

Time-tradeoff Utility Assessment with Equal Horizons: Would You Prefer “Good then Bad” or “Moderate”?

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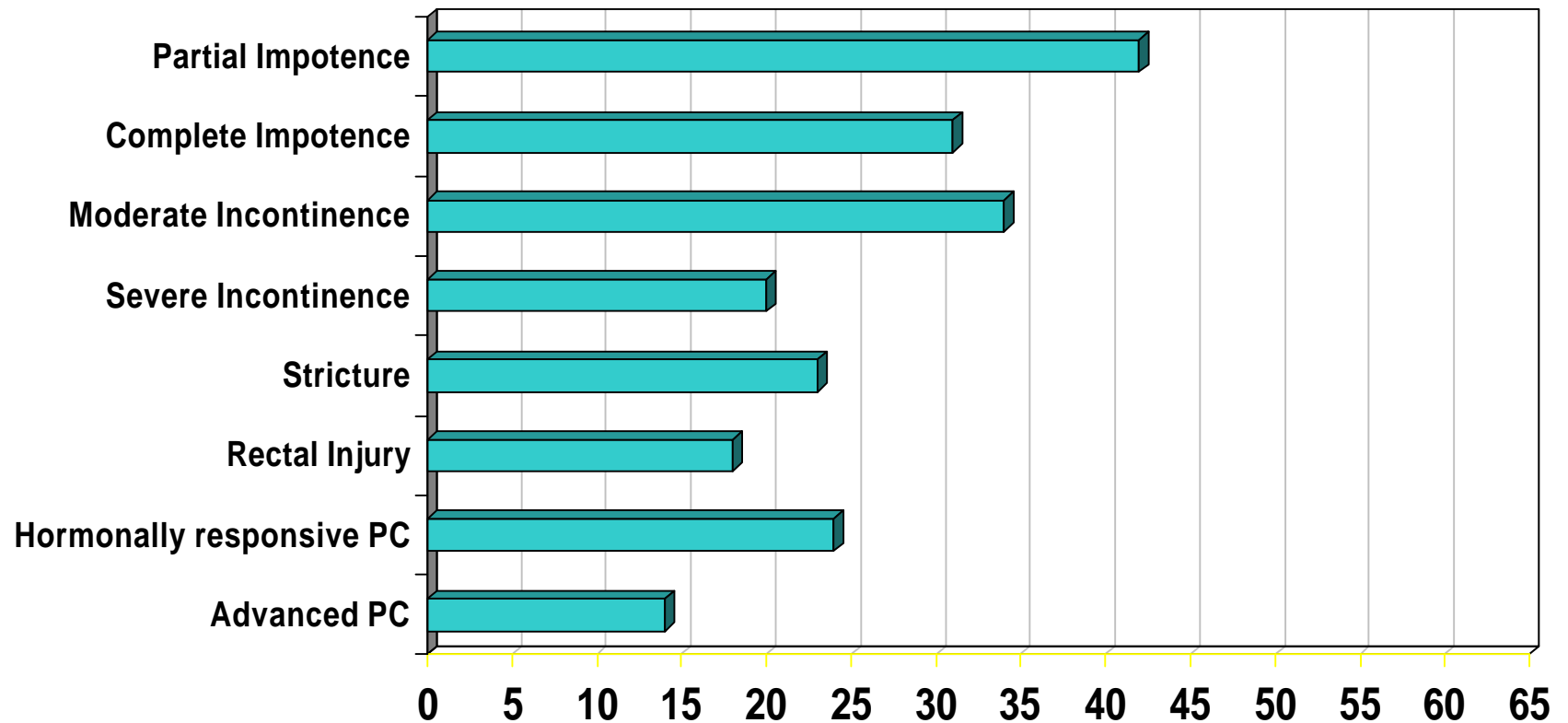
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Problem Statement

- **Health state utility assessment**
 - **To assess utility of spending time in a health state, we measure individuals' utilities.**
 - **We have two commonly used methods**
 - **Standard Gamble**
 - **Time Tradeoff**
- **Problem**
 - **A significant portion of people do not “play the game”.**

Percentage of Husbands Unwilling to Trade Time for each Health State Related to Prostate Cancer Treatment

Graph from Volk, Cantor, Cass, and Spann, SMDM, 2000



Problem: People won't gamble, trade.

