# Predictors of Patient Preferences and Treatment Choices for Localized Prostate Cancer

**Benjamin D. Sommers, MD, PhD**[1]
**Clair J. Beard, MD**[2]
**Anthony V. D'Amico, MD, PhD**[2]
**Irving Kaplan, MD**[3]
**Jerome P. Richie, MD**[4]
**Richard J. Zeckhauser, PhD**[5]

[1] Division of General Medicine, Brigham and Women's Hospital, Boston, Massachusetts.

[2] Department of Radiation Oncology, Brigham and Women's Hospital, Boston, Massachusetts.

[3] Department of Radiation Therapy, Beth Israel Deaconess Medical Center, Boston, Massachusetts.

[4] Division of Urology, Brigham and Women's Hospital, Boston, Massachusetts.

[5] Harvard Kennedy School of Government, Cambridge, Massachusetts.

Dr. Sommers was supported by fellowships from the National Science Foundation and the Harvard MD/PhD Program in the Social Sciences.

We are grateful to Drs. Michael Barry and Al Mulley for suggestions on study design, Dr. John Ayanian and 3 anonymous reviewers for insightful comments, and Dr. Douglas Dahl for patient recruitment.

Address for reprints: Benjamin D. Sommers, MD, PhD, Division of General Medicine, Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115; Fax: (617) 734-6580; E-mail: bsommers@post.harvard.edu

Received March 11, 2008; revision received May 19, 2008; accepted May 21, 2008.

**BACKGROUND.** Little is known regarding how patients select treatment for localized prostate cancer. This study examined determinants of patients' preferences for health states related to prostate cancer, and assessed whether preferences and/or other factors predict treatment choices.

**METHODS.** A survey of 167 patients with newly diagnosed localized prostate cancer was conducted in 4 academic medical practices from 2004 to 2007. The authors assessed demographic and health factors, and used a time-tradeoff method to elicit preferences in the form of quality-adjusted life years (QALYs) regarding health states related to prostate cancer. Linear regressions identified predictors of preferences (in QALYs) for erectile dysfunction (ED), urinary incontinence, rectal/bowel symptoms, and metastatic prostate cancer. Linear probability models identified predictors of treatment choice.

**RESULTS.** Patient preferences were affected by a range of behavioral, demographic, and health factors. For example, sexually active men reported significantly lower QALYs for living with ED, and men with family members who died of cancer reported lower QALYs for metastatic disease. The strongest predictor of treatment was the type of physician seen (radiation oncology vs urology) at the time of the survey. Age and tumor grade also were found to be strongly predictive of treatment. In general, QALYs were not found to predict treatment choice.

**CONCLUSIONS.** Patient preferences, as reported in QALYs, are shaped by reasonable behavioral and demographic influences. However, actual treatment choices appear to bear little relation to these patient preferences, and instead demonstrate a strong association with clinician specialty. More attention to variation in preferences among patients, as well as the use of decision-support technologies, may enable physicians to facilitate more optimal individualized treatment choices for patients with prostate cancer. ***Cancer*** **2008;113:2058–67.** © *2008 American Cancer Society.*

**KEYWORDS: prostate cancer, patient preferences, quality-adjusted life year, health states.**

Choosing a treatment for localized prostate cancer presents a challenge for patients and physicians, for 2 main reasons. First, with the exception of 1 recent trial comparing radical prostatectomy and watchful waiting, to our knowledge there is little evidence from randomized controlled trials evaluating the treatment options for local therapy.[1] Second, prostate cancer treatment involves subjective tradeoffs between quality of life and length of life. Even patients with similar clinical features, such as age and tumor grade, will differ in their willingness to accept the risk of particular side effects in exchange for reducing the risk of metastatic cancer.[2] These tradeoffs provide an opportunity to explore the factors that shape patient preferences and treatment decisions.


DOI 10.1002/cncr.23807
Published online 14 August 2008 in Wiley InterScience (www.interscience.wiley.com).

Previous research provides several insights. Surgery is often preferred by patients seeking a cure, whereas brachytherapy (BT) is more often chosen by patients professing a desire for "the least invasive" treatment.[3] In general, however, men with prostate cancer often base treatment decisions on scientific misconceptions and anecdotal experiences of friends or family.[4]

What about the information patients receive when making decisions? Physician advice depends heavily on the physician's specialty (radiation oncology vs urology), as well as geographic region.[5,6] Such findings raise concerns that physicians' recommendations may not fully take into account patients' own preferences.[7] A critical review of patient education materials determined that prostate cancer patients often lack adequate information with which to make treatment decisions.[8]

Overall, the literature suggests that the decision-making process for prostate cancer treatment could be significantly improved, and that our knowledge of this process is inadequate. A 2003 review article concluded that there is very little information available regarding how prostate cancer patients use different types of input when making decisions regarding treatment.[9]

The current study analyzed survey data from men who were recently diagnosed with prostate cancer, but had not yet undergone treatment. The objective of the current study was to answer 2 questions: 1) What patient characteristics predict preferences for health states related to prostate cancer, such as erectile dysfunction (ED), urinary incontinence, bowel symptoms, and metastatic cancer? 2) How much do these patient preferences (compared with other factors such as physician advice and clinical features of disease) affect the treatment a patient ultimately selects?

