

Patient Decision-Making Factors in Aggressive Treatment of Low-Risk Prostate Cancer

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Abstract

Background: Active surveillance (AS) is underutilized for low-risk prostate cancer. This study examines decision-making factors associated with AS vs aggressive treatment in a population-based cohort of low-risk patients. **Methods:** Newly diagnosed patients (n = 599) were enrolled through the North Carolina Central Cancer Registry from 2011 to 2013 and surveyed regarding 5 factors that may impact treatment decision making: perceived cancer aggressiveness, aggressiveness of treatment intent, most important goal (eg, cure, quality of life), primary information source, and primary decision maker. We examined the association between treatment decision-making factors with patient choice for AS vs aggressive treatment using multivariable logistic regression analysis. **Results:** This is a sociodemographically diverse cohort reflective of the population-based design, with 37.6% overall (47.6% among very low-risk patients) choosing AS. Aggressive treatment intent (odds ratio [OR] = 7.09, 95% confidence interval [CI] = 4.57 to 11.01), perceived cancer aggressiveness (OR = 4.93, 95% CI = 2.71 to 8.97), most important goal (cure vs other, OR = 1.72, 95% CI = 1.12 to 2.63), and primary information source (personal and family vs physician, OR = 1.76, 95% CI = 1.10 to 2.82) were associated with aggressive treatment. Overall, 88.4% of patients (92.2% among very low-risk) who indicated an intent to treat the cancer “not very aggressively” chose AS. **Conclusions:** These data from the patient’s perspective shed new light on potentially modifiable factors that can help further increase AS uptake among low-risk patients. Helping more low-risk patients feel comfortable with a “not very aggressive” treatment approach may be especially important, which can be facilitated through patient education interventions to improve the understanding of the cancer diagnosis and AS having a curative intent.

Prostate cancer is the most common cancer in men in the United States, with an estimated diagnosis of 191 930 new cases in 2020 (1). About 40% of all prostate cancer patients have low-risk disease, a condition that is unlikely to be life threatening (2). Overtreatment of patients with low-risk disease has been well described (3); for these patients, aggressive treatments such as surgery and radiation therapy are unlikely to improve survival and can harm patients by causing treatment-related adverse quality-of-life impact (4,5). Active surveillance (AS) is an approach of monitoring the patient, reserving aggressive treatment for those who demonstrate disease progression. Current guidelines recommend AS for patients with low-risk prostate cancer (6,7). The use of AS in the United States has increased, but more than half of the patients with low-risk cancer do not choose this option (8).

The reasons for the underutilization of AS are not well understood, especially from the patient’s perspective. Prior work using only cancer and demographic factors has been insufficient to fully explain patients’ decision-making in AS vs aggressive treatment. In the North Carolina Prostate Cancer Comparative Effectiveness and Survivorship Study (NC ProCESS), a population-based, prospective cohort of prostate cancer patients, participants were surveyed regarding perceptions about prostate cancer, treatment goals, and the decision-making processes. These data provide a unique opportunity to examine decision-making factors that may contribute to low-risk prostate cancer patients’ choice of AS vs aggressive treatment. We posit that patient decision-making factors are strongly correlated to the choice of aggressive treatment. Insights regarding potentially modifiable factors can help the

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Box 1. Treatment decision-making questions

- How aggressive is your prostate cancer? (not very aggressive, somewhat aggressive, very aggressive)
- How aggressively do you want to treat your prostate cancer? (very aggressively, moderately aggressively, not very aggressively)
- Which is the most important in your making a decision about treatment for your prostate cancer? (preserving your quality of life, curing your cancer, not being a burden on your family and/or friends, cost to you to receive this treatment, how this treatment will affect your usual daily activities, some other concern)
- Which of these 4 statements about treatment decisions is most true for you? (I make the decision with little or no input from my doctor or doctors; I make the decision after seriously considering my doctor's opinion; my doctor and I make the decision together; I prefer my doctor to make the decision on what the best treatment is for me")
- Which of the following had the biggest effect on your decision on treatment? (your personal research/reading, your physician's recommendation, the opinion of your family or friends, other)

design of future interventions to further decrease overtreatment in prostate cancer.

