Preference Assessment Method Affects Decision-Analytic Recommendations: A Prostate Cancer Treatment Example

Elena B. Elkin, PhD, Mark E. Cowen, MD, Daniel Cahill, MD, Mary Steffel, Michael W. Kattan, PhD

Purpose. *To evaluate the effect of preference assessment method on treatment recommended by an individualized decision-analytic model for early prostate cancer.* ***Methods.*** *Health state preferences were elicited by time tradeoff, rating scale, and a power transformation of the rating scale from 63 men ages 55 to 75. The authors used these values in a Markov model to determine whether radical prostatectomy or watchful waiting yielded the greater quality-adjusted life expectancy.* ***Results.*** *Time tradeoff and transformed rating scale recommendations differed widely. Time tradeoff and transformed rating scale utilities differed in their treatment recommendation for 21% to 52% of men, and the mean difference in quality-adjusted life years varied from less than 0.5 to greater than 1.0.* ***Conclusions.*** *Treatment recommendations from the prostate cancer decision model were sensitive to the method of preference assessment. If decision analysis is used to counsel individual patients, careful consideration must be given to the method of preference elicitation.* ***Key words:*** *preference assessment method; decision-analytic model; prostate cancer; time tradeoff; rating scale; quality-adjusted life expectancy.* ***(Med Decis Making 2004;24:504–510)***

Choosing a treatment option can be an arduous task for someone diagnosed with a life-threatening illness. Decision-analytic models have been developed to support the decision process by providing a formal and explicit framework for making choices. When the primary outcome of a decision model is quality-adjusted life expectancy, survival must be weighted by some measure of health-related quality of life.

Two common methods of obtaining weights for quality adjustment of life years are the rating scale (RS) and time tradeoff (TTO).[1] TTO is considered by some researchers to be the more valid method of preference assessment because the tradeoff between length and quality of life best reflects the real-world choices involved in selecting certain treatments.[2] TTO is also appealing because it has some basis in utility theory, although it does not involve consideration of uncertain outcomes. However, as trading life years for improvement in health is a task unfamiliar to most people, preferences might be imprecise.[3]

RS techniques, derived from the field of psychometrics, are considered more feasible for assessing health-related quality of life because they are simple and easily self-administered.[4] However, RS may be inappropriate in situations that involve trading length of life or the probability of survival for an improvement in health because its unit of measurement is arbitrary.[2] RS is also subject to systematic biases, such as avoidance of the extreme ends of the scale.[3] Although RS values might indicate preferences, they are generally not considered true "utilities," as they have no basis in expected utility theory.

In response to systematic biases in preferences elicited by RS, Torrance and colleagues have suggested a power transformation of RS values.[5] At the group level, mean transformed rating scale (TRS) values appear more similar than RS values to average utilities elicited by the TTO and standard gamble, a method of preference assessment grounded in utility theory.

Received 5 August 2003 from the Departments of Biostatistics and Epidemiology (EBE, MWK) and Urology (MWK), Memorial Sloan-Kettering Cancer Center, New York; St. Joseph Mercy Hospital, Ann Arbor, Michigan (MEC, DC); and Columbia University, New York (MS). Revision accepted for publication 19 May 2004.

Address correspondence and reprint requests to Michael W. Kattan, PhD, Department of Biostatistics and Epidemiology, Wb4, Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44195; phone: 216-444-0584; fax: 630-604-3605; e-mail: kattanm@ccf.org.

DOI: 10.1177/0272989X04268954

Because preferences often vary with the method of elicitation, a critical question for decision analysis is whether the method of preference assessment affects the decision-analytic recommendation. If the decision-analytic treatment recommendation for an individual is the same whether health state preferences are elicited by TTO or by RS, one could argue that choice of preference assessment method is not very important. However, if the recommended treatment strategy depends on the preference assessment method used, a considerable problem arises because a plurality of methods are used and advocated.

