PCR139

Accounting for Risk Aversion in Health Technology Assessment: Utility Over Multiple Health Indexes in Non-Small Cell Lung Cancer

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BACKGROUND

- Generalized Risk-Adjusted Cost-Effectiveness (GRACE) relaxes restrictive assumptions of traditional cost-effectiveness analysis (CEA) such as risk-neutrality over health
- Yet, practical implementation is limited by reliance on visual analog scale (VAS)-based health scores and general-population risk preference estimates

OBJECTIVE

- This study aims to directly estimate utility functions for patients with non-small cell lung cancer (NSCLC) and to establish an empirically grounded mapping between time trade-off (TTO) and VAS health indexes

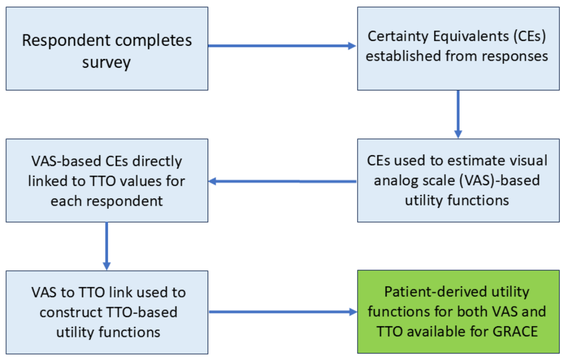
METHODS

Overview:

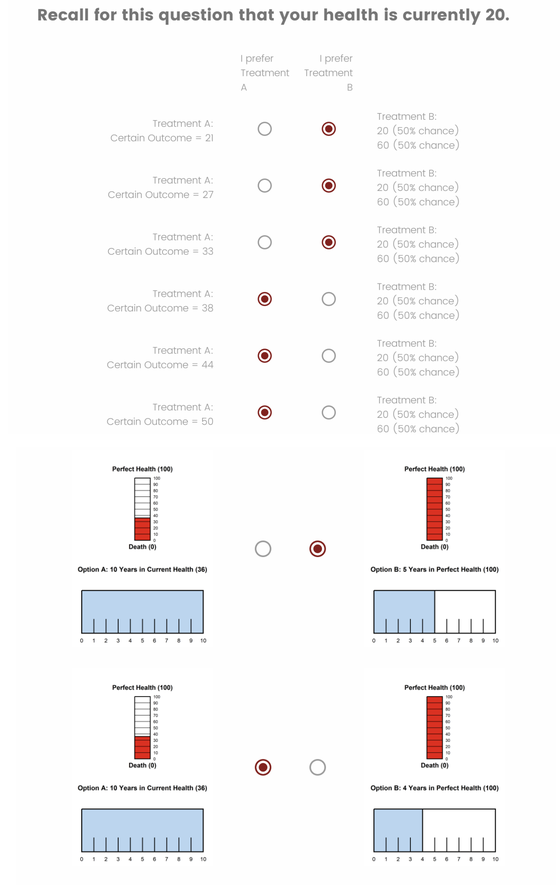
- Patients with NSCLC recruited via survey sites and Norris Center; demographic & clinical characteristics recorded
- Respondents then complete survey containing 6 hypothetical health gamble scenarios based on VAS, then 6 standard TTO questions

How It Works:

- Survey elicits preference between certain and risky health outcomes when offered various treatment options
- The point where patients are indifferent between certain and risky options reveals a certainty equivalent (CE)
- CEs used to estimate utility functions over health via three parametric models under expected utility theory
- Standard TTO questions fielded at each corresponding CE to link VAS index to TTO within study



METHODS



Risk Preference Section (Based on VAS)

- For 6 hypothetical health gamble scenarios leveraged from Mulligan et al. 2024, certainty equivalents (CEs) elicited via choice between certain outcome (A) or risky prospect (B)
- In both, subjects are told to imagine health as increasing in a number ranging from 0 (death) to 100 (perfect health)
- Respondents are also told to imagine being 40 years old with usual health equal to 100, and to imagine further that their health deteriorates to specified level 20 out of 100
- Respondents are told that treatments would change their health for one year, after which time it would return to 100
- Switch point from treatment B to A indicates CE → **In this example, CE would be 35.5 (midpoint of 33 and 38)**

Time Trade-Off (TTO) Section

- 6 standard TTO questions fielded; one at each of the CEs identified for each respondent (in this case, 36 after rounding)
- Asked to choose between Option A: Living 10 years in impaired health state <100, followed by death, vs. Option B: Living x years in full health (100), followed by death
- Top-down titration approach, with duration in full health decreased in whole-year increments (9, 8, 7…0) until switch from Option B to A, aligning closest with EQ-VT protocol
- Slider then presented to get more granular estimates