Prior research using decision analysis offers the following predictions for how patient preferences should affect optimal treatment choices. Of those individuals choosing active treatment, patients who are more averse to bowel symptoms should be relatively more likely to choose surgery, whereas those who are more averse to ED and urinary symptoms should be relatively more likely to choose radiation. Patients placing a high value on avoiding symptoms in all 3 areas—erectile function, urinary continence, and bowel function—should be more likely to choose watchful waiting than patients who place a greater relative value on length of life or avoidance of metastatic disease.[2]

## MATERIALS AND METHODS

We recruited men with prostate cancer from 2 radiation oncology clinics and 2 urology clinics at Boston-area teaching hospitals. Eligible patients were men with clinically localized prostate cancer (stages T1N0M0 or T2N0M0) who had not yet undergone treatment (surgery, radiation, or hormonal therapy). The sample excluded patients who were unable to read English, or who exhibited impaired decision-making as judged by their physician. Eligible individuals received a brief explanation of the study after an office visit. Those interested in participating were asked to provide informed consent and were given surveys. Patients submitted completed surveys anonymously by mail using a preaddressed, stamped envelope. This survey was a companion project to a decision-analytic study described in a previous publication.[2] The study was approved by institutional review boards at all participating sites.

The survey elicited demographic and health measures, preferences regarding health states related to prostate cancer, and what treatment (if any) the individual had chosen by the time of the survey.

The survey elicited patients' preferences in the form of quality-adjusted life years (QALYs) using a time-tradeoff approach. The survey asked participants to consider the following hypothetical situation: "Imagine you have 10 years to live. You are in excellent health, except that you have the following condition. . ." The health states were then described. Separate questions were presented for each health state. Then the survey asked, "How many years of your life, ranging from 0 to 10 years, would you be willing to sacrifice to achieve ideal health without this condition?" Patients answered using a combination of years and/or months. This assessment tool has been validated and shown to be reliable in prior analyses, yielding estimates comparable to those from the U-Titer, a multi-item computer assessment program that is a significantly more costly and time-intensive approach.[10]

The survey drew the following descriptions of health states from previous research: 1) ED, "unable to maintain an erection firm enough to have sexual intercourse, even with the use of medication"; 2) urinary problems, "frequently leaking urine or losing bladder control, interfering with some activities," possibly requiring the individual to "wear pads to help deal with wetness"; 3) bowel problems, "frequent diarrhea, rectal discomfort (pain, burning, or irritation), or constipation"; 4) metastatic prostate cancer, "The disease and its treatment can cause severe bone pain, back pain, hot flashes, nausea, water retention, lack of sexual desire, problems getting erections, weakness, weak bones leading to fractures, and weight gain."[11,12]

Responses were converted into QALYs by the formula: QALY = (10 − years sacrificed)/10. A QALY of 1.0 indicates a year at full function. Thus, sacrificing 1.5 years from a 10-year life expectancy to avoid incontinence yields a QALY of 0.85 for incontinence.

### Data Analysis

Two sets of linear regressions were estimated.

The first set identified predictors of preferences, as measured in patient-reported QALYs. A separate linear regression was estimated for each condition: ED, urinary incontinence, bowel symptoms, and metastatic prostate cancer. In each regression, the outcome variable was the QALY for a particular health state. The independent variables, the same for all four regressions, were:

- Demographics: age (as a continuous variable), marital status, having children, race/ethnicity, educational attainment, income, and working status.
- Behavioral characteristics—sexual activity and sexual orientation. Multiple choice options were provided for frequency of sexual activity (not sexually active, active less than once a month, once or twice a month, once a week, or twice or more a week) and for self-reported sexual orientation (heterosexual/straight; bisexual; homosexual/gay; other).
- Health status—overall self-reported health; baseline presence of ED, incontinence, and/or bowel problems; and tumor risk stratification based on Gleason score and prostate-specific antigen (PSA) (Gleason score $\geq$8 *or* PSA level $\geq$20 ng/mL was classified as high risk; a Gleason score $\leq$6 *and* PSA $<$10 was classified as low risk; and all other tumors were classified as medium risk).[13]
- Attitudinal and experiential measures—optimism versus pessimism (using a scale of 1 to 5, from most pessimistic to most optimistic), frequency of thoughts about one's own death (with 4 options, ranging from at least once a day to less than once a month), and whether the individual has had any experience with friends or family members dying from prostate cancer or other cancers.