The purpose of this study was to examine whether the method of preference assessment affected the recommendation of a decision analysis. We obtained preference weights for 5 health states using 3 different methods: TTO, RS, and a power transformation of the RS. We inserted each set of values into a published decision model for the treatment of clinically localized prostate cancer and identified the preferred treatment strategy. We then compared the decision-analytic treatment recommendations obtained using the quality-adjustment weights of each of the 3 sets.

METHODS

We elicited preference weights from a convenience sample of 63 men between the ages of 55 and 75 who did not have known prostate cancer. These men were all patients in general medicine practices in Michigan. For each subject, the same interviewer read descriptions of 5 health states: prostate cancer managed expectantly ("watchful waiting"), hormonally responsive metastatic cancer, hormonally refractive metastatic cancer, treatment-related incontinence, and treatment-related impotence. Preference weights were elicited with the aid of computer software (Sonnenberg FA, U-Maker 1.0, Microcomputer Utility Assessment Program, 1993) using the TTO and RS methods.[6] In addition to the preference weight elicitations, data were collected on subjects' sociodemographic characteristics, current medical conditions, and smoking status. Subjects were also asked to complete a general health status questionnaire and 2 symptom-specific instruments addressing urinary function and sexual function.

The TTO assesses the amount of time in a particular health state the respondent would be willing to forgo to live fewer years in perfect health. The more undesirable the health state is perceived to be, the more time a respondent should be willing to give up to avoid that state. To compute a person's utility for a given health state, the number of life years traded for perfect health was divided by the person's life expectancy based on age and race.[7] The quotient was then subtracted from 1. For example, a man who would forgo 1 of 10 years of remaining life expectancy with urinary incontinence in exchange for perfect health has a utility of 0.90 for the state of urinary incontinence. In other words, for him, 10 years with urinary incontinence and 9 years in perfect health are equal.

The RS asks the patient to evaluate his health on a scale from 0 to 100, where 0 represents dead and 100 represents perfect health. We used a visual analog scale in which the continuum from death to perfect health was represented by a straight line anchored at 0 (*death*) and 100 (*perfect health*). Subjects were asked to indicate points on the line that reflected the position of each health state along the continuum. Each subject placed all health states on a single visual analog scale, and the values corresponding to points on the line were divided by 100 to produce quality-adjustment weights.

Transformed rating scale utilities were calculated using a power transformation given by the equation: $TRS = 1 - (1 - RS)^{\gamma}$, where TRS is the transformed rating scale utility and RS is the raw rating scale value. We assumed that γ was equal to 2.29, the value suggested by Torrance and colleagues,[8] but varied this assumption in sensitivity analysis.

We inserted each set of preferences into a decision-analytic model of treatment for early prostate cancer.[9] The model simulated the sequelae of 2 treatment options—watchful waiting and radical prostatectomy—among men who present initially with clinically localized prostate cancer. Over time, disease could progress to hormonally controlled metastases, then to hormone-refractory disease, and ultimately to cancer death. After radical prostatectomy, additional morbidity was possible from 2 iatrogenic outcomes: impotence and incontinence. The probability of cancer progression, derived from studies of watchful waiting[10] and radical prostatectomy,[11] depended on the grade of the tumor at biopsy. The probability of noncancer death was a function of patient age and the presence of coexisting conditions.[12] Additional details, including specific transition probabilities, have been published elsewhere.[13]

We obtained a total of 9 treatment recommendations for each subject, based on the decision-analytic model. For each of the 3 sets of preference weights (TTO, TRS, RS), we analyzed the model 3 times, assuming that the patient's tumor grade on biopsy was well, moderately, or poorly differentiated. Patient-specific information regarding age and comorbidities was used in the decision-analytic model. For all recommendations, the optimal treatment strategy (radical prostatectomy or watchful waiting) was the one that yielded the