- **Standard gamble method**
 - **But some people will not gamble, so $u = 1.0$.**
- **Time tradeoff method**
 - **But some people will not trade, so $u = 1.0$.**
- **A method without this problem:**
 - **Rating with visual analogue scale**
 - **People happily use the whole scale.**
 - **But there is no theoretical reason to think their answers are utilities.**

Implications for utility assessments of health states

- **Implication of not trading or not gambling:**
 - A utility of 1.00 is assigned.
 - This undervalues the suffering of the health state.
 - E.g., no research funds would be spent to cure it, because you cannot get any better.
- **Implication of low Visual Analogue Scale ratings.**
 - Very low utilities are assigned.
 - This overvalues the suffering of the health state.
 - E.g., too many research funds would be spent to cure

Solution for the “they won’t play” problem: A new method?

- **Goal: To develop and test a method**
 - **Compared to SG and TTO, fewer people would refuse to gamble, or to trade.**
 - **Compared to VAS ratings, the utilities would be more realistic.**
- **Context: A study evaluating materials informing men about advantages and disadvantages of prostate cancer screening.**

Proposed method: Time in State Tradeoff (TISTO).

- **To evaluate a moderately unhealthy health state, subject has a choice between**
 - a length of time in the moderately unhealthy state
 - or being healthy for a period, and then having a shorter length of time in a worse health state.
- **No risk of immediate death (compare to SG)**
- **No shortening of life, for both choices have same length (compare to TTO)**
- **Choice provides motivation to take task seriously**
 - (compared to rating on a 1 to 10 scale)
- **We compared TISTO with SG, TTO, and Visual Analogue Ratings.**

Rating Judgment

- **Assign a number to:**
M
- **No time line.**
- **Verbal description.**
- **Participant response:**
 - **Rating on a 0 to 10 visual analogue scale.**



Verbal Description: Uncontrollable Metastatic Prostate Cancer

- **In uncontrollable metastatic prostate cancer, the cancer has metastasized (spread) to other parts of the body, such as:**
 - **Pelvis and spine which causes pain in the legs and back**
 - **Skull which causes severe headaches and sinus pain**
- **Complications and side effects:**
 - **Medication to control pain is not very effective and can make it difficult to pay attention.**
 - **Bones become brittle, problems initiating urination, and fatigue**
 - **The patient may need to spend much of his time resting and need assistance with many daily activities such as dressing, washing, or using the toilet.**
 - **The doctor may try to alleviate symptoms with surgery or medication, this can cause:**
 - **nausea and vomiting**
 - **incontinence (inability to control urine)**
 - **impotence (inability to have an erection)**

Utility derived from rating judgment

- **Stimulus**

M

- **Response**

r(M), rating on 0 to 10 scale

- **Utility**

$$u_{Rating}(M) = \frac{r(M)}{10}$$

Standard Gamble (SG)

Visual aids: Life line ruler, probability wheel.

- Compare this life with certainty (length = LE)

PPPPPPPPPPPPPPPPMMMM

- to a gamble with a $1-p$ chance of living with perfect health until your life expectancy LE

PPPPPPPPPPPPPPPPPPPP

- and a p chance of dying at an earlier time (LS) after a life in perfect health.

PPPPPPPPPPPPPPPP

- Adjust the probability ‘ p ’ until indifferent.
- $b(M)$ is fixed.
 - It could be at 0 (the beginning).
- LS is fixed

INFORMS 2000 We set $LS = b(M) = 15$.

Utility derived from Standard Gamble

- **Stimulus:**

b(M) LE

PPPPPPPPPPPPPPPPMMMM

- **versus**

(1-p) PPPPPPPPPPPPPPPPPPPPP

(p) PPPPPPPPPPPPPPPPP

LS

- **Response: p, the probability of the shorter life**

- **Utility:**
$$u_{SG}(M) = \frac{p * LS + (1 - p) * LE - b(M)}{LE - b(M)} * u(P)$$

Time Trade Off (TTO)

Visual Aid: 2 life line rulers

- Compare this life with certainty (length = LE)

PPMMMMMMMMMMMMMMMM

- with this life with certainty (length = LS)

PPPPPPPPPPPPPP

- Participant adjusts LS until indifferent.