The second set of regressions identified predictors of treatment choice, using linear probability models. The dependent variables (the patient's treatment choice) were radical prostatectomy (RP), external beam radiation (EB), BT, hormonal therapy (HT), watchful waiting (WW), and undecided. We conducted a total of 6 regressions, 1 for each treatment option (including undecided). Some patients indicated that they planned to receive more than 1 treatment; the majority of these patients (24 of 26 patients; 92%) selected adjuvant HT along with radiation. For these patients, we treated all treatment components independently. Thus, patients who selected combined therapy (eg, EB + HT) were coded as having a positive outcome for both EB and HT regressions. The independent variables for these regressions were the same as above, with the following additions:

- QALYs for all 4 health states described above.
- The patient's most important factor in selecting treatment, from the following options: "preventing cancer from spreading," "doctor's advice," "avoiding unpleasant side effects," "family's wishes," and "cost of treatment."
- Type of physician seen at the visit when the patient was recruited into the study (urologist or radiation oncologist). Patients may have seen multiple specialists, before or after completing the survey; this variable only refers to the specialist seen at the time of recruitment.

We tested for the sensitivity of our results to the use of linear probability models, as well as to the inclusion of a large number of explanatory variables. We reanalyzed treatment choice using a more parsimonious multivariate logistic approach, which only included variables producing statistically significant effects ($P < .05$) in the original model.

To analyze the precision of the estimates for the effects of QALYs on treatment choice, 95% confidence intervals (95% CIs) were derived from the linear probability model. We calculated the 95% CI for the effect of a 1-standard deviation change in QALY score for each symptom on the probability of a patient choosing a particular treatment.

All data analyses were conducted using Stata 7.0 software (StataCorp, College Station, Tex).

## RESULTS

### Descriptive Statistics

Surveys were distributed to 428 patients, 46% of whom responded. Of surveys submitted, 19 failed to complete the QALY items, 1 omitted nearly every demographic item, and 5 included inappropriate responses (eg, giving up more than 10 years of a 10-year life expectancy). These 25 surveys were excluded from our analysis; 6 more were excluded because they indicated that they were completed after the patients had undergone treatment. This yielded a final sample of 167 patients. Table 1 provides descriptive statistics.

**TABLE 1**
**Descriptive Statistics for the Sample (N=167)**

| | |
|---|---|
| Average age (SE), y | 62.0 (8.5) |
| Tumor risk | |
| Low | 53.2% |
| Medium | 32.3% |
| High | 10.2% |
| Unknown | 4.2% |
| Pretreatment conditions | |
| Erectile dysfunction | 36.5% |
| Urinary incontinence | 10.2% |
| Bowel/rectal discomfort | 4.8% |
| Self-reported health | |
| Excellent | 48.5% |
| Good | 44.9% |
| Fair/poor | 6.6% |
| Race | |
| White non-Hispanic | 88.0% |
| Black | 7.8% |
| Hispanic | 1.2% |
| Asian | 1.2% |
| Other | 1.8% |
| Education | |
| ≤High school diploma | 16.2% |
| Any college | 45.5% |
| Graduate/professional school | 38.3% |
| Income | |
| <$30,000 | 10.8% |
| $30,000 to $50,000 | 22.8% |
| >$50,000 | 64.7% |
| Unreported | 1.8% |

SE indicates standard error.

**TABLE 2**
**Preferences and Treatment Choices for Prostate Cancer**

| Preferences for Health States | Mean QALY (SD) | 10th-90th Percentile |
|---|---|---|
| Urinary incontinence | 0.906 (0.141) | 0.750-1.000 |
| Erectile dysfunction | 0.923 (0.139) | 0.700-1.000 |
| Bowel/rectal discomfort | 0.859 (0.171) | 0.500-1.000 |
| Metastatic prostate cancer | 0.651 (0.287) | 0.200-1.000 |

| Most Important Factor in Selecting Treatment* | |
|---|---|
| Preventing cancer from spreading | 73.1% |
| Physician's advice | 19.2% |
| Avoiding unpleasant side effects | 8.4% |
| Your family's wishes | 0.0% |
| Cost of treatment | 0.0% |

| Treatment Decision at Time of Survey† | |
|---|---|
| Undecided | 19.6% |
| Watchful waiting | 4.2% |
| Radical prostatectomy | 37.1% |
| Brachytherapy | 24.0% |
| External beam radiotherapy | 19.2% |
| Hormonal therapy | |
| Adjuvant hormonal therapy | 14.4% |
| Hormonal therapy alone | 0.6% |

QALY indicates quality-adjusted life years; SD, standard deviation.
*Total sums to >100% because 1 patient indicated that 2 factors were "the most important."
†Percentages sum to >100%, because some patients chose multiple treatments.

Table 2 summarizes the variables related to preferences and treatment choices. The average QALYs in our sample were comparable to previously published values.[14] Preferences varied widely across the sample.