Table 1 Characteristics of the Study Population

	n	%
Marital status		
Currently married	53	84
Not married	10	16
Education		
High school or less	17	27
>High school	46	73
Annual income		
<$30,000	18	29
≥$30,000	45	71
Smoking status		
Never	26	41
Current or former	37	59
Self-reported race		
White	42	67
African American	19	30
Hispanic	1	2
Asian	1	2
Medical conditions[a]		
None	17	27
1	16	25
2	14	22
3 or more	16	25

Note: The mean age was 65.5 (s = 6.3) years.
a. Self-reported medical conditions include diabetes, heart attack, angina, congestive heart failure, stroke, lower extremity circulatory problems, asthma, emphysema, stomach ulcer, irritable bowl syndrome, kidney disease, major depression, seizures, alcoholism, drug problems, and other cancer.

Table 2 Prostate Cancer Health State Utilities

	Rating Scale		Time Tradeoff		Transformed Rating Scale	
Health State	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Watchful waiting	0.67	0.23	0.72	0.25	0.86	0.22
Impotence	0.61	0.22	0.71	0.22	0.83	0.18
Incontinence	0.48	0.24	0.62	0.27	0.71	0.23
Metastatic, hormone responsive	0.47	0.17	0.47	0.25	0.73	0.22
Metastatic, hormone refractory	0.24	0.16	0.19	0.16	0.43	0.27

greater number of expected quality-adjusted life years (QALYs).

Mean health state utilities were calculated for each preference assessment method. We compared the rank order of health states by TTO and TRS using Spearman's rank correlation coefficient.[14] We also evaluated the within-subject correlation between TTO and TRS for each of the 5 health states using Spearman's rank correlation coefficient. Since each within-subject Spearman correlation coefficient was estimated from a very small number of observations (n = 5 per subject), the t distribution used for determining statistical significance was not a good approximation of the sampling distribution of the test statistic.[15] Therefore, instead of performing tests for statistical significance, we compared within-subject Spearman correlation coefficients to a critical value of 0.90, indicative of strong rank order correlation.

We performed 3 two-way comparisons to evaluate agreement between treatment recommendations generated by each preference assessment method, stratified by tumor grade. Among subjects whose decision-analytic treatment recommendations varied with utility assessment method, we examined the difference in QALYs between watchful waiting and radical prostatectomy. All analyses were performed using SAS version 8.1 (SAS Institute, Cary, NC).

RESULTS

The mean age of the study group was 65.5 years (Table 1). A majority of subjects were white, married, and had received education beyond high school. Seventy-three percent of the sample reported at least 1 medical condition, and 59% were current or former smokers.

Mean preference weights generated by each assessment method are shown in Table 2. For 3 of the 5 health states, RS weights were lower than those generated by TTO. For all health states, TRS yielded preference weights that were substantially higher than those yielded by RS and TTO. There were no statistically significant differences between the mean weights assessed by each method.

Averaged across the entire sample, the TRS and TTO produced the same rank ordering of health states. However, only 2 (3%) of the 63 study subjects had TRS and TTO scores that yielded identical rank ordering of health states. Of the 5 health states evaluated, only impotence demonstrated a significant rank order correlation between TRS and TTO (Table 3), with a Spearman coefficient of 0.35. The mean within-subject Spearman coefficient was 0.57, and the median was 0.67. Only 26% of within-subject Spearman coefficients were greater than or equal to 0.90.