- $b(M)$ is fixed.

- It could be at 0 (the beginning).

Utility derived from Time Tradeoff

- **Stimulus:**

b(M)
LE
PPPPPPMMMMMMMMMMMM

- **versus**

LS
PPPPPPPPPPPPPPPP

- **Response: LS, the length of the shorter life**

- **Utility:**

$$u_{TTO}(M) = \frac{LS - b(M)}{LE - b(M)} * u(P)$$

Time in State Tradeoff (TISTO)

Visual Aids: 2 life line rulers

- Compare this life with certainty (length = LE) and fixed $b(M)$

PPPMMMMMMMMMMMMMM

- with this life with certainty (length = LE)

PPPPPPPPPPPPPPPPWWW

- Participant adjusts $b(W)$ until indifferent.
- $b(M)$ is fixed.
 - It could be at 0 (the beginning).
- The method's result, $u(M)$, also depends on a separate estimate of $u(W)$. "Chaining".

Utility derived from Time in State Tradeoff

- **Stimulus:**

$b(M)$ LE
PPPPPPMMMMMMMMMMMM

- **versus**

$b(W)$ LE
PPPPPPPPPPPPPPPPWWW

- **Response: $b(W)$, the length of the worst health state**

- **Utility:**
$$u_{TISTO}(M) = \frac{(b(W) - b(M)) * u(P) + (LE - b(W)) * u(W)}{LE - b(M)}$$

– $u(W)$ is from SG or TTO or Rating or combination

Summary: Notable Features of our Utility Assessments

- **SG, TTO, and TISTO**

- **Life stream display. Makes perspicuous the characteristics of the experience of the health state through time.**

PPPPPPPPPPPPPPPPPPPPPP

- **Compare to “20 years in perfect health”.**

- **Imperfect health states don’t begin immediately.**

PPPPPPPPVVVVVVVVVVVVVV

- **$b(W) > 0$.**

- **LS in standard Gamble > 0 . No chance of “immediate death”.**

- **Metastatic Prostate Cancer: starts 15 years in future.**
- **(Blindness: assessed in usual manner, over full range of 20 years.)**

- **TISTO**

- **LE the same in both options.**
- **Requires chaining. If $u(W)$ from other method is 1.0, then TISTO utility would also be 1.0.**

Description of study

- **Purpose: Evaluation of materials informing men about advantages and disadvantages of prostate cancer screening: does it affect their behavior?**
- **Utility Assessment is done for comparison of their behavior with an individualized decision analysis.**
 - **Do those who SHOULD GET screened, GET screened?**
 - **$u(\text{screening}) > u(\text{not screening}) \implies$ should get screening**
 - **Half do UA now, half at 6 months**
 - **Half have spouse invited to participate.**
 - **She does UA separately, same time he does.**
- **Data so far: 147 men, 30 spouses, W and AA, 40-70**
- **UA for 64 men, 12 spouses**
- **Order: Rating, TTO, TISTO, SG.**

Method: Standard Gamble

- **Three health states assessed. (LE = 20)**
 - **Blind in one eye starting now**
 - **Blind in both eyes starting now**
 - **Uncontrollable metastatic prostate cancer (description provided) for 5 years, starting 15 years from now.**
- **For the blindness assessments, the gamble was between death at 20 years and death immediately.**
- **For metastatic PC, the gamble was between death at 20 years and death at 15 years.**
 - **In effect, we moved a typical SG (evaluating 5 years of uncontrollable metastatic prostate cancer) off 15 years into the future.**

Results: Standard gamble utilities

- **What was effect of moving the bad health state starting point off 15 years into the future?**

- **Blind: start now**
- **Metastases: start 15 years in future.**

- **Only 1 refused to gamble.**
 - **Cannot determine if it is that $u(\text{blindness}) > u(\text{met PC})$, or that death in 15 years is less aversive than death in one year. I think the latter.**

	Mean SG utility	# equal to death	# in expected range	# refuse to trade or gamble
Blind in 1 eye	0.86	0	50	26
Blind in 2 eyes	0.65	5	62	8
Uncontrolled metastatic prostate cancer	0.31	30	45	1

- **30 said Met PC is as bad as death.**

- Had reasons for what they said
- Very different from usual Standard Gamble results: seldom does the subject set at 100% the $p(\text{early death})$ that makes the gamble equivalent to the sure thing.