At the time of the survey, 80% of respondents had decided on a treatment. The most common choice was RP (37%), followed by BT (24%) and EB (19%). Sixteen percent chose multiple treatments, most commonly combining radiation and HT. Nearly all (25 of 26 patients; 96%) of the patients receiving HT did so as part of combined therapy, rather than monotherapy.

## Predictors of Patient Preferences

Table 3 presents the analysis of patient preferences. The dependent variables in these regressions were QALYs. Thus, independent variables with negative coefficients were associated with a greater aversion to that health state, and positive coefficients with less aversion.

The only factor that was found to predict preferences across all conditions was age. Older men reported lower QALYs for all 4 conditions, indicating a greater willingness to sacrifice life expectancy to eliminate side effects. Other key predictors of preferences are listed below, for each condition.

### *Erectile dysfunction*

Men who engaged in more frequent sexual activity reported significantly lower QALYs for living with ED than did men who had sex infrequently. White men reported higher QALYs for ED than did nonwhite men.

### *Urinary incontinence*

Men who had ever had children reported significantly higher QALYs for living with urinary incontinence than did men without children.

### *Bowel problems*

Men who were working full-time reported lower QALYs for living with bowel discomfort than did men working part-time or not working.

### *Metastatic prostate cancer*

Men with close friends or family members who had died of cancer reported lower QALYs for living with

**TABLE 3**
**Predictors of Preferences (in Quality-Adjusted Life Years) for Health Conditions Related to Prostate Cancer**

| Variables | Regression Coefficients for Each Health State | | | |
|---|---|---|---|---|
| | Erectile Dysfunction | Urinary Incontinence | Bowel Symptoms | Metastatic Prostate Cancer |
| Age | −0.005* | −0.006* | −0.008* | −0.014* |
| Health (referent: excellent) | | | | |
| Good | 0.19 | −0.01 | 0.00 | 0.06 |
| Fair/poor | 0.08 | 0.03 | 0.06 | −0.02 |
| Tumor risk (referent: low) | | | | |
| High | 0.03 | 0.01 | 0.05 | 0.01 |
| Medium | 0.00 | 0.01 | 0.02 | 0.02 |
| Unreported | −0.07 | −0.07 | −0.08 | −0.03 |
| Close friend or family died of | | | | |
| Prostate cancer | 0.01 | −0.05 | −0.02 | −0.02 |
| Any other cancer | −0.01 | −0.03 | −0.07 | −0.13† |
| Current symptoms | | | | |
| Bowel problems | 0.00 | 0.06 | 0.06 | 0.19 |
| Erectile dysfunction | 0.03 | 0.05 | 0.06 | 0.19* |
| Urinary incontinence | 0.04 | 0.02 | −0.08 | 0.03 |
| Sexual activity (referent: none) | | | | |
| Twice weekly | −0.09† | −0.01 | 0.01 | 0.00 |
| Once weekly | −0.08† | −0.01 | 0.01 | −0.14† |
| Once monthly | −0.03 | −0.03 | −0.04 | −0.03 |
| Less than monthly | 0.00 | 0.08 | 0.05 | −0.09 |
| Optimism (referent: least) | | | | |
| Most optimistic | 0.00 | 0.00 | 0.00 | 0.07 |
| Somewhat optimistic | −0.01 | 0.01 | 0.02 | 0.03 |
| Thoughts of death (referent: rarely) | | | | |
| Several times a week | −0.01 | −0.03 | −0.01 | −0.02 |
| Once or twice a week | 0.00 | −0.01 | 0.00 | −0.04 |
| Education (referent: graduate/professional) | | | | |
| ≤High school | 0.04 | 0.00 | 0.01 | 0.14 |
| Any college | −0.03 | −0.02 | −0.02 | 0.01 |
| Work status (referent: not working) | | | | |
| Full time | −0.03 | −0.05 | −0.08† | −0.12† |
| Part time | −0.03 | −0.02 | −0.01 | 0.01 |
| Income (referent: unreported) | | | | |
| <$30,000 | −0.08 | 0.00 | 0.09 | 0.02 |
| $30,000 to $50,000 | −0.11 | −0.06 | 0.05 | 0.00 |
| >$50,000 | −0.06 | −0.01 | 0.08 | 0.05 |
| White | 0.09† | 0.05 | 0.03 | 0.04 |
| Heterosexual | −0.01 | 0.00 | 0.00 | 0.04 |
| Married/engaged | 0.04 | −0.04 | −0.03 | −0.06 |
| Have children | 0.04 | 0.09† | 0.02 | −0.01 |

QALY indicates quality-adjusted life-year.
*$P < .01$.
†$P < .05$.

metastatic prostate cancer. Sexually active men and those with intact erectile function reported lower QALYs for metastatic disease than men having less frequent sexual activity or with ED at baseline.

