Feasibility of using guidelines to choose treatment for prostate cancer

Ravinder Mohan, MD,[1] Hind Beydoun, PhD,[2] John Davis, MD,[3] Raymond Lance, MD,[4] Paul Schellhammer, MD[4]

[1]Department of Family and Community Medicine, Eastern Virginia Medical School, Norfolk, Virginia, USA
[2]Graduate Program in Public Health, Eastern Virginia Medical School, Norfolk, Virginia, USA
[3]Department of Urologic Oncology, M.D. Anderson Cancer Center, Houston, Texas, USA
[4]Department of Urology, Eastern Virginia Medical School, Norfolk, Virginia, USA

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Introduction: *Treatment for localized prostate cancer (LPC) may not improve survival and commonly impairs health related quality of life. National guidelines provide algorithms to choose between treatment or observation for LPC, but the algorithms require the factoring of the patient's baseline comorbidity adjusted life expectancy (CALE). However, no method is available to estimate CALE of 10 or more years.*

Materials and methods: *A mailed survey was completed by newly diagnosed untreated LPC patients. Their baseline CALE was estimated by weighting their age based life expectancy by quartiles of comorbidity scores, and a national guideline was used to find if treatment or observation was recommended for each patient. Demographic, health and cancer characteristics, and beliefs were compared in patients who chose treatment or observation concordant with the guideline, and those who chose under treatment or over treatment.*

Results: *Of 184 survey participants, 10 chose under treatment, 144 chose concordant treatment, and 30 chose over treatment. Under treatment patients had similar sociodemographic and health characteristics to patients who were concordant. In comparison to concordant patients, over treatment patients were older, had a lower Gleason grade or PSA level, a higher comorbidity score, a lower CALE, and lower scores on the Fear of Cancer Recurrence scale.*

Conclusion: *Comorbidity scores can be used to estimate CALE in LPC patients, and estimation of CALE allows the use of guidelines in the choice of treatment. In our study, over treatment occurred more frequently than under treatment. Factors known to limit the survival benefit of treatment were associated with over treatment. Over treatment patients also had lower fear of cancer recurrence.*

Key Words: guidelines, treatment, localized prostate cancer

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Address of correspondence to Dr. Ravinder Mohan, Department of Family and Community Medicine, Eastern Virginia Medical School, 825 Fairfax Avenue, Norfolk, Virginia USA

Introduction

Over treatment of localized prostate cancer (LPC) has been an increasing concern.[1] In the United States, 94% of LPC patients choose treatment[2] even though about 80% of US patients 55-59 years old who chose observation for low to moderately differentiated clinically diagnosed LPC were free of death due to prostate cancer at 20 years.[3] Survival may be even better for patients who are diagnosed by screening since screening is

associated with a lead time of about 10 years.[4] In patients diagnosed through screening, prostate cancer specific survival after active surveillance was 99.2% after 8 years of follow up in 299 patients in a Canadian study[5] and 100% after 10 years of follow up in 616 patients in a multicenter European study.[6] Treatment damages health related quality of life (HRQOL) for at least 6 years,[7] and may improve HRQOL adjusted survival by only 1.2 months.[5] An over treatment rate of 55% in the US was reported,[1] and the cost of each potentially unnecessary prostatectomy or radiation therapy in 2000 dollars was about $10,000 to $25,000.[8] About a decade ago, several studies had also found under treatment of LPC especially in African American patients.[9] Under treatment can also occur in patients who are not treated because they are older than 69 years but who still have a life expectancy of more than 10 years.[10]