Methods

Patient Cohort

The design of the NC ProCESS (NCT02564120) has been described elsewhere (9). Briefly, newly diagnosed, nonmetastatic prostate cancer patients throughout all 100 counties of North Carolina were identified by the Rapid Case Ascertainment system of the North Carolina Central Cancer Registry between 2011 and 2013 and contacted for study enrollment. This is a population-based cohort as participant identification and enrollment were facilitated through the state cancer registry. All patients were enrolled prior to any prostate cancer treatment, at a median of 5 weeks after diagnosis, and followed prospectively. Verbal informed consent was obtained from each enrolled patient. This study was approved by the University of North Carolina institutional review board.

Patient-level demographic information (self-identified race, insurance, employment, marital status, education) were collected by patient report. Patient-reported racial categories were American Indian or Alaskan Native, Black, White, and Refused or Do Not Know. Marital status was stratified to married or not married. Diagnostic (date of diagnosis, biopsy Gleason score, prostate-specific antigen at diagnosis, clinical stage) and primary treatment information were abstracted from collected medical records. National Comprehensive Cancer Network risk groups were assigned to each patient using diagnostic information. Patients who received no prostate cancer treatment within 12 months after diagnosis were considered to have pursued an AS approach, consistent with prior studies (10).

Decision-Making Factors

A unique aspect of NC ProCESS is that it collected patient-reported information on factors that could have contributed to treatment decision making. For each patient, 5 questions were asked (with response choices; see Box 1). Because no validated surveys exist specifically for this topic, these 5 questions were created for the NC ProCESS cohort.

Statistical Analysis

Among 1419 patients enrolled in the NC ProCESS cohort, 599 patients with low-risk prostate cancer (including 353 with very low-risk disease based on National Comprehensive Cancer Network criteria) were included for analysis, as the primary goal of the current study is to examine factors associated with low-risk patients choosing AS vs aggressive treatment.

Descriptive statistics were used to summarize patient clinical and demographic characteristics and factors associated with receipt of AS vs aggressive treatment. χ^2 and Fisher exact tests were used to assess the statistical significance of differences between groups. Multivariable binary logistic regression models were used to examine the associations between receipt of aggressive treatment and covariates. Covariates included sociodemographics and patient-reported factors listed above. A two-sided P value less than .05 was considered statistically significant. All analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, NC).

Results

Table 1 describes patient characteristics, which are diverse and reflective of a population-based cohort. Overall, 23.0% were non-White and 29.7% had a high school education or less. The median age was 65 years. Among these patients, 37.6% chose AS. In the subgroup of 353 patients with very low-risk disease, 47.6% chose AS.

We evaluated patient-reported factors associated with choice of initial management (Table 2). All 5 factors assessed were statistically significantly associated with treatment choice in low-risk patients overall and also in the very low-risk subgroup. Among patients who thought their cancer was "not very aggressive," 47.6% chose active surveillance; in contrast, only 8% of patients who thought their cancer was "very aggressive" chose AS. Among patients who indicated that they wanted to treat their cancer "not very aggressively," 88.4% chose AS; in contrast, only 22.8% of patients who indicated they wanted to treat the cancer "very aggressively" chose AS. Conversely, among all low-risk patients who chose AS, 91.6% felt their cancer was "not aggressive" vs 65.6% in patients who chose definitive treatment (Supplementary Table 1, available online). Among patients who chose AS, 37.8% wanted to treat their cancer "very aggressively" vs 83.2% of patients who chose definitive

Table 1. Patient demographics^a

Variable	All low risk (n = 599)	Very low risk (n = 353)
Median age at diagnosis (IQR), y	65 (58-70)	65 (58-69)
Race, No. (%)		
American Indian/Alaskan Native	7 (1.2)	3 (0.8)
Black	127 (21.2)	72 (20.4)
White	461 (77.0)	227 (78.5)
Refused/Do not know	4 (0.6)	1 (0.3)
Insurance, No. (%)		
Medicare	299 (49.9)	183 (51.8)
Private	240 (40.1)	143 (40.5)
Other/None	60 (10.0)	27 (7.7)
Employment, No. (%)		
Retired	261 (43.6)	150 (42.5)
Full time	219 (36.6)	140 (39.7)
Other, None	119 (19.9)	63 (17.9)
Married, No. (%)		
Yes	493 (82.6)	296 (84.1)
Never married	13 (2.2)	6 (1.7)
Separated	8 (3.1)	5 (1.4)
Divorced	57 (9.6)	31 (8.8)
Widowed	26 (4.4)	14 (4)
Education, No. (%)		
High school or less	178 (29.7)	104 (29.5)
Some college	178 (29.7)	101 (28.6)
College graduate	243 (40.6)	148 (41.9)
Number of positive cores, No. (%)		
0-2	361 (62.9)	353 (100.0)
≥3	213 (37.1)	0 (0.0)
Treatment, No. (%)		
Active surveillance	225 (37.6)	168 (47.6)
Radical prostatectomy	201 (33.6)	100 (28.3)
Radiation therapy	145 (24.2)	68 (19.3)
Other	28 (4.7)	17 (4.8)