Results: Time Tradeoff

- **What was effect of moving the beginning of the health state (metastatic PC) 15 years into the future?**

Mean utility	# worse than death	# equal to death	# in expected range	# refuse to trade or gamble
-0.16	29	11	30	6

- **6 still refused to trade**
- **11 said “let me die at the beginning of the metastatic PC period.**
- **29 said “I would trade off some extra good years, to avoid 5 years of metastatic PC”. Utilities went as low as -3 (trading 15 extra good years)**
- **Not a successful method variant.**
 - **Constrain tradeoffs: no more than amount at risk?**
 - **But they are telling us something! (Met PC is worse than death.)**

Results: Time in State Tradeoff

- What was effect of
 - Fixing LE equal
 - Comparing M state to W state
 - Chaining with $u_{SG}(W)$

	Mean utility	# worse than death	# equal to death	# in expected range	# refuse to trade or gamble
Impotence	0.91	0	0	47	29
Mild incontinence	0.92	0	0	53	23
Severe incontinence	0.88	0	0	59	17
Watchful waiting	0.95	0	0	46	30
Hormone therapy	0.88	0	1	55	20

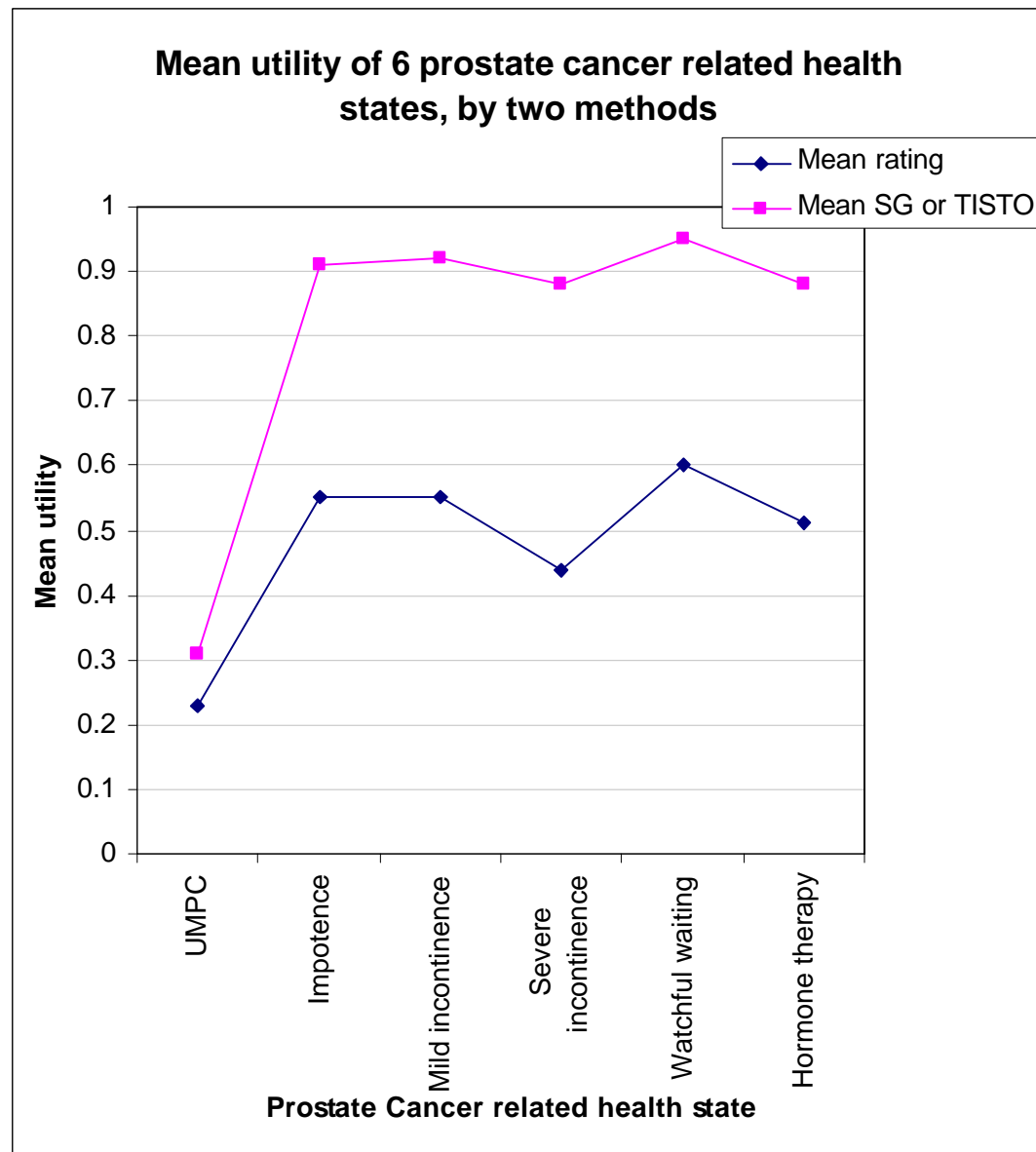
- Refusal to trade not due to dependence on SG
 - Only 1 had $u_{SG}(W) = 1$.
- Refusal to trade not due to religious prohibition on suicide.
- Participants clearly articulated that they would rather have M than any W.