Estimating Utility Functions over Health

- CEs from survey to be used to structurally estimate parametric utility functions under expected utility theory as follows
- Using Constant Relative Risk Aversion (CRRA) as an example, utility (W) over health (H) can be represented as:

$$W(H) = \frac{H^{1-\rho}}{1-\rho}$$

- We can then rescale so that $W(H) = H^{1-\rho}$, so that $W(1) = 1$
- Since utility from CE is same as that of gamble:

$$H_{CE}^{1-\rho} = \frac{1}{2}\bar{H}^{1-\rho} + \frac{1}{2}\underline{H}^{1-\rho}$$

- Here, H, $\bar{H}$, and $\underline{H}$ depict health level, and that of the high and low outcome, respectively
- Next, ρ can be estimated using nonlinear least squares (NLLS) via the estimating equation:

$$H_{CE,i} = \left(\frac{1}{2}\bar{H}^{1-\rho} + \frac{1}{2}\underline{H}^{1-\rho}\right)^{\frac{1}{1-\rho}} + \epsilon_i$$

- When ρ is estimated, so is the utility function
- Same approach for estimating utility under other structures (1- and 2-parameter expo-power [EP])

3 utility functions estimated:

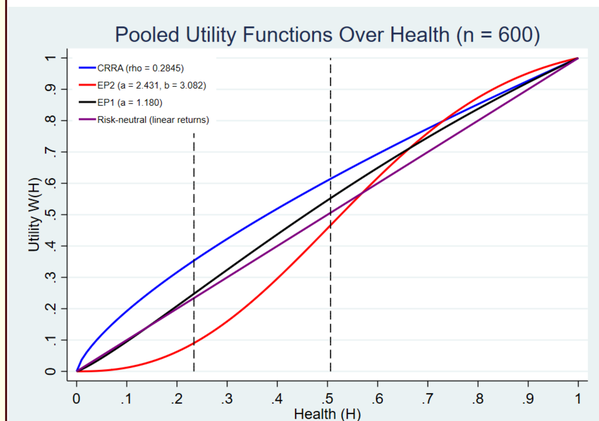
- $W^{CRRA}(H) = \frac{H^{1-\rho}}{1-\rho}$
- $W^{EP2}(H) = c - \exp\{-bH^a\}$
- $W^{EP1}(H) = c - \exp\{-\frac{H^a}{a}\}$

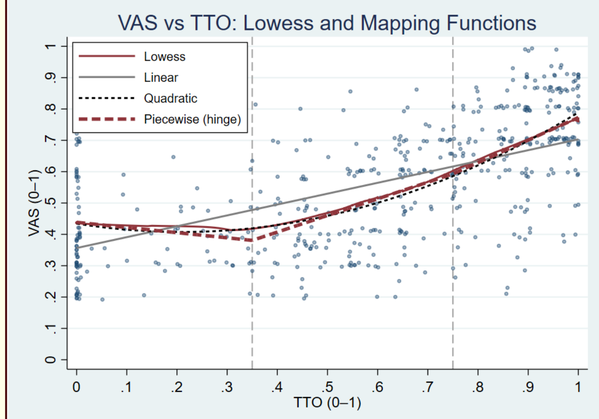
Mapping TTO to VAS

- Estimated empirical mappings from TTO values to VAS-based CEs using linear, quadratic, and piecewise-linear specifications
- Tobit and fractional logit models were evaluated as robustness checks

RESULTS

- Interim sample comprised 128 respondents (100 post-exclusion), yielding 600 pooled observations across tasks
- Across all utility specifications, respondents exhibited nonlinear returns to health, inconsistent with risk-neutrality
- The two-parameter EP model provided the best fit, indicating risk-seeking behavior at lower health levels and a switch to risk aversion above health levels of 0.51 (on a 0-1 scale)
- Piecewise-linear mapping captured nonlinearity while similar to linear and quadratic models over range of ~ 0.3-0.8





CONCLUSION

- We find clear departures from risk-neutrality over health assumptions, further suggesting that traditional CEA likely biases value assessment conclusions
- Despite alignment of patient and general-population risk preferences, tradeoffs between quality & length of life differ
- We establish a link between TTO and VAS that expands these general utility functions over multiple health indexes, providing flexibility to conduct GRACE in an array of contexts