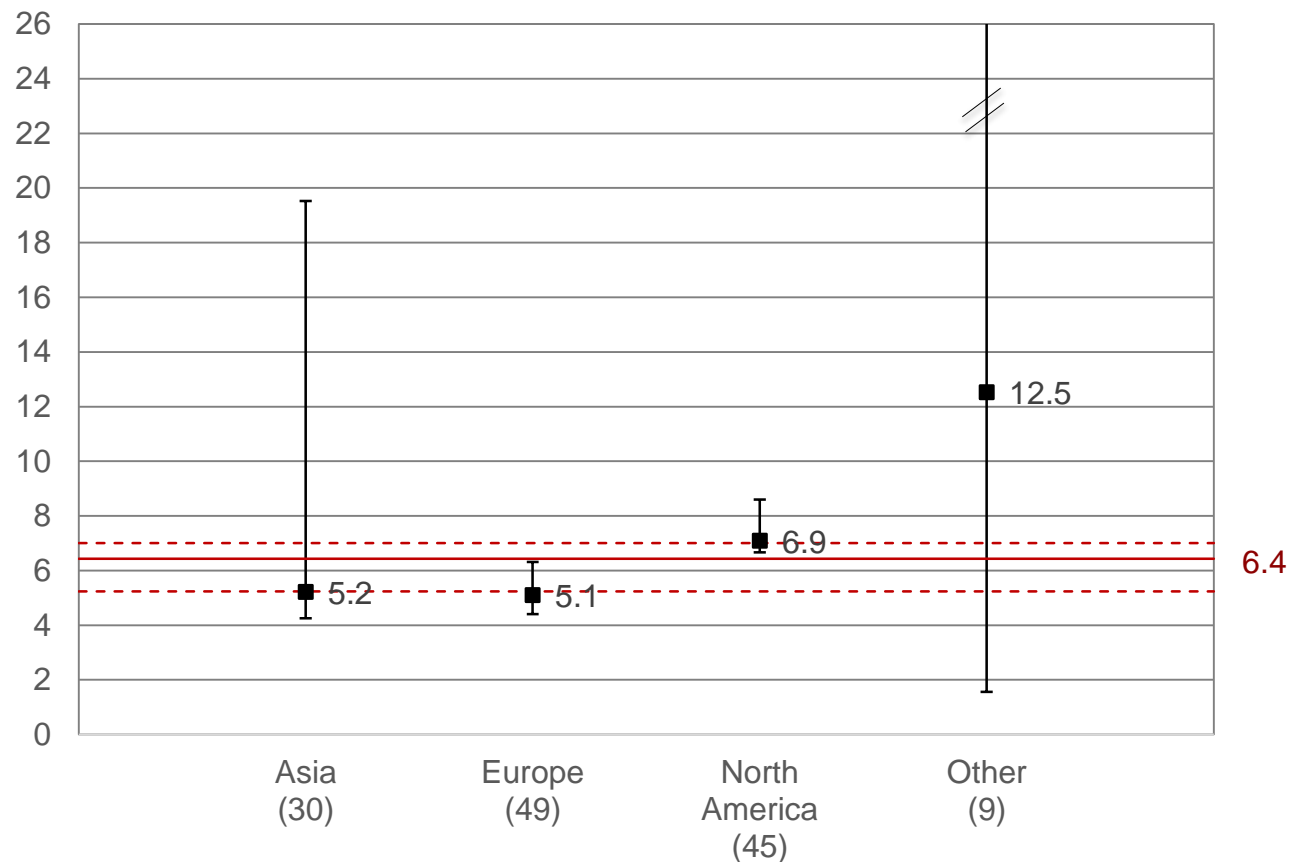
## Median VSLY Estimates by Region



# Value of a Statistical Life Year (VSLY)

Empirical Results from Economic Studies (WW, n=120), 1995-2015

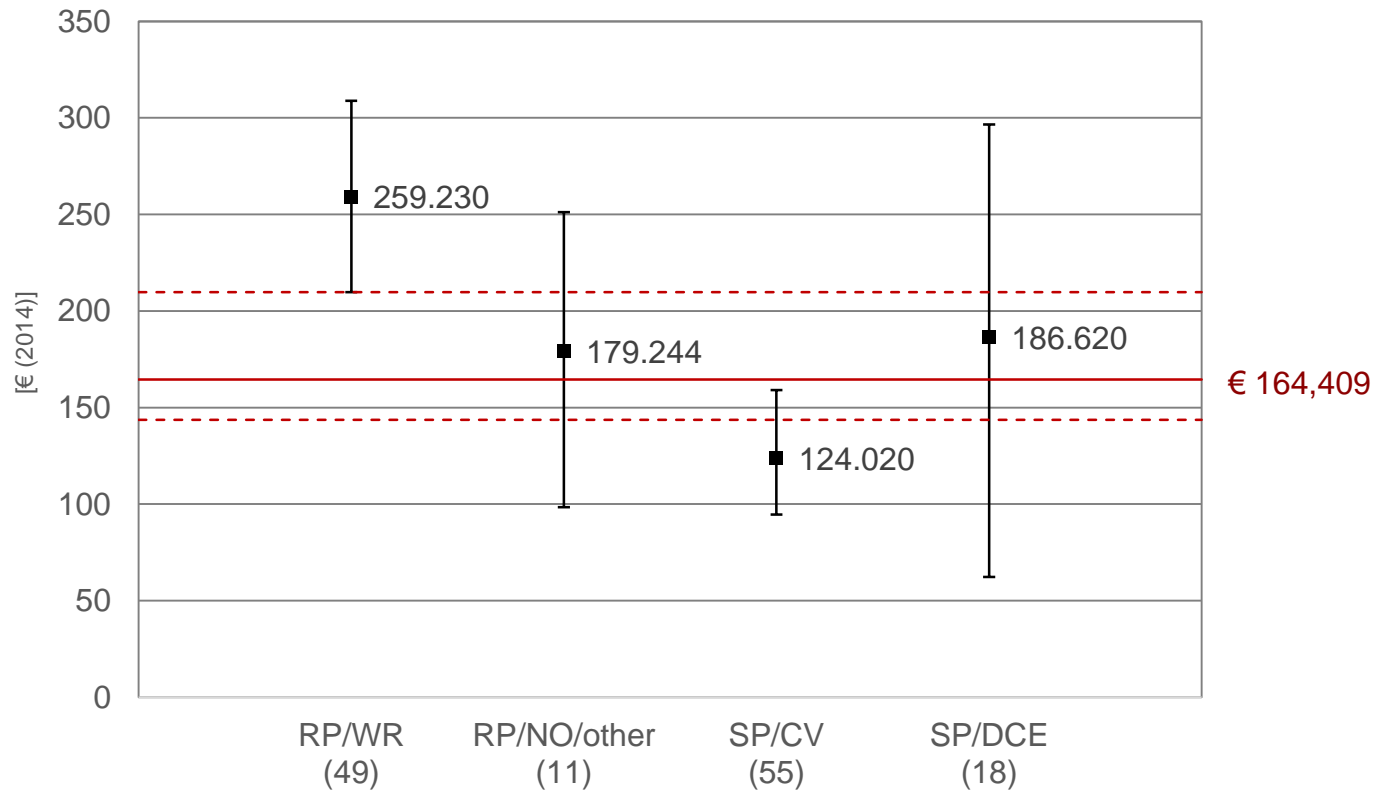
## Median VSLY per GDP/capita by Region



# Value of a Statistical Life Year (VSLY)

Empirical Results from Economic Studies (WW, n=120), 1995-2015

## Median VSLY Estimates by Method

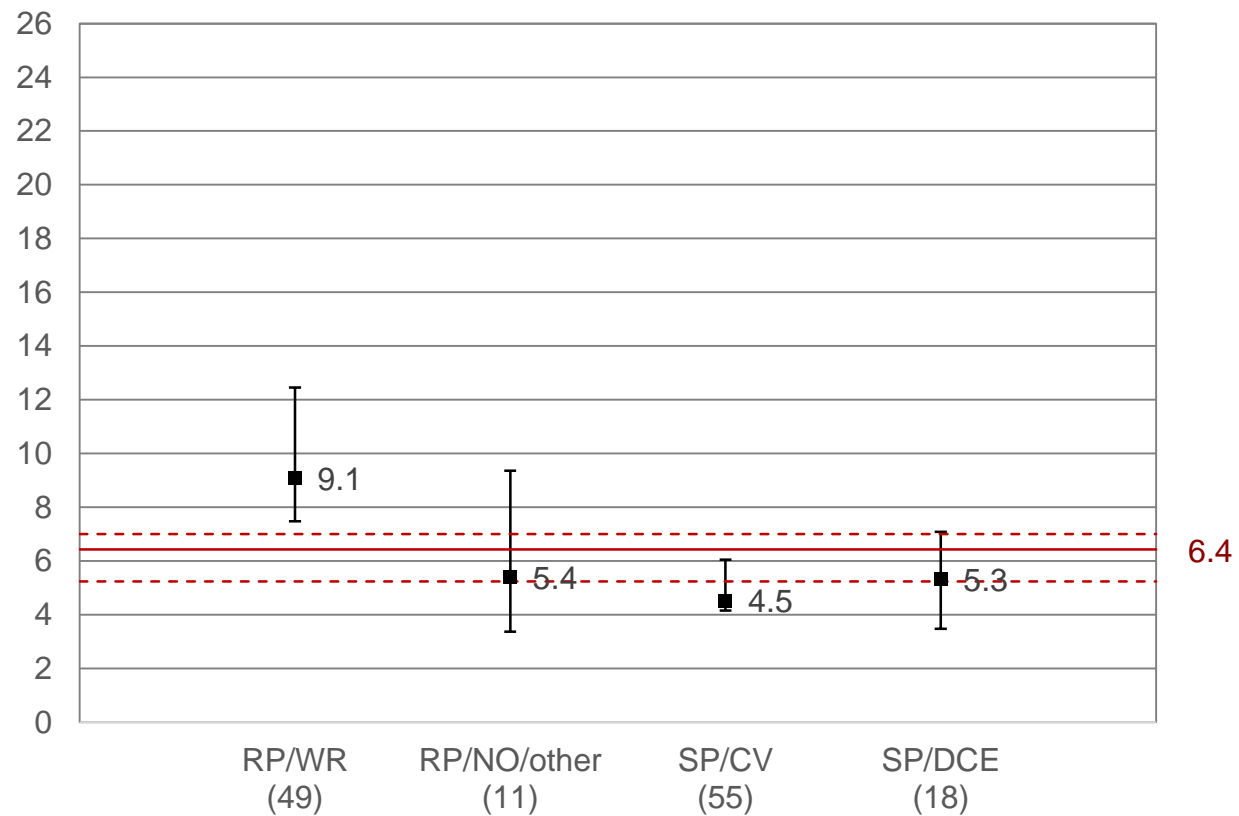




# Value of a Statistical Life Year (VSLY)

Empirical Results from Economic Studies (WW, n=120), 1995-2015

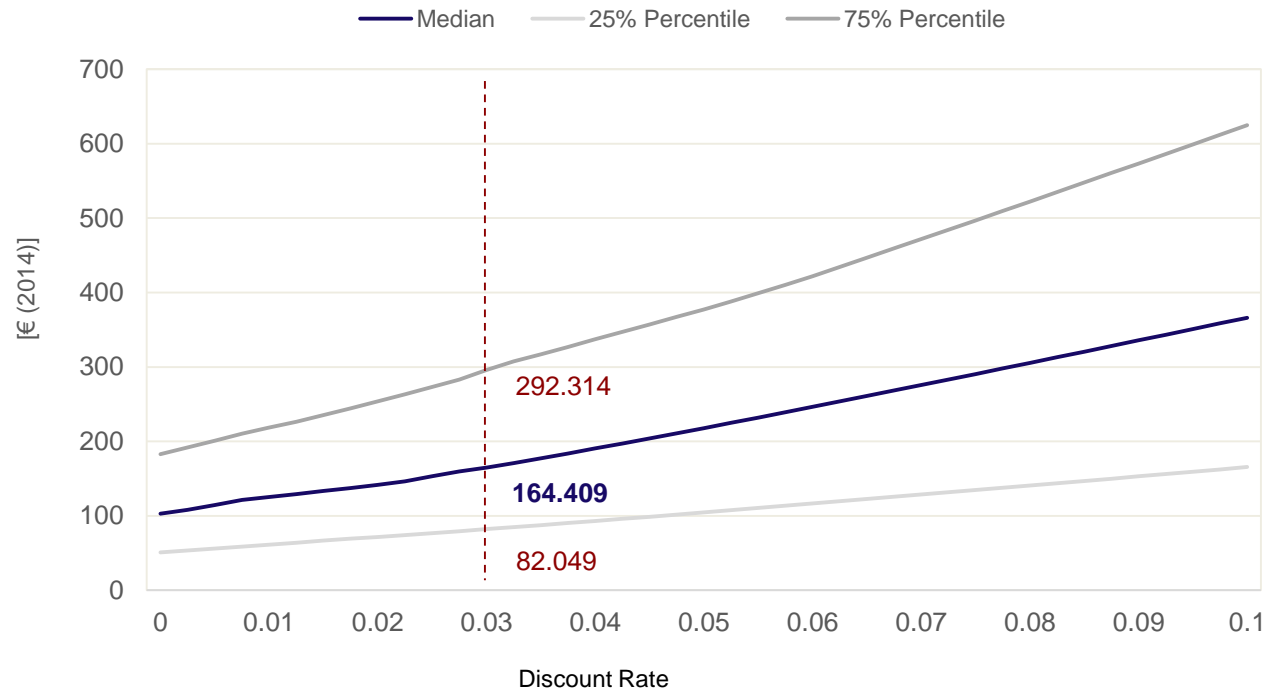
