

Valuing nonfatal health risk: Inferring monetary values from QALYs

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Outline

- Components of value of nonfatal risk
- QALYs as a measure of utility (preferences)
- Relationship between WTP and QALYs
 - In theory
 - Stated-preference estimates

Three components of value

- Financial effects
 - Medical expenses, lost income
 - Part born by individual, household, etc.
 - Impoverishment
 - Part born by government, insurance firms, etc.
- Lost productivity (non-market); time cost of medical care
 - Effects on individual
 - Effects on household members
- Pure utility loss (e.g., pain & suffering)
 - Few empirical estimates relative to diversity of nonfatal health outcomes
- Components may interact
 - In principle, should estimate monetary value to individual incorporating all three components
 - Supplement with effects on other parties

Inferring monetary value of utility from QALYs

- QALYs are (arguably) a measure of utility loss
 - Reasonably easy to estimate
 - Estimate monetary value as a function of QALYs?
- What about DALYs?
 - DALYs measure health, not wellbeing
 - Empirically, may be good proxy for QALYs
- QALYs as a measure of preferences for own health
 - Preferences must satisfy several conditions
 - Reasonable on average?
 - Often violated

Quality-adjusted life years

$$QALYs = qt$$

Constant health

$$QALYs = \sum_{i=1}^N q_i t_i$$

Time-varying health

- q = "Health-related quality of life" (HRQL)
 - $q \leq 1$
 - $q = 1$ (full health)
 - Age dependence?
 - $q = 0$ (equivalent to dead)
 - $q < 0$ worse than dead
- t = duration