In general, we found considerable disagreement in decision-analytic treatment recommendations by utility assessment method (Table 4). The TTO and RS exhibited the least agreement of the 3 possible compari-

Table 3 Rank Order Correlation of Time Tradeoff and Transformed Rating Scale Utilities by Health State

	Health State Spearman Correlation Coefficient (ρ)	***P***
Watchful waiting	0.14	0.26
Impotence	0.35	<0.01
Incontinence	0.22	0.17
Metastatic, hormone responsive	0.10	0.45
Metastatic, hormone refractory	0.17	0.18

Table 4 Concordance Between Model Recommendations

Comparison	**Tumor Grade**	**Agreement (%)**[a]
Time tradeoff versus rating scale	Well differentiated	51
	Moderately differentiated	48
	Poorly differentiated	65
Time tradeoff versus transformed rating scale	Well differentiated	56
	Moderately differentiated	60
	Poorly differentiated	54
Rating scale versus transformed rating scale	Well differentiated	57
	Moderately differentiated	79
	Poorly differentiated	73

a. Percentage agreement reflects the proportion of subjects for whom the decision model recommends the same treatment (watchful waiting or radical prostatectomy) with health state utilities assessed by the 2 methods compared.

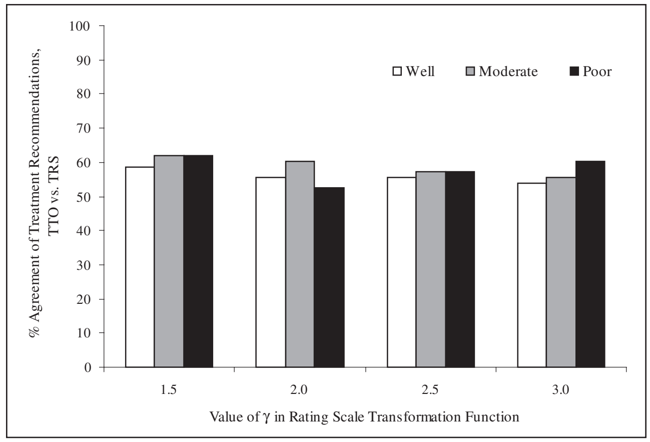

Figure 1 *Sensitivity analysis on value of γ in transformed rating scale (TRS) function, where* $TRS = 1 - (1 - RS)^{\gamma}$. *The percentage agreement between decision-analytic treatment recommendations with time tradeoff (TTO) and TRS utilities is shown for 4 values of γ, stratified by tumor grade (well, moderate, and poor differentiation).*

sons, whereas RS and TRS exhibited the greatest agreement. Tumor grade had little effect on agreement between treatment recommendations.

Agreement between decision-analytic treatment recommendations based on TRS and TTO utilities was not sensitive to the value of γ in the transformation function (Figure 1). For values of γ between 1.5 and 3.0, agreement of recommendations was between 55% and 65%, independent of tumor grade.

In cases in which the decision model recommended watchful waiting with one set of preference weights and radical prostatectomy with another, we examined the difference in QALYs between the 2 treatment strategies (Figures 2a–2c). The greatest mean difference—1.4 QALYs—was seen in the TTO versus TRS comparison, in patients with well-differentiated prostate cancer. For some subjects, in well- or moderately differentiated cancer, the difference between treatment recommendations was as great as 3 QALYs. The TTO versus RS comparison yielded the smallest difference in QALYs within each level of tumor grade. In all comparisons, QALY differences were smallest for poorly differentiated cancer since this scenario yielded the lowest absolute number of QALYs, regardless of quality adjustment weights.

DISCUSSION

In this study, we evaluated the impact of preference assessment methods on the outcome of a decision-analytic model. For at least half of the men in our sample, a decision-analytic model for early prostate cancer yielded divergent treatment recommendations, depending on the preference assessment method used. Although these subjects were not actually facing the modeled decision at the time they participated, our findings raise concerns about the ability of individualized decision models to guide treatment choices. Which preference assessment method, if any, should be used to counsel men facing a decision between watchful waiting and radical prostatectomy? We are not sure, but the choice clearly matters in this situation and certainly in other diseases and treatment decisions as well.