National guidelines and algorithms can be used in choosing treatment or observation but their use requires an estimate of the patient's baseline comorbidity adjusted life expectancy (CALE), and there has been no method described in literature by which long term CALE (e.g., of 10 or more years) can be estimated. This also makes it difficult to use the "10 year rule" which is commonly used by clinicians and which recommends treatment if a patient has a CALE of 10 or more years.[11] Rough estimates of CALE by primary physicians[12] and urologists and radiation oncologists[13] have a high margin of error. Walz et al had found that multifactorial models that have been used in urology settings to predict survival in LPC patients had a predictive accuracy of 69% to 70%, and their own model's accuracy was 84%,[14] but in all of these models both cancer characteristics and CALE were factored simultaneously to predict survival. Instead, the guidelines require an estimate of the patient's baseline CALE independent of the newly diagnosed cancer. Additionally, patients also need to know their baseline CALE to understand how the cancer or its treatment could affect their survival. Life expectancy based on age alone also cannot by used because comorbidity is the strongest predictor of longevity in LPC patients; this effect is even stronger in LPC patients who are younger or have screen detected LPC.[15] Because health and life expectancy become increasingly heterogeneous with advancing age, Walter and Covinsky had suggested the use of life expectancy quartiles in making decisions of screening for different cancers.[16] Their concept, that the middle two quartiles of life expectancy represents the life expectancy of patients in average health, was also endorsed by the National Comprehensive Care Network (NCCN) guidelines for selecting treatment or observation for LPC.[17] However, no study has suggested criteria by which patients can be stratified in groups of average health, below average and above average health. We used a 12 item self administered version of the Charlson Comorbidity Index (CCI) that was used by the Prostate Cancer Outcomes Study (PCOS)[18] and found that in PCOS, as well as in our patients,[19] about half of the patients had a CCI score of 1 or 2 diseases. By attributing a 0 disease score to the top health quartile, 1 or 2 disease scores to the middle two health quartiles, and 3 or more disease score to the bottom health quartile, we were able to construct estimates of baseline CALE. With the use of CALE estimated by this method, we used NCCN guidelines to find decisions of over treatment, recommended treatment, and under treatment in patients newly diagnosed with LPC.

Materials and methods

We surveyed patients who had been newly diagnosed with LPC (stages T1a to T2c), had met with their urologist after the diagnosis, were scheduled to get treatment or had chosen observation, and had not yet been treated with surgery or radiation. All patients were recruited from a private urology practice in Norfolk, Virginia. Staff at this practice systematically contacted patients newly diagnosed with LPC between March 2005 and October 2007 regarding their interest in participation in a self administered mailed survey. Surveys were mailed to interested patients. Survey questions included expectations of survival with and without treatment, fear of cancer recurrence, comorbid diseases, and generic, symptom specific and domain specific HRQOL. Patients who did not return surveys were contacted by telephone. Demographic and medical information, and the type of treatment given, was obtained from patient charts. The study methods were approved by an Institutional Review Board.

Measures

The Charlson Comorbidity Index (CCI): This is a validated measure of comorbidity. We used a patient self reported CCI scale that asked about the presence and severity of 12 chronic conditions; this CCI version was used by the Prostate Cancer Outcomes Study (PCOS).[18] Score categories are 0, 1, 2, and 3 or more diseases.

Estimation of Comorbidity Adjusted Life Expectancy (CALE): The NCCN guidelines recommend that health adjusted life expectancy of LPC patients be estimated by weighting mean life expectancy by 1.5 for patients in the highest health quartile, having no weighting for patients in the middle two health quartiles, and weighting by 0.5 for patients in the lowest health quartile.[17] We categorized patients in health quartiles

by using their CCI score: 0 disease score (highest quartile), 1 or 2 disease score (middle two quartiles) and 3 or more disease score (lowest quartile).

"Over treatment" and "Under treatment": In the NCCN guideline, the first step is to calculate the risk due to cancer recurrence based on cancer stage, cancer grade, and PSA level. In the next step, treatment recommendation is obtained based on the risk due to cancer recurrence and the patient's CALE. We combined radical prostatectomy and radiation into one group called "Treatment", and patients who were not planning on either radiation or surgery were in the group called "Observation". Hormone therapy did not influence this grouping. The patient's decision was considered to be one of "Over treatment" if by NCCN recommendation the patient was at low risk and could have chosen either Observation or Treatment, and the patient had chosen Treatment. The decision was considered "Under treatment" if the only NCCN recommendation was Treatment, and the patient had chosen Observation.

Patient expectations of survival with and without treatment: Baseline CALE calculated according to age and comorbidity scores was grouped in four categories: < 5 years, 5-10 years, 10-20 years, and > 20 years. Additionally, survey questionnaires asked patients to estimate their expected survival in these four categories with treatment (Q1), and without treatment (Q2). Perceived Decrease in Longevity with Observation (PDLO) was 10 or more years if Q1 category was two or more categories less than the calculated CALE category. Perceived Increase in Longevity with Treatment (PILT) was 10 or more years if Q2 category was two or more categories more than the Q1 category. This method was reported by us previously.[19]