## Median VSLY per GDP/capita by Method



# Value of a Statistical Life Year (VSLY)

Empirical Results from Economic Studies (WW, n=120), 1995-2015

## Sensitivity Analysis



# Value of a Statistical Life Year (VSLY)

## Empirical Results from Economic Studies (WW, n=120), 1995-2015

### Regression Analysis

- **Income** (GDP/capita) in the country of study impacts VSLY estimates positively.
- Studies implemented with a **revealed preferences - wage risk (RP/WR) approach report higher VSLY estimates**, relative to those with a stated preference / contingent valuation or DCE approach (SP/CV; SP/DCE).
- **North American studies report higher VSLY estimates**, compared to those from other regions (*baseline*), even after considering income effects.
- Size of (fatality) risk and study design (cross-sectional vs. panel data analyses) were not significant at conventional levels.

## Implications

**Benchmarks for cost effectiveness (WTP/LYG, WTP-Q) widely used in the context HTAs and health economic evaluations appear to be much lower than the individual willingness-to-pay (WTP) for a life year (or “VSLY”) in other sectors of life, as reported in the relevant empirical economic literature.**

- Potential policy implications will be influenced by the type of health care system in question; for example, a National Health Scheme (NHS) with a politically determined health budget may respond differently compared to a bottom-up financed system.
- We do not intend to suggest a new benchmark for WTP-Q.
- In fact, we believe that there are compelling reasons to reject a universal WTP-Q benchmark on both normative and empirical grounds, unless health care policy makers were prepared to override prevailing social norms and preferences of citizens.