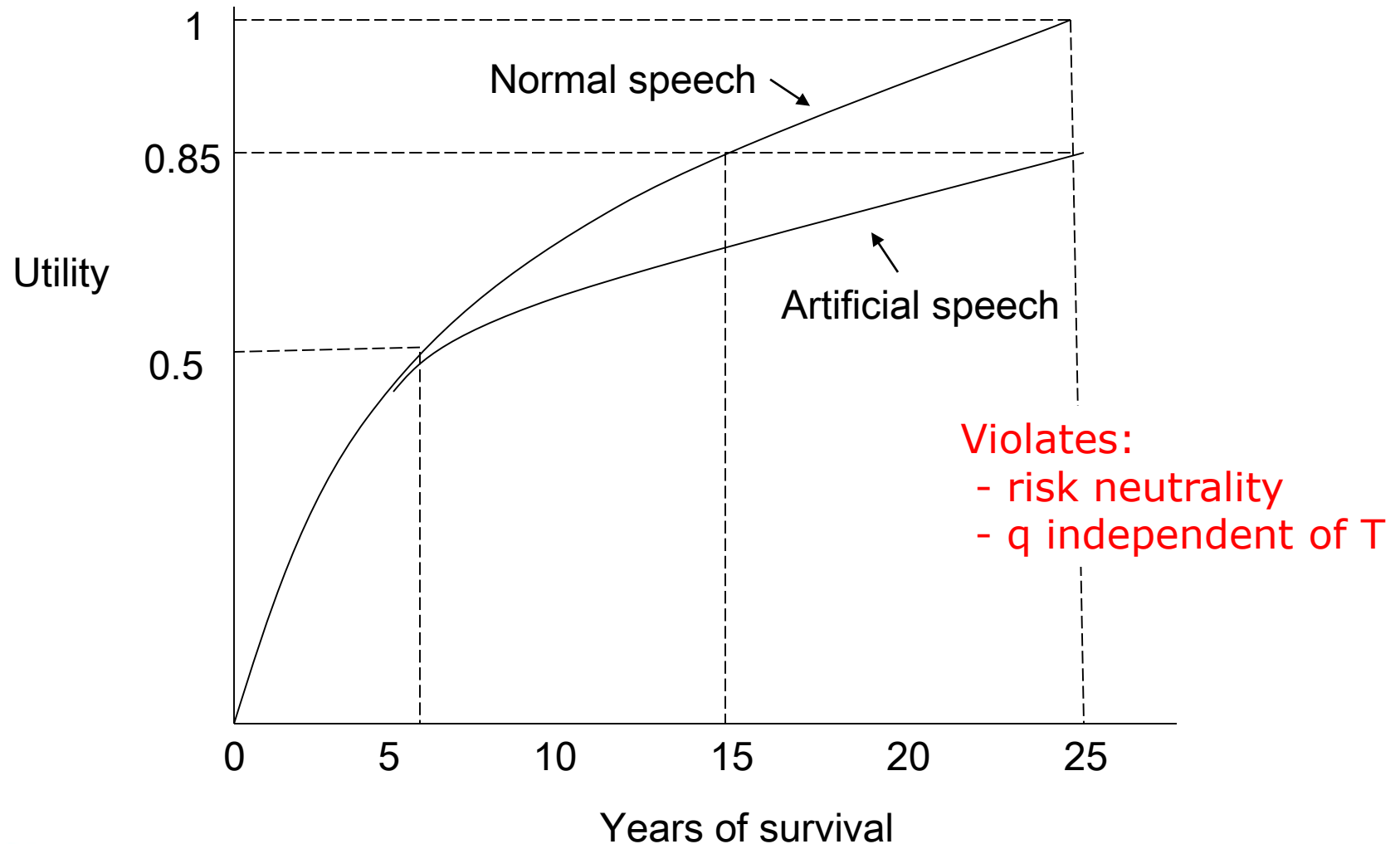
Key assumptions

$$QALYs = qt$$

$$QALYs = \sum_{i=1}^N q_i t_i$$

- q (health-related quality of life)
 - Independent of duration
 - If 40 yrs good health ~ 30 yrs excellent health
 - Then 4 yrs good health ~ 3 yrs excellent health
 - Independent of previous & succeeding states
- t (duration)
 - Utility is proportional to t
 - (or to present value of t)
 - Risk neutral over lotteries on duration
 - 50/50 chance of 0 or 2 days sick ~ 1 day sick for sure

McNeil et al. (1981), "Speech and Survival: Tradeoffs between Quality and Quantity of Life in Laryngeal Cancer," NEJM



Empirical evidence on risk posture (%)

	RN	RA	RS	other
Pliskin, Shepard, Weinstein (1980) N = 10 Harvard health faculty, 1 qx	40	20	40	--
Corso & Hammitt (2001) US N = 865, 4 binary choices	0	14	11	75
N = 610, 5 binary choices	0	13	9	78
3 pairwise choices among 3 shifts to survival curve (same life expectancy)				
Nielsen et al. (2010) N = 129 40 year olds in Newcastle UK	6	22	23	49
Hammitt & Tunçel (2015) N = 1024 French general population	23	14	16	47

WTP per QALY

- **If**
 - Individual preferences for own health are consistent with QALYs
 - Value of additional wealth is larger if one survives than dies (i.e., as bequest)
- **Then**
 - Marginal WTP per QALY is a decreasing function of QALYs
 - WTP / QALY decrease with QALYs

Eliciting WTP to reduce nonfatal risk

- Two stated-preference studies
 - US internet panels
 - WTP to reduce risk by 1 / 10,000 to 3 / 10,000
 - Per meal or per year
- Acute illness (1, 3, 7 days) from food contaminants
 - Described symptoms, elicited HRQL
- Chronic illness (1 month, 1 year, rest of life) from environmental pollution
 - Described illness using health-state classification system (EQ-5D) which predicts HRQL
- Results:
 - WTP increases with QALY gain, at sharply decreasing rate
 - WTP per QALY decreases with QALY gain

Regression results

	Acute	Chronic
Log risk reduction	0.52 *** (0.05)	1.01 *** (0.23)
Log HRQL loss	0.20 *** (0.05)	0.34 *** (0.09)
Log duration	0.11 ** (0.05)	0.13 *** (0.03)
N	4851	2343

***, ** denote significantly different from zero at 1 and 5%, respectively

Elicited & implied values (\$)

Δq	t	WTP	Value / case	Value / QALY	Implied WTP	Value / case
0.1	1 day	1.36	6,800	24,800,000	0.03	132
0.9	1 day	2.10	10,500	4,250,000	0.24	1,180
0.1	7 days	1.67	8,300	4,350,000	0.18	921
0.9	7 days	2.57	12,900	745,000	1.66	8,290
0.1	1 month	79	524,000	62,900,000	0.60	4,000
0.9	1 month	170	1,140,000	15,100,000	5.40	36,000
0.1	40 yrs	165	1,100,000	275,000	168	1,118,000
0.9	40 yrs	357	2,380,000	66,200	1,510	10,060,000

Implied values: VSL = \$9.3m, $r = 3\%$, LE = 40 yrs \rightarrow WTP / QALY = 480k

Values per case plausible for severe, not for milder cases?

Conclusions

- WTP not proportional to QALYs
 - Increasing but strongly concave function of QALYs
- Can WTP be reliably predicted using a more elaborate function of severity, duration (and context)?
 - Different values for different QALYs?
- Should we force consistency (constant value per QALY)?