HRQOL scales: Short-Form 36,[20] Prostate Cancer Index,[21] Duke Activity Status Index (DASI),[22] the Hospital Anxiety and Depression Scale,[23] the Fear of Cancer Recurrence Scale,[24] the Medical Outcome Study (MOS) Social Support survey,[25] and a Delighted Terrible seven faces scale for satisfaction with life, health, and with education given by physicians about treatment options for LPC. Health literacy was evaluated by a telephonic administration of a brief version of the Rapid Adult Assessment of Literacy in Medicine (REALM) scale.[26]

Statistical analyses

All analyses were performed using the SAS software, version 9.2 (SAS Institute Inc., Cary, NC). Frequencies and relative frequencies were used to describe categorical variables. Mean and standard deviations were used as summary measures for continuous variables. Chi-square tests, Fisher's exact test and independent samples t-test were used to examine bivariate associations. Two sided statistical significance was assessed at an alpha level of 0.05.

Results

A total of 356 patients received the survey before any treatment had been done. One hundred eighty-four of these patients (52%) agreed to participate and returned the survey. Of the 172 patients who did not return the survey, after telephone follow up, 104 patients said they were "not interested" in participating and 68 patients did not give a reason or they could not be contacted. Most patients mentioned lack of time before impending treatment as the main reason of not being able to participate. Tables 1 and 2 show that of the 184 patients who returned surveys, 10 (5.4%) chose under treatment, 144 (78.3%) chose treatment concordant with NCCN recommendations, and 30 (16.3%) chose over treatment. Tables 3-5 show that under treatment patients had similar sociodemographic and health characteristics to patients who were concordant with recommendations, except that their baseline bowel function scores were worse. In comparison to patients who chose treatment concordant with NCCN

TABLE 1. **Calculation of risk of cancer recurrence in 184 LPC patients by NCCN guidelines**

Stage	Grade	PSA	Risk of recurrence
T1A, T1B, T1C, T2A n = 161	2-6 n = 96	< 10 n = 88	Low
		10-20 n = 7	Inter
		> 20 n=7	High
	7 n = 54	20 or less n = 53	Inter
		> 20 n = 1	High
	8-10 n = 11	Any n = 11	High
T2B, T2C n = 21	2-7 n = 13	20 or less n = 13	Inter
		>20 n = 0	High
	8-10 n = 8	Any n = 8	High
T3A n = 2	Any n = 2	Any n = 2	High

TABLE 2. **Calculation of the recommended treatment option by NCCN guidelines in 184 LPC patients, and concordance of treatment choice by patients with the recommended option**

Risk of recurrence	CALE (in years) †	NCCN recommended option*	Concordant patients (n)	Discordant patients (n)
Low n = 88	< 10 n = 5	Observation	3	2 (over treatment)
	10-20 n = 36	Observation	10	26 (over treatment)
	> 20 n = 47	Only treatment	43	4 (under treatment)
Inter n = 73	< 10 n = 2	Observation	0	2 (over treatment)
	10 or more n = 71	Only treatment	67	4 (Under treatment)
High n = 23	< 5 n = 0	Only observation	0	0
	5 or more n = 23	Only treatment	21	2 (under treatment)

†CALE: comorbidity adjusted life expectancy

*NCCN guidelines (2002 version); unless specified as "only observation", "treatment" was also a recommended option when "observation" was recommended. "Treatment" includes surgery or radiation.

guidelines, patients planning on over treatment were older (65.3 ± 4.0 versus 60.6 ± 8.3 years; $p < 0.0001$), had a lower Gleason grade (6.1 ± 0.3 versus 6.6 ± 0.8; $p < 0.0001$), a lower PSA level (4.8 ± 2.2 versus 7.1 ± 5.7; $p < 0.0001$), a higher comorbidity score (1.47 ± 1.43 versus 0.74 ± 0.91 diseases; $p < 0.0001$) and a lower comorbidity adjusted life expectancy (18.0 ± 3.9 versus 24.2 ± 7.7 years; $p < 0.0001$). Over and under treatment decisions were not significantly related to patient expectations of survival with and without treatment. However, patients planning on over treatment had lower scores on the Fear of Cancer Recurrence scale than concordant patients (8.7 ± 2.5 versus 12.4 ± 4.9; $p = 0.0003$). Other demographic, socioeconomic and health characteristics were not significantly associated with the decision to choose over treatment.