### *Predictors of patient treatment choices*

Table 4 presents the regression analysis of patient treatment choices. The strongest predictor of treatment choice was the type of physician seen (radiation oncology vs urology) at the time of enrollment in the survey. Patients enrolled by urologists overwhelmingly chose RP. Patients enrolled by radiation oncologists were significantly more likely to choose EB or BT, and also were more likely to choose HT (usually in combination with radiation) or to remain undecided about treatment.

In terms of preferences, with 1 exception (ie, patients with high QALYs for bowel problems were less likely to choose BT), QALYs did not significantly predict treatment choices. However, simple qualita-

**TABLE 4**
**Predictors of Treatment Choice for Prostate Cancer**

| Variables | Regression Coefficients for Each Treatment | | | | | |
|---|---|---|---|---|---|---|
| | Undecided | Radical Prostatectomy | External Beam Radiotherapy | Brachytherapy | Hormonal Therapy | Watchful Waiting |
| QALY-erectile dysfunction | −0.32 | 0.35 | 0.03 | −0.25 | 0.09 | −0.01 |
| QALY-urinary incontinence | 0.00 | 0.05 | −0.03 | 0.23 | −0.12 | 0.02 |
| QALY-bowel symptoms | 0.26 | −0.10 | 0.39 | −0.53* | 0.18 | 0.10 |
| QALY-metastatic cancer | 0.05 | −0.10 | −0.02 | 0.19 | −0.05 | −0.13 |
| Main decision factor (referent: physician's advice) | | | | | | |
| Avoid side effects | −0.13 | −0.23* | −0.21 | 0.27*,† | −0.14 | 0.21‡ |
| Prevent cancer spread | 0.05 | 0.01 | −0.04 | 0.04 | 0.00 | −0.05 |
| Recruiting physician for study (referent: radiation oncology) | | | | | | |
| Urology | −0.29‡ | 0.67‡ | −0.28‡ | −0.22‡ | −0.21‡ | −0.07 |
| Age | −0.003 | −0.016‡ | −0.002 | 0.017‡ | −0.003 | −0.001 |
| Health (referent: excellent) | | | | | | |
| Good | 0.08 | −0.02 | −0.07 | 0.06 | −0.07 | −0.01 |
| Fair/poor | 0.19 | −0.10 | 0.00 | −0.15 | 0.04 | 0.10 |
| Tumor risk (referent: low) | | | | | | |
| High | −0.09 | −0.05 | 0.44‡ | −0.25* | 0.43‡ | −0.05 |
| Medium | 0.03 | −0.04 | 0.25‡ | −0.18‡ | 0.19‡ | −0.03 |
| Unreported | 0.22 | −0.17 | 0.04 | −0.42* | 0.04 | 0.08 |
| Close friend or family died of | | | | | | |
| Prostate cancer | 0.01 | −0.08 | 0.03 | 0.09 | 0.01 | 0.00 |
| Any other cancer | 0.11 | −0.17*,† | 0.00 | 0.02 | −0.04 | 0.00 |
| Current symptoms | | | | | | |
| Bowel problems | −0.03 | −0.09 | −0.16 | 0.08 | −0.13 | 0.25‡ |
| Erectile dysfunction | −0.11 | 0.08 | 0.07 | −0.01 | 0.04 | 0.08 |
| Urinary incontinence | −0.17 | −0.03 | 0.09 | 0.27* | 0.10 | −0.03 |
| Sexual activity (referent: none) | | | | | | |
| Twice weekly | −0.13 | −0.05 | 0.12 | 0.11 | 0.10 | −0.01 |
| Once weekly | 0.02 | −0.05 | 0.05 | −0.01 | 0.06 | 0.01 |
| Once monthly | −0.02 | −0.12 | 0.13 | 0.01 | 0.06 | −0.04 |
| Less than monthly | 0.05 | −0.15 | 0.15 | −0.10 | 0.19 | −0.02 |
| Optimism (referent: least) | | | | | | |
| Most optimistic | 0.00 | 0.03 | 0.05 | −0.08 | −0.03 | 0.07 |
| Somewhat optimistic | 0.00 | 0.10 | −0.01 | −0.18 | −0.05 | 0.08 |
| Thoughts of death (referent: rarely) | | | | | | |
| Several times a week | −0.20* | 0.19* | 0.11 | −0.03 | 0.11 | 0.01 |
| Once or twice a week | −0.03 | −0.05 | 0.03 | 0.01 | −0.03 | 0.01 |
| Education (referent: graduate/professional) | | | | | | |
| ≤High school | −0.23* | −0.11 | 0.03 | 0.27* | 0.10 | 0.01 |
| Any college | −0.06 | −0.06 | −0.09 | 0.15* | −0.06 | 0.02 |
| Work status (referent: not working) | | | | | | |
| Full time | 0.12 | −0.19* | −0.06 | 0.09 | −0.10 | 0.03 |
| Part time | −0.05 | −0.03 | −0.15 | 0.08 | −0.15 | 0.07 |
| Income (referent: unreported) | | | | | | |
| <$30,000 | −0.61*,† | 0.48* | 0.41 | −0.17 | 0.29 | 0.03 |
| $30,000 to $50,000 | −0.53*,† | 0.23 | 0.34 | 0.08 | 0.33 | 0.02 |
| >$50,000 | −0.52*,† | 0.33 | 0.45* | −0.17 | 0.40 | 0.02 |
| White | 0.15 | −0.13 | 0.04 | −0.15 | 0.04 | 0.05 |
| Heterosexual | −0.05 | 0.38* | 0.07 | −0.11 | 0.08 | −0.05 |
| Married/engaged | 0.03 | 0.06 | −0.22*,† | 0.02 | −0.03 | 0.04 |
| Have children | −0.03 | −0.10 | 0.03 | 0.03 | 0.01 | 0.08 |