Our analysis did not appear to reveal systematic differences among preferences assessed by TTO, RS, and TRS, nor did it indicate systematic biases in the resulting decision-analytic treatment recommendations. Previous studies provide conflicting characterizations of the relationship between TTO and RS techniques. Torrance proposed a power function to explain the relationship between group averages of TTO and RS

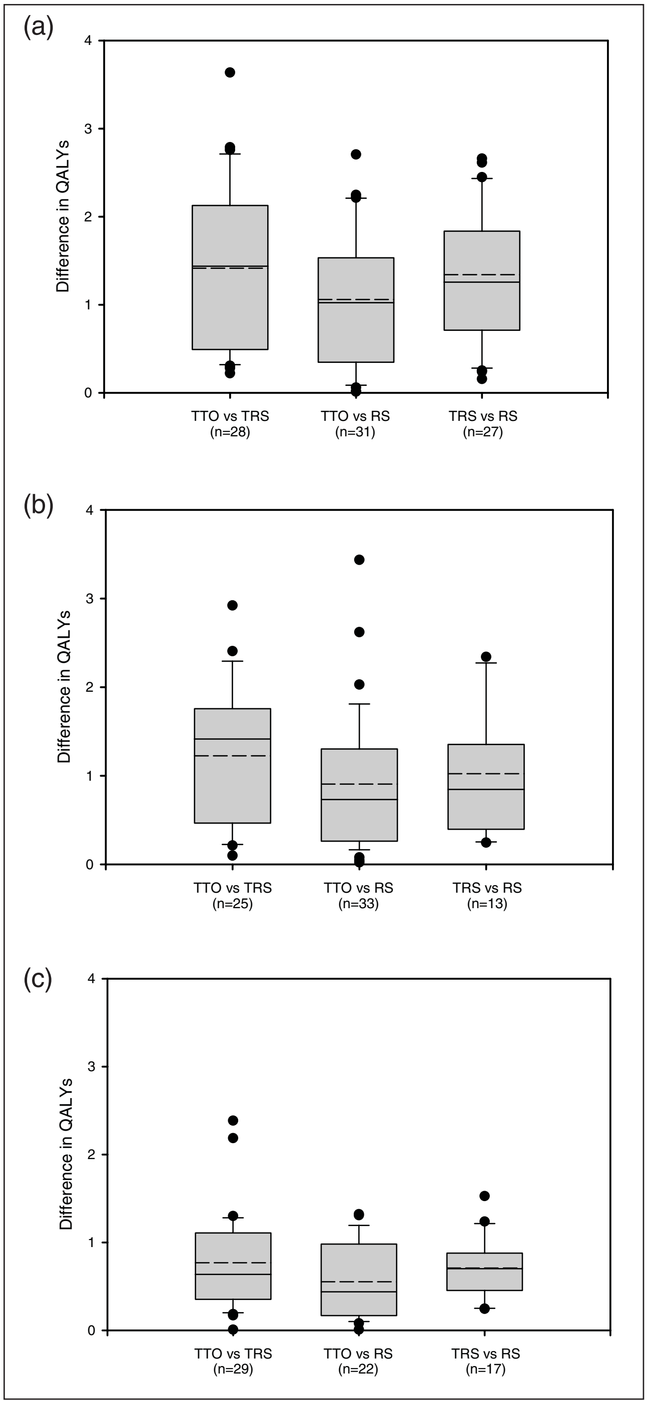

Figure 2 Box plots showing mean (dashed line), median (solid line), interquartile range (shaded box), 90th and 10th percentiles (whiskers), and outliers (circles) for absolute value of difference in quality-adjusted life years (QALYs) between treatment recommendations (watchful waiting and radical prostatectomy) with different sets of utilities, in cases in which recommendation varied with utility assessment method, assuming prostate cancer is (a) well differentiated, (b) moderately differentiated, and (c) poorly differentiated.

Note: TTO = time tradeoff; TRS = transformed rating scale; RS = rating scale.

scores.[16] Alternatively, O'Leary and colleagues suggested that a plateau model better represents the relationship between methods because it captures the fact that many people are unwilling to tradeoff any time, even while assigning RS values less than 100.[4] Neither Torrance nor O'Leary and colleagues found a systematic relationship between techniques at the individual level.