Discussion

One in six American men will be diagnosed with prostate cancer in their lifetime, and in nonsmoking men prostate cancer is the most common cause of cancer death. Yet, about three fourths of patients have localized cancer that is low to moderately differentiated cancer (Gleason score less than 8) in whom treatment may be unnecessary.[28] Especially in the case of low risk patients, i.e., who have stage T1c disease, PSA < 10 and Gleason grade < 7,[17] who constitute almost half of newly diagnosed patients,[29] data from randomized trials does not favor either observation or treatment.

Patients and their families experience significant anxiety due to uncertainties that follow diagnosis, and the NCCN guidelines can be very helpful because they offer unbiased, updated, and evidence based recommendations [30] regarding choice of treatment or observation. However, we could not find any publications in the PubMed that mentioned the use of NCCN or any national guidelines in decision making in individual LPC patients. Our search had used combination of terms such as "prostate cancer, practice guidelines, NCCN, medical oncology/standards, evidence based practice, urology/standards, and neoplasms/therapy". While the algorithm is easy to use, it requires factoring of the patient's baseline CALE which is difficult to estimate for primary care physicians[12] and for specialists.[13] Also, we could not find any research methods in literature that we could use to estimate the long term (> 10 years) CALE of individual ambulatory patients.

To our knowledge, our study is the first to use a plan that attempts to estimate baseline CALE of newly diagnosed LPC patients based on objective criteria. Also, it is the first to show published use of NCCN guidelines in decision making in individual LPC patients. It also can characterize a given decision as concordant with NCCN guidelines,

TABLE 3. **Distribution of patients in the study sample by sociodemographic characteristics and concordance of treatment choice with NCCN guidelines**

	Under treated (n = 10) n (%)	**Concordant (n = 144) n (%)**	**Over treated (n = 30) n (%)**
Age (years)	n = 10	n = 144	n = 30
	p = 0.48†	reference	p < 0.0001†
< 60	3 (30.0)	67 (46.5)	1 (3.3)
60-70	6 (60.0)	58 (40.3)	27 (90.0)
> 70	1 (10.0)	19 (13.2)	2 (6.7)
	p = 0.22	reference	p < 0.0001
Mean ± SD	63.9 ± 5.4	60.6 ± 8.3	65.3 ± 4.0
Race	n = 10	n = 144	n = 30
	p = 0.36†	reference	p = 1.00†
African American	0 (0.0)	22 (15.3)	4 (13.3)
Caucasian American	10 (100)	122 (84.7)	26 (86.7)
Education	n = 10	n = 144	n=30
	p = 0.71†	reference	p = 0.58†
None	0 (0.0)	3 (2.1)	1 (3.3)
Less than high school	0 (0.0)	5 (3.5)	2 (6.7)
High school	5 (50.0)	51 (35.4)	9 (30.0)
College	5 (50.0)	85 (59.0)	18 (60.0)
Health literacy	n = 10	n = 136	n = 27
	p = 0.63†	reference	p = 1.00†
Below 6th grade	0 (0.0)	1 (0.7)	0 (0.0)
6th-9th grade	0 (0.0)	14 (10.3)	2 (7.4)
Above 9th grade	10 (100)	121 (88.9)	25 (92.6)
Family income	n = 10	n = 140	n=54
	p = 1.00†	reference	p = 0.74
Low income < $50,000	3 (30.0)	44 (31.4)	10 (34.4)
High income ≥ $50,000	7 (70.0)	96 (68.6)	19 (65.5)

*Unless otherwise specified, statistical significance is for Chi-square test (categorical variables) or independent samples t-test (continuous variable); † Fisher's exact test.

or either over treatment or under treatment. Our plan is based on three presumptions: 1) that "over treatment" should include a choice of treatment when the NCCN recommends observation as an equally recommended option, 2) that patients in the lowest and highest quartiles of health status (as determined by their CCI score) will have the lowest and highest quartile of life expectancy (as found in US Life Tables for their age), and 3) that a CCI score of 1 to 2 diseases indicates average health i.e., the middle two quartiles of health status. The basis of the latter presumption was that approximately half of 184 patients in our study, and approximately half of 3173 newly diagnosed LPC patients in a Prostate Cancer Outcomes Study (PCOS) publication,[18] had 1 or 2 diseases on a 12-disease CCI. In a recent study, the impact of comorbidity on survival was studied in older patients with a mean age of 77 years who were undergoing colorectal cancer screening, and CCI scores of 0 disease, 1 to 3 diseases, and 4 or more diseases were considered indicative of insignificant, average, and severe comorbidity.[31] However, this study had used the conventional CCI scale which has 19 possible diseases. We preferred using the 12-disease CCI, which had been used in several PCOS studies, to the conventional 19 disease scale because screen-detected LPC patients commonly do not have many of the 19 diseases listed in the conventional scale. For instance, in 1910 consecutive patients who underwent prostatectomy for LPC, only 11 of the 19 diseases in the conventional CCI contributed to 10 year mortality.[32, 33]