QALY indicates quality-adjusted life years.

*$P < .05$.

†No longer statistically significant at $P \leq .05$ in a parsimonious logistic regression model that included only the significant variables from the base case analysis.

‡$P < .01$.

**TABLE 5**
**Ninety-Five Percent Confidence Intervals for Effect of a 1-Standard Deviation Change in Quality-Adjusted Life Years on Treatment Choice**

| | QALY | | | |
|---|---|---|---|---|
| Treatment | Erectile Dysfunction | Urinary Incontinence | Bowel Symptoms | Metastatic Disease |
| Undecided | −12% to 3% | −9% to 9% | −4% to 14% | −7% to 10% |
| Radical prostatectomy | −2% to 11% | −7% to 8% | −9% to 6% | −10% to 4% |
| External beam radiotherapy | −6% to 7% | −8% to 8% | −1% to 15% | −8% to 7% |
| Brachytherapy | −11% to 4% | −5% to 12% | −18% to −1%* | −2% to 13% |
| Hormonal therapy | −5% to 8% | −9% to 6% | −5% to 11% | −8% to 6% |
| Watchful waiting | −4% to 4% | −4% to 5% | −3% to 6% | −8% to 1% |

QALY indicates quality-adjusted life years.
*$P < .05$.

tive preferences did have some impact. Patients who listed "avoiding side effects" as the most important factor in choosing their treatment were significantly more likely to choose BT or WW, and significantly less likely to choose RP.

Among the remaining variables, the following were key predictors of treatment choice:

*Undecided.* Patients who were undecided about treatment tended to be more highly educated, and less likely to think about their own death.

*Radical prostatectomy.* Younger men were more likely to choose RP. Patients experiencing frequent thoughts of death also were more likely to choose RP. RP was less likely to be chosen by men who reported "avoiding side effects" as their top priority.

*External beam radiation.* Men with high- or medium-risk tumors were significantly more likely than those with low-risk tumors to choose EB.

*Brachytherapy.* Older men were more likely to choose BT, as were men with low-risk tumors. Men who prioritized "avoiding side effects" were more likely to select BT.

*Hormonal therapy.* HT was more common in patients with high- and medium-risk tumors. Notably, HT was used as monotherapy for just 1 patient in our sample, and otherwise was always an adjuvant to EB or BT.

*Watchful waiting.* WW was more commonly chosen by men expressing a desire to avoid side effects.

The analyses in Table 4 were repeated using logistic regression models that excluded all independent variables that did not reach statistical significance at the $P \leq .05$ level. In this more parsimonious model, the key results discussed above were persistent and unchanged, with the exception of "avoiding side effects" as a positive predictor for choosing BT. The effect remained positive, but was no longer statistically significant at conventional levels ($P = .08$). Other minor differences in the results are detailed in Table 4.

We also conducted a regression in which the outcome variable was EB alone (excluding patients who received adjuvant HT) and the only difference noted compared with the results above is that tumor risk was no longer a significant predictor of receiving EB.

Table 5 provides 95% CIs for the effect of preferences on treatment choice. These statistics describe the 95% CI for how much a 1-standard-deviation change in the QALY score for a given health state would affect the probability of a particular treatment choice. In general, the 95% CIs are fairly narrow, within ±10%, with none was greater in absolute value than 18%.

## DISCUSSION

Patients' preferences, measured in QALYs using a simple survey, appear to be shaped by reasonable behavioral and demographic influences. The majority of the results noted in Table 3 make intuitive sense. Many factors that predict preferences—such as frequency of sexual activity, work status, and experience with close friends or family members dying of cancer—can be assessed easily by both physicians and patients, and should be discussed explicitly in determining what treatment side effects and outcomes are most likely to affect an individual's quality of life.

Older men reported lower QALYs for all 4 conditions, indicating that older men were more willing than younger men to trade away years of life to obtain symptomatic relief. As one grows older and life expectancy becomes shorter, it is reasonable that quality of life becomes a greater priority than quantity of life—although this finding may not generalize to other clinical scenarios. Older respondents may

also envision a rapidly declining quality of life overall because of old age. If so, they plausibly are more willing to give up years at the end of their lives.