O'Leary and colleagues[4] and Souchek and colleagues,[17] as well as numerous other investigators, observed that TTO values tend to be greater than RS values at the group level. In a study of men with advanced prostate cancer, Souchek and colleagues found a within-subject Pearson correlation coefficient of 0.76 between methods after standardizing scores. At the individual level, they found that RS values were more highly correlated with the patients' explicit rank ordering of health states than were TTO values. Bleichrodt and Johannesson observed the opposite.[3]

In addition to our small sample size, an important limitation of this analysis is our exclusion of the standard gamble (SG) method of preference elicitation. Of all available preference elicitation methods, only the SG yields utilities consistent with the axioms of expected utility theory.[16] Moreover, the SG reflects the risk and uncertainty inherent in clinical decisions.[1,18,19] Critics of the SG method cite ample evidence that intelligent decision makers regularly violate the axioms of expected utility theory,[20–23] suggesting that conformity with these axioms is a poor criterion for selection of a preference assessment method.

Comparisons between preferences elicited by SG and those elicited by other methods have produced mixed findings. Torrance and colleagues[1] and Read and colleagues[24] found a Pearson correlation coefficient of 0.65 between SG and TTO utilities. Hornberger and colleagues[25] found a much poorer correlation between the SG and TTO and between the SG and RS, with Spearman correlation coefficients of 0.31 and 0.14, respectively. Using linear regression, Wolfson and colleagues[26] found a stronger association between the SG and TTO ($r^2 = 0.84$) than between the SG and RS ($r^2 = 0.76$). They also found that SG utilities were consistently the highest of the 3 methods, with TTO utilities slightly lower and RS values the lowest. Read and colleagues[24] found a similar pattern, although Dolan and colleagues[27] found that SG utilities were generally lower than those obtained by TTO.

Read and colleagues compared RS and SG values, elicited from a sample of 60 physicians, in a "didactic decision model" of surgical versus medical therapy for coronary artery disease.[24] They found that for 60% of subjects, the treatment recommended by the decision model varied with the method of preference assessment. Compared with our analysis, their study design was considerably different, wherein subjects evaluated health state probability and duration combinations, rather than the health states alone, as was the exercise in our study. We cannot say how SG utilities would compare with the other methods evaluated here with regard to decision-analytic treatment recommendations.

It is notable that only 2 of the 63 subjects in our study gave TTO and TRS utilities that exhibited identical rank ordering of health states. Although mean utilities for the sample produced identical rank ordering for both preference assessment methods, within-subject rankings were highly inconsistent. The substantial disagreement in treatment recommendations between RS and TRS values, despite identical within-subject rank order of health states, further illustrates the sensitivity of the decision-analytic treatment recommendation to utility values.

We found that agreement between decision-analytic recommendations based on TTO versus TRS utilities was not sensitive to the power function used to estimate TRS from utilities from RS values. The range of exponents we evaluated—1.5 to 3.0—includes values estimated in other studies,[4,5,16,26,28–30] although at least one study estimated much higher exponents of 4.5 and 20.9 in 2 different samples.[31]

The high rate of rank order inconsistency between RS and TTO values prompts some concern about our subjects' understanding of the preference assessment exercise. Logic errors in preference elicitation, such as assigning a higher utility to an obviously poorer health state, are quite common.[17,32,33] Although our RS task asked each subject to place all health states on a common RS, we did not explicitly ask the subject to rank the health states. However, given that our RS task closely resembled a ranking activity, it seems that the TTO did not provide utilities consistent with a simple ranking by the subject.