TABLE 4. **Distribution of patients in the study sample by cancer characteristics and concordance of treatment choice with practice guidelines**

	Under treated (n = 10)	Concordant (n = 144)	Over treated (n = 30)
Gleason grade	n = 10	n = 144	n = 30
	p = 0.30†	reference	p < 0.0001
2-4	0 (0.0)	0 (0.0)	0 (0.0)
5-6	6 (60.0)	69 (47.9)	28 (93.3)
7	2 (20.0)	58 (40.3)	2 (6.7)
8-10	2 (20.0)	17 (11.8)	0 (0.0)
	p = 0.81	reference	p < 0.0001
Mean ± SD	6.6 ± 0.8	6.6 ± 0.8	6.1 ± 0.3
PSA	n = 10	n = 143	n = 30
	p = 0.66†	reference	p = 0.016†
≤ 10	8 (80.0)	121 (84.6)	30 (100)
> 10	2 (20.0)	22 (15.4)	0 (0.0)
	p = 0.99	reference	p = 0.0004
Mean ± SD	7.1 ± 4.0	7.1 ± 5.7	4.8 ± 2.2
Life expectancy by age	n = 10	n = 144	n = 29
	p = 0.49†	reference	p < 0.0001†
< 10 years	0 (0.0)	4 (2.8)	0 (0.0)
10-20 years	7 (70.0)	69 (47.9)	28 (96.6)
20 years or more	3 (30.0)	71 (49.3)	1 (3.5)
Comorbidity score	n = 10	n = 144	n = 30
	p = 0.28†	reference	p < 0.0001†
0	3 (30.0)	69 (47.9)	2 (6.7)
1	4 (40.0)	50 (34.7)	21 (70.0)
2	2 (20.0)	22 (15.3)	3 (10.0)
≥ 3	1 (10.0)	3 (2.1)	4 (13.3)
	p = 0.23	reference	p = 0.011
Mean ± SD	1.1 ± 0.99	0.74 ± 0.91	1.47 ± 1.43
Comorbidity adjusted life expectancy (CALE)			
All ages	10 (100)	144 (100)	29 (100)
	p = 0.23†	reference	p < 0.0001†
< 5 years	0 (0.0)	1 (0.7)	0 (0.0)
5-10 years	1 (10.0)	3 (2.1)	3 (10.0)
11-19 years	4 (40.0)	43 (29.9)	26 (86.7)
≥ 20 years	5 (50.0)	97 (67.4)	0 (0.0)
	p = 0.05	reference	p < 0.0001
Mean ± SD	19.4 ± 6.4	24.2 ± 7.7	18.0 ± 3.9

†Fisher's exact test.

Thirty of our 184 patients chose over treatment, which is an over treatment rate of 16%. This rate is much lower than the 55% over treatment rate found by Miller et al[1] in the population based data in 24405 patients with low risk, i.e., in patients who had well differentiated tumors, or who were 70 years of age or older and had moderately differentiated tumors. In their study, over treatment was defined as treatment which had not been found in leading studies to be better than observation in extending survival. Because their study was population based, Miller et al discussed that their findings may be difficult to use for decision making

TABLE 5. **Distribution of patients by health characteristics and adequacy of treatment**