Although our patients' preferences (in QALYs) reflected a set of reasonable underlying tendencies, actual treatment choices bore little relation to these preferences. Of 6 regression equations, each with 4 QALY variables, only 1 QALY measure from 1 regression had a significant coefficient. Given that the optimal treatment choice for localized prostate cancer critically depends on individual preferences, this result is discouraging.[2]

Although the QALY measures did not significantly predict treatment, more simplified measures of preferences were associated with patient decisions. The question, "What factor is most important to you in choosing a treatment?"—in particular the tradeoff between side effects and preventing cancer from spreading—strongly predicted whether a patient chose RP, BT, or WW. Frequency of thoughts about death also was found to significantly predict treatment choice, a finding that is consistent with previous research demonstrating the effects of anxiety on cancer treatment decisions.[15]

Why might qualitative measures of preferences predict treatment choices better than quantitative QALY measures? One possibility is that our QALY measures are less meaningful than we suspect. However, the results in Table 3 strongly suggest that these QALYs represent a rich set of behavioral and demographic influences, giving them significant face validity. The most likely explanation is that simple questions such as, "What is the most important factor for you in making this choice?" and "How much anxiety about death is your cancer causing you?" are easier for physicians to ask and for patients to answer than are QALY assessments. Even the fairly straightforward QALY assessment used in the current study is more time-consuming and difficult to integrate into clinical practice. A related issue is that patients may struggle to communicate these preferences to their physicians, even when physicians do ask about them. One possible solution to such barriers in assessment and communication about preferences would be to incorporate explicit quantitative measurement of QALYs into the clinical encounter. Patient-friendly assessment tools and computerized decision support could facilitate the use of more tailored patient preferences when considering treatment choices.

It is also possible that the study was underpowered to detect a true effect of QALYs on treatment choices because of sample size. Table 5 provides an estimate of how large an effect of this type our study may have missed. For example, Table 5 indicates that with 95% probability, a 1-standard deviation change in the QALY score for ED at most increased the likelihood of selecting watchful waiting by 4%. Overall these results suggest that our analysis has not missed any large effects of QALYs on treatment choices because of power considerations.

Overall, preferences play a discouragingly small role in treatment choices. What does affect treatment choice? As expected, age and tumor risk profile were found to be strong predictors. Older patients were less likely to undergo surgery and more likely to receive BT. This likely reflects that older patients are poorer surgical candidates, whereas younger patients may be more likely to choose what they see as the most aggressive therapy. Combination therapy—primarily EB with adjuvant HT—was more common among men with high-risk tumors.

However, the most important predictor of treatment choice was the specialty of the physician seen by the patient at the time of recruitment into the study—radiation oncology versus urology. One must be very cautious in interpreting this finding because numerous factors could produce it. The most obvious is that patients can determine, or influence, the kinds of physicians they see. Patients who were more interested in surgery or were more appropriate surgical candidates were more likely to see a urologist; similarly, patients more likely to choose radiation most likely saw a radiation oncologist. Thus, 1 interpretation of this finding that we cannot rule out is that it is a self-fulfilling prophecy: the type of physician seen simply reflected the treatment decision the patient had already made.

There are several reasons, however, to suspect that a patient's intended treatment is not the sole factor at work in this relation. First, the regressions controlled for several clinical factors that might lead certain patients to see a urologist versus a radiation oncologist: age, tumor risk (using PSA and Gleason score), and overall health status. Second, the regressions controlled for patients' preferences regarding the health states relevant to this treatment choice. In a supplemental analysis not presented in the current study, physician specialty was not found to be a significant predictor of patient QALY scores. Last, previous research indicates that physicians' advice regarding treatment for prostate cancer is significantly affected by specialty.[5] Thus, it is likely that the strong predictive relation between physician specialty and patient treatment choice reflects both unobserved patient preferences and physician bias toward their own field. Again, this suggests a role in

patient care for impartial computerized decision-support tools that can assess QALYs and then use these preferences in a decision-analytic framework to guide optimal therapy choices.

### Limitations of the Current Study

This study has several limitations. First, and most important, the sample was nonrandom, and the response rate was only 46%. Thus, it is possible than our respondents were not representative of all prostate cancer patients at our institutions. The sample also was comprised of patients obtaining specialty care at academic medical centers, and was disproportionately white and well-educated. This sample may not be comparable to other patient populations, particularly those in nonacademic medical centers and in other regions of the country. Our regressions controlled for a host of demographic features including age, ethnicity, marital status, education, income, and occupational status, thus limiting many potential biases from sample composition. Nonetheless, our results may have been biased by unmeasured variables, and may not directly generalize to other patient populations.