In an effort to inform clinical policy and societal resource allocation, decision-analytic methods have been widely used to evaluate the long-term, uncertain outcomes of medical interventions at the group level. Such analyses rely heavily on preference assessment to quantify the effect of interventions on health-related quality of life. Findings from the current study, as well as previous research, suggest that different methods of assessment produce health state preferences with identical rank ordering and similar magnitude when averaged across a group. However, as we have shown previously, decision-analytic recommendations based on group-level utilities often conflict with individual-level treatment recommendations.[34]

Less frequently, formal decision analysis has been brought directly to the bedside as an instrument of shared decision making.[35–38] Our current finding, that individualized decision-analytic recommendations vary considerably with the method of preference assessment, suggests that such decision aids may be heavily dependent on the method of preference assessment. It should be emphasized that we examined only a single decision analysis of treatment for clinically localized prostate cancer, and the generalizability of our findings to other medical decision analyses is unknown. Although cost-effectiveness analysts routinely perform sensitivity analysis to assess the impact of health state utility weights on incremental cost-effectiveness ratios, we identified only 1 prior study[24] that explicitly evaluated the sensitivity of decision-analytic treatment recommendations to the method of health state preference assessment. Further research is warranted to understand the validity and reliability of individual health state preferences assessed by different methods and their impact on decision-analytic treatment recommendations.

REFERENCES

1. Torrance G, Furlong W, Feeny D, Boyle M. Multi-attribute preference functions: health utilities index. Pharmoeconomics. 1995;9:503–20.

2. Stiggelbout AM, de Haes JC. Patient preference for cancer therapy: an overview of measurement approaches. J Clin Oncol. 2001;19(1):220–30.

3. Bleichrodt B, Johannesson M. Standard gamble, time trade-off and rating scale: experimental results on the ranking properties of QALYs. J Health Econ. 1997;16:155–75.

4. O'Leary J, Fairclough D, Jankowski MK, Weeks J. Comparison of time-tradeoff utilities and rating scale values of cancer patients and their relatives. Med Decis Making. 1995;15:132–7.

5. Torrance GW, Feeny DH, Furlong WJ, Barr RD, Zhang Y, Wang Q. Multiattribute utility function for a comprehensive health status classification system. Med Care. 1996;34(7):702–22.

6. Torrance GW, Thomas WH, Sackett DL. A utility maximization model for evaluation of health care programs. Health Serv Res. 1972;Summer:118–33.

7. US Census Bureau. Statistical Abstract of the United States. Washington (DC): Government Printing Office; 1994.

8. Torrance GW, Feeny D, Furlong W. Visual analog scales: do they have a role in the measurement of preferences for health states? Med Decis Making. 2001;21:329–34.

9. Fleming C, Wasson JH, Albertson PC, Barry MJ, Wennberg JE. A decision analysis of alternative treatment strategies for clinically localized prostate cancer. JAMA. 1993;269:2650–8.

10. Chodak GW, Thisted RA, Gerber GS, et al. Results of conservative management of clinically localized prostate cancer. N Engl J Med. 1994;330:242–8.