	Under treated (n = 10)	Compliant (n = 144)	Over treated (n = 30)
SF-36 scores			
PCS	51.8 ± 16.2 (n = 5)	54.5 ± 7.3 (n = 110)	54.8 ± 6.5 (n = 27)
	p = 0.73	reference	p = 0.84
MCS	45.1 ± 5.4 (n = 5)	43.7 ± 7.2 (n = 110)	45.6 ± 4.8 (n = 27)
	p = 0.66	reference	p = 0.19
Prostate cancer index function scores			
Urinary function	89.7 ± 10.0 (n = 5)	89.9 ± 18.3 (n = 109)	91.6 ± 12.1 (n = 27)
	p = 0.98	reference	p = 0.55
Bowel function	94.0 ± 3.9 (n = 5)	88.3 ± 13.3 (n = 110)	89.9 ± 9.9 (n = 27)
	p = 0.03	reference	p = 0.48
Sexual function	44.4 ± 22.0 (n = 5)	58.6 ± 30.5 (n = 105)	56.5 ± 29.5 (n = 26)
	p = 0.31	reference	p = 0.75
Anxiety scores			
All patients	n = 10	n = 143	n = 30
No anxiety	9 (90.0)	111 (77.6)	25 (83.3)
	p = 0.56†	reference	p = 0.95†
Depression scores			
All patients	n = 9	n = 140	n = 29
No depression	9 (100)	134 (95.7)	29 (100)
	p = 1.00†	reference	p = 1.00†
Fear of cancer recurrence scores	11.1 ± 3.8 (n = 5)	12.4 ± 4.9 (n = 111)	8.7 ± 2.5 (n = 25)
	p = 0.47	reference	p = 0.0003
Functional capacity scores			
All patients	n = 10	n = 143	n = 30
Vigorous activities	9 (90.0)	127 (88.2)	27 (90.0)
6+ METS‡	p = 1.00†	reference	p = 1.00†
Social support scores			
All patients	n = 10	n = 144	n = 30
> 75th percentile	6 (60.0)	112 (77.8)	25 (83.3)
	p = 0.25†	reference	p = 0.84†
Satisfaction with life	5.7 ± 1.2 (n = 10)	5.8 ± 1.4 (n = 143)	6.0 ± 1.4 (n = 30)
	p = 0.80	reference	p = 0.42
Satisfaction with health	5.4 ± 1.2 (n = 10)	4.7 ± 1.8 (n = 143)	5.1 ± 1.7 (n = 30)
	p = 0.21	reference	p = 0.28
Satisfaction with education by physicians in choices	6.2 ± 0.8 (n = 10)	5.9 ± 1.5 (n = 143)	5.9 ± 1.5 (n = 30)
	p = 0.25	reference	p = 0.82
PDLO			
All patients	n = 6	n = 135	n = 29
PDLO > 10 years	2 (33.3)	71 (52.6)	10 (34.5)
	p = 0.36	reference	p = 0.077
PILT			
All patients	n = 6	n = 135	n = 29
PILT >10 years	1 (16.7)	54 (40.0)	10 (34.5)
	p = 0.40	reference	p = 0.58

*Unless otherwise specified, statistical significance is for Chi-square test (categorical variables) or independent samples t-test (continuous variable); †Fisher's exact test. ‡Metabolic Equivalents; PCS and MCS are physical and mental component summary scores; PDLO = perceived decrease in longevity with observation; PILT = perceived increase in longevity with treatment.

in individual patients. In our study, we defined over treatment as discordance with the NCCN guideline based on the patient's stage and grade of cancer, PSA, and the estimated CALE. Additionally, our calculations included the caveat that we defined over treatment as a choice of treatment even though observation was an equally recommended option. Our over treatment rate is lower than that in Miller et al's study possibly because we had used the 2002 version of the NCCN guideline which recommended either observation or treatment for low risk patients with a CALE of less than 20 years. More recent versions recommend either option for low risk patient with any CALE. Had we had used the recent versions, our over treatment group would include an additional 47 low risk patients who had a CALE of more than 20 years and who had chosen treatment; thus, by current guidelines our study had an over treatment rate of 41.8%.

We used the term "under treatment" for 10 of 184 (5.3%) patients who had higher risk but who had chosen observation. None of these patients was African American. Twenty-six of our 184 patients were African American, and race was not associated with under or over treatment in our study. Although over treatment rate decreased nationally from 94% in 2000-2001 to 90% in 2004-2006,[29] it is unclear if under treatment is decreasing in African American patients. The racial gap in mortality persists, because from 1981 to 2005 prostate cancer related deaths per 100,000 US population decreased from 30 to 22 in whites, but only from about 62 to 53 in blacks.[34]

Except for focus group qualitative studies, to our knowledge our study is also the first that had surveyed LPC patients before treatment about why they were planning on either treatment or observation, and what outcomes they expected. We found that over treatment decisions were made significantly more commonly by patients who were older, had a higher CCI score, had a lower CALE, and in whom the cancer had a lower grade and the PSA was lower. These patients chose treatment even though there is no evidence that treatment would improve their survival. Over treatment was common even though 60% of our patients had a college education and an income of > $50,000 and about 90% patients had at least a ninth grade health literacy and had excellent functional capacity. We had recently reported that 47.6% of our 184 patients had expected to live longer by 10 or more years by choosing treatment; such expectations could be considered gross over expectations since treatment has not been shown to improve survival in patients with low to moderately differentiated LPC (Gleason grade < 8) by even 1 year.[19] In the current analysis, we did not find that over expectation of survival was more common in patients who were planning on over treatment, but over treatment patients had a lower fear of recurrence of cancer. This could be a result of reassurance obtained from choosing treatment.