A second concern is that our measured QALYs may be sensitive to the method used to assess them.[16] Moreover, the single-item time-tradeoff approach may be subject to framing bias or a ceiling effect because 17% of respondents reported QALYs of 1.0 for every condition.[17] Fortunately, these concerns are diminished because we used a validated instrument, and the average QALY values in the current study are comparable to previously published values using other assessment techniques.[14]

In terms of treatment choices, the current study did not include enough individuals choosing HT alone to identify predictors of this treatment. Given that all but 1 patient who chose HT did so as adjuvant therapy, our results for HT likely do not generalize to hormonal monotherapy. Future research exploring predictors of HT monotherapy could provide valuable information.

For some of our secondary variables, such as optimism or frequency of thoughts about death, we opted to use single-item measures, rather than multi-item scales that have been validated in previous research. In doing so, we may have missed significant predictive effects because of measurement error. Future research, focusing more specifically on some of these behavioral measures, could use more detailed assessment tools to improve upon our approach.

Finally, given the observational nature of our study, our regressions only identify associations, which may not be cause-and-effect relations. The variables found to significantly predict preferences or treatment choices may not be causally related to the outcomes in question.

### Conclusions

Prostate cancer exemplifies a disease in which both clinical features and individual preferences are required to determine the optimal treatment for any particular patient. In this study of 167 men with newly diagnosed localized prostate cancer, preferences in the form of QALYs were assessed using a straightforward self-administered survey. These QALYs appear to represent a reasonable set of behavioral and demographic influences. However, these preferences ultimately appeared to have little impact on the treatment decisions made by these patients, suggesting that physicians should pay more attention to variation in preferences among patients as they facilitate individualized treatment choices. Future research is needed to explore the effectiveness of decision-support tools and shared decision-making approaches, which may offer a better means of incorporating the preferences of each individual patient than do current practices.

## REFERENCES

1. Bill-Axelson A, Holmberg L, Ruutu M, et al. Radical prostatectomy versus watchful waiting in early prostate cancer. *N Engl J Med*. 2005;352:1977-1984.
2. Sommers BD, Beard CJ, D'Amico AV, et al. A decision analysis using individual patient preferences to determine optimal treatment for localized prostate cancer. *Cancer*. 2007;110:2210-2217.
3. Gwede CK, Pow-Sang J, Seigne J, et al. Treatment decision-making strategies and influences in patients with localized prostate carcinoma. *Cancer*. 2005;104:1381-1390.
4. Denberg TD, Melhado TV, Steiner JF. Patient treatment preferences in localized prostate carcinoma: the influence of emotion, misconception, and anecdote. *Cancer*. 2006;107:620-630.
5. Fowler FJ, Collins MM, Albertsen PC, et al. Comparison of recommendations by urologists and radiation oncologists for treatment of clinically localized prostate cancer. *JAMA*. 2000;283:3217-3222.
6. McNaughton Collins M, Barry MJ, et al. United States radiation oncologists' and urologists' opinions about screening and treatment of prostate cancer vary by region. *Urology*. 2002;60:628-633.
7. O'Connor AM, Mulley AG, Wennberg JE. Standard consultations are not enough to ensure decision quality regarding preference-sensitive options. *J Natl Cancer Inst*. 2003;95:570-571.

8. Fagerlin A, Rovner D, Stableford S, Jentoft C, Wei JT, Holmes-Rovner M. Patient education materials about the treatment of early-stage prostate cancer: a critical review. *Ann Intern Med*. 2004;140:721-728.
9. Patel HRH, Mirsadraee S, Emberton M. The patient's dilemma: prostate cancer treatment choices. *J Urol*. 2003; 169:828-833.
10. Albertsen PC, Nease RF, Potosky AL. Assessment of patient preferences among men with prostate cancer. *J Urol*. 1998; 159:158-163.
11. Krahn M, Ritvo P, Irvine J, et al. Construction of the Patient-Oriented Prostate Utility Scale (PORPUS): a multiattribute health state classification system for prostate cancer. *J Clin Epidemiol*. 2000;53:920-930.
12. Foundation for Informed Medical Decision Making. Treatment Choices for Prostate Cancer: A Shared Decision-Making Program. Boston, MA: Health Dialog, Inc.; 2003.
13. D'Amico AV, Whittington R, Malkowicz SB, et al. Biochemical outcome after radical prostatectomy, external beam radiation therapy, or interstitial radiation therapy for clinically localized prostate cancer. *JAMA*. 1998;280:969-974.
14. Stewart ST, Lenert L, Bhatnagar V, Kaplan RM. Utilities for prostate cancer health states in men aged 60 and older. *Med Care*. 2005;43:347-355.
15. Dale W, Bilir P, Han M, Meltzer D. The role of anxiety in prostate carcinoma. *Cancer*. 2005;104:467-478.
16. Elkin EB, Cowen ME, Cahill D, Steffel M, Kattan MW. Preference assessment method affects decision-analytic recommendations: a prostate cancer treatment example. *Med Decis Making*. 2004;24:504-510.
17. Tversky A, Kahneman D. The framing of decisions and the psychology of choice. *Science*. 1981;211:453-458.