11. Gerber GS, Thisted RA, Chodak GW, et al. Results of radical prostatectomy in men with clinically localized prostate cancer: multi-institutional pooled analysis. J Urol. 1996;153:615–9.
12. Albertsen PC, Fryback DG, Storer BE, Kolon TF, Fine J. Long-term survival among men with conservatively treated localized prostate cancer. JAMA. 1995;274:626–31.
13. Kattan MW, Cowen ME, Miles BJ. A decision analysis for treatment of clinically localized prostate cancer. J Gen Intern Med. 1997;12(5):299–305.
14. Spearman C. The proof and measurement of association between two things. Am J Psychol. 1904;15:72–101.
15. Rosner B. Fundamentals of Biostatistics. 4th ed. Belmont (CA): Duxbury; 1995.
16. Torrance G. Social preferences for health states: an empirical evaluation of three measurement techniques. Socionomic Planning Science. 1976;10:129–36.
17. Souchek J, Stacks JR, Brody B, et al. A trial for comparing methods for eliciting treatment preferences from men with advanced prostate cancer. Med Care. 2000;10:1040–50.
18. Ben-Zion U, Gafni A. Evaluation of public investment in health care: is risk irrelevant? J Health Econ. 1983;2:161–5.
19. Gafni A, Birch S. Preferences for outcomes in economic evaluation: an economic approach to addressing economic problems. Soc Sci Med. 1995;40:767–76.
20. Llewellyn-Thomas H, Sutherland HJ, Tibshirani R, Ciampi A, Till JE, Boyd NF. The measurement of patients' values in medicine. Med Decis Making. 1982;2(4):449–62.
21. Kahneman D, Tversky A. Choices, values and frames. Am Psychol. 1983;39:341–50.
22. Anderson NH. Algebraic rules in psychological measurement. Am Sci. 1979;67:555–63.
23. Schoemaker PJH. The expected utility model: its variants, purposes, evidence and limitations. J Econ Lit. 1982;20:529–63.
24. Read JL, Quinn RJ, Berwick DM, Fineberg HV, Weinstein MC. Preferences for health outcomes: comparison of assessment methods. Med Decis Making. 1984;4(3):315–29.
25. Hornberger JC, Redelmeier DA, Petersen J. Variability among methods to assess patients' well-being and consequent effect on a cost-effectiveness analysis. J Clin Epidemiol. 1992;45:505–12.
26. Wolfson AD, Sinclair AJ, Bombardier C, McGeer A. Preference Measurements for Functional Status in Stroke Patients: Interrater and Intertechnique Comparisons. Lexington (MA): Lexington Books; 1982.
27. Dolan P, Gudex C, Kind P, Williams A. Valuing health states: a comparison of methods. J Health Econ. 1996;15(2):209–31.
28. Feeny D, Townsend M, Furlong W, et al. Assessing health-related quality-of-life in prenatal diagnosis, comparing chorionic villus sampling and amniocentesis: a technical report. Working paper, McMaster University; 2000.
29. Krabbe PF, Essink-Bot ML, Bonsel GJ. The comparability and reliability of five health-state valuation methods. Soc Sci Med. 1997;45:1641–52.
30. Mrus JM, Yi MS, Freedberg KA, et al. Utilities derived from visual analog scale scores in patients with HIV/AIDS. Med Decis Making. 2003;23(5):414–21.
31. Robinson A, Loomes G, Jones-Lee M. Visual analog scale, standard gambles, and relative risk aversion. Med Decis Making. 2001;21:17–27.
32. Chapman GB, Elstein AS, Kuzel TM, et al. Prostate cancer patients' utilities for health states: how it looks depends on where you stand. Med Decis Making. 1998;18:278–86.
33. Lenert L, Sturley A, Rupnow M. Toward improved methods for measurement of utility: automated repair of errors in elicitations. Med Decis Making. 2003;23(1):67–75.
34. Cowen ME, Miles BJ, Cahill DF, Giesler RB, Beck JR, Kattan MW. The danger of applying group-level utilities in decision analyses of the treatment of localized prostate cancer in individual patients. Med Decis Making. 1998;18:376–80.
35. Clancy CM, Cebul RD, Williams SV. Guiding individual decisions: a randomized, controlled trial of decision analysis. Am J Med. 1988;84:283–8.
36. Michie S, Smith D, McClennan A, Marteau TM. Patient decision-making: an evaluation of two different methods of presenting information about a screening test. Br J Health Psychol. 1997;2:317–26.
37. Rothert RM, Holmes-Rovner M, Rovner D, et al. An educational intervention as decision support for menopausal women. Res Nurs Health. 1997;1997:377–87.
38. Pauker SP, Pauker SG. The amniocentesis decision: ten years of decision analytic experience. Birth Defects Orig Artic Ser. 1987;23:151–69.