Our study's limitations are that we had a small sample size, almost half of our patients could not complete and return the survey before treatment, and that our study included only a few African American patients. Also, we termed any treatment as over treatment if observation was equally recommended but this reasoning may not be considered acceptable. Because of these reasons, it may not be possible to generalize our over treatment rates.

The main usefulness of our study is that it shows how individual cancer patients and their physicians can estimate the patient's baseline CALE by using a short patient administered 12 disease CCI, and then be able to use NCCN guidelines to find whether treatment or observation is recommended. Additionally, this approach makes it possible to say whether a given treatment choice for LPC represents recommended treatment, over treatment, or under treatment. We have included Table 6 that shows, for instance, that CALE can be 11.4 years old at age 80 if the patient is in the top health quartile, but only 9.8 years at age 60 if the patient is in the bottom health quartile. Our method uses the CCI, which is considered the gold standard among comorbidity indices,[35] and the NCCN guideline, which was rated as most evidence based among guidelines for selecting a treatment or observation for LPC.[30] On reviewing the literature, we could not find other methods that could be used to estimate long term CALE (> 10 years) in individual ambulatory patients. We needed to estimate long term CALE because newly diagnosed LPC patients usually have a life expectancy of at least 10 years and commonly of more than 20 years. In our patients, 60.9% patients had a CALE of 20 years or more.[19] Functional capacity is also a known predictor of life expectancy,[16] but it may not be useful in younger patients because most younger patients belong to the highest functional capacity category. Our patients had a mean CCI score of 0.9 ± 1.0 diseases but on the DASI scale about 90% of them perceived themselves to be in the highest functional capacity category.[19] The method of Declining Exponential Approximation of Life Expectancy[36] has been used to estimate CALE, but it cannot be used in individual patients because the method requires factoring of known disease specific mortalities of comorbid diseases, and mortality rates of different diseases with varying severities are not known. A prognostic index incorporating age, sex, smoking status, six comorbid conditions and

TABLE 6. **Comorbidity adjusted life expectancy in US males (years)**

Age	Top 25th percentile of health	Middle two percentiles of health	Bottom 25th percentile of health
50	42.69	28.46	14.23
51	41.43	27.62	13.81
52	40.18	26.79	13.39
53	38.94	25.96	12.98
54	37.71	25.14	12.57
55	36.49	24.33	12.16
56	35.28	23.52	11.76
57	34.06	22.71	11.35
58	32.88	21.92	10.96
59	31.69	21.13	10.56
60	30.54	20.36	10.18
61	29.4	19.6	9.8
62	28.27	18.85	9.42
63	27.16	18.11	9.05
64	26.07	17.38	8.69
65	25.00	16.67	8.33
66	23.94	15.96	7.98
67	22.90	15.27	7.63
68	21.88	14.59	7.29
69	20.89	13.93	6.96
70	19.90	13.27	6.63
71	18.96	12.64	6.32
72	18.01	12.01	6.00
73	17.11	11.41	5.70
74	16.21	10.81	5.40
75	15.36	10.24	5.12
76	14.52	9.68	4.84
77	13.71	9.14	4.57
78	12.93	8.62	4.31
79	12.16	8.11	4.05
80	11.43	7.62	3.81

four functional variables could stratify community dwelling older adults according to their 4 year mortality,[37] but in a Dutch population the discriminant value of this index was similar to that of age and sex alone.[38] The only alternative to using comorbidity status in determining life expectancy that we could find was the use of a single question on self rated health (SRH) because weightings of responses have been correlated with longevity.[36] SRH is subjective but it may be reliable,[39] and it is quick. We preferred the use of comorbidity as it is more objective and it was the strongest predictor of survival in LPC patients undergoing treatment.[15] The 12 item CCI that we used takes only about one to two minutes to self administer.

In conclusion, we have described a method that can facilitate the use of NCCN guidelines in choosing treatment or observation for newly diagnosed LPC. □

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