**Females were more likely than males not to trade and not to gamble.
Same as Volk et al found with TTO.**



Results: Visual Analogue Scale Ratings

- Compare VAS rating with SG (for met PC) and TISTO (for other 5 health states).
- High correlation
 - suggests TISTO utilities are valid
- Too flat?



Results: Comparison of proportion of trade/gamble refusals, our TISTO and SG versus Volk et al's TTO, male subjects only.

	TISTO: Proportion refusing to trade, males		Volk et al: TTO proportion refusing to trade, males
Impotence	0.34	Partial impotence	0.42
		Complete impotence	0.31
Mild incontinence	0.23		
		Moderate incontinence	0.34
Severe incontinence	0.16	Severe incontinence	0.20
Watchful waiting	0.38		
Hormone therapy	0.20	Hormonally responsive PC	0.24
SG: Uncontrollable metastatic prostate cancer	0.02	Advanced PC	0.14

- **TISTO vs TTO:**
 - **TISTO has almost as large a proportion refusing to trade against death and against metastatic prostate cancer as TTO had.**
- **SG vs TTO:**
 - **Fewer refused to gamble with SG, than refused to trade with TTO**

Discussion: Goals

- **Goal of study:**
 - **Produce alternative utility assessment method for health states**
 - **to reduce % refusing to trade (TTO) or gamble (SG)**
- **New method:**
 - **Time in State Tradeoffs (TISTO), plus**
 - **Standard Gamble (SG) with delayed onset**

Discussion: Time in State Tradeoff (TISTO)

- **Features**

- Life stream displays

PPPPPPMMMMMMMMMMMM

PPPPPPPPPPPPPPPPPPPPW

- Both life streams the same length
- Comparison: set beginning of worst state W in second life stream to be equally preferable to the first life stream.

- **Results**

- TISTO only slightly reduced % refusing to trade.

Discussion: Standard Gamble (SG)

- **Features**
 - **Delayed onset**
 - of moderate health care outcome
 - of death, in the short gamble outcome
 - **Delays are equal**
- **Results**
 - **This reduced % refusing to gamble**
 - **But it increased % willing to have 100% chance of the shorter life.**

Discussion: The severity of the worst state W is crucial to the feasibility of the method

- **Some participants saw W as worse than death.**
 - They would give up some good years to avoid “Uncontrollable Metastatic Prostate Cancer”.
 - In TTO, it produced 0 utilities and negative utilities.
 - In SG, it produced utilities of 0.
 - The difference of TTO and SG is due to response constraints.
- **This did not meet our tactical goal, to provide an outcome that is not as bad as death.**
- **Also, for those willing to trade, they were asked to take on more years of worst state than patients actually live with it.**

Questions for further research

- **Should Time in State Tradeoffs be used again?**
 - Is the refusal to trade acceptable?
 - But why not just use TTO, already well known?
 - Would it be better with a “worst state” that is not “worse than death”?
- **Should Standard Gamble with late onset health states be used again?**
 - Few refusals to gamble, with worst state.
 - More willingness to die ($U = 0$) at beginning of W period than immediately.
 - Would these findings hold for medium health states?