^aIQR = interquartile range.

treatment. Patients who reported quality of life as the most important treatment goal chose active surveillance more frequently (50.8% vs 30.8%) than those who reported cure as the most important treatment goal.

Shared decision-making factors were also associated with treatment choice (Table 2). Patients who indicated that the treatment decision was made by the physician or shared with the physician were more likely to choose AS (44.3%) compared with patients who were primary decision makers (33.9%). Similarly, patients who indicated that their primary information source was the physician were more likely to choose AS (44.6%) than those with a primary information source of patient or family (28.7%).

Multivariable analysis examined the association between the 5 patient-reported decision-making factors with aggressive treatment, while controlling for sociodemographic variables (Table 3). Among all low-risk patients, aggressive treatment intent (odds ratio [OR] = 7.09, 95% confidence interval [CI] = 4.57 to 11.01), perceived aggressive cancer (OR = 4.93, 95% CI = 2.71 to 8.97), primary information source being personal and/or family (OR = 1.76, 95% CI = 1.10 to 2.82), and treatment goal of cure (OR = 1.72, 95% CI = 1.12 to 2.63) were statistically significantly associated with aggressive treatment. The C statistic, a measure of concordance, was increased from 0.51 with sociodemographic factors alone to 0.67 with the addition of patient-reported factors. Findings were similar in the very low-risk

subgroup, although the smaller sample size diminished statistical significance in some of the factors.

Given the importance of a desire for aggressive treatment on receipt of aggressive treatment as seen in the multivariable analysis, we next examined factors associated with patients' stated desire to treat their cancer aggressively (Table 4). For all low-risk patients and also in the very low-risk subgroup, patients' perceptions of cancer aggressiveness and most important treatment goal were associated with their desired levels of treatment aggressiveness. For example, among low-risk patients who perceived their cancer to be "very aggressive," 88.5% also expressed a desire for very aggressive treatment. In addition, 74.2% of patients who indicated cure to be most important goal also expressed desire for very aggressive treatment, compared with 48.4% of patients who indicated that quality of life was most important. Conversely, patients who desired to treat their cancer very aggressively more frequently indicated that their cancer was somewhat to very aggressive (29.9% vs 12.8%) and cure was the most important goal (66.5% vs 41.2%) (Supplementary Table 2, available online).

Discussion

AS is the preferred approach for patients with low-risk prostate cancer (11,12). Aggressive treatment for these patients with

Table 2. Associations of treatment choice with patient-reported decision-making factors

Patient-reported decision-making factors	All low risk				Very low risk			
	AS No. (%)	RT No. (%)	RP No. (%)	P ^a	AS No. (%)	RT No. (%)	RP No. (%)	P ^a
How aggressive is your prostate cancer?				<.001				<.001
Not very aggressive	206 (47.6)	112 (25.9)	115 (26.6)		158 (56.2)	57 (20.3)	66 (23.5)	
Somewhat aggressive	17 (15.0)	30 (26.5)	66 (58.4)		8 (17.8)	10 (22.2)	27 (60.0)	
Very aggressive	2 (8.0)	3 (12.0)	20 (80.0)		2 (20.0)	1 (10.0)	7 (70.0)	
How aggressively do you want to treat your prostate cancer?				<.001				.003
Not very aggressively	61 (88.4)	7 (10.1)	1 (1.4)		47 (92.2)	3 (5.9)	1 (2.0)	
Moderately aggressively	79 (61.2)	37 (28.7)	13 (10.1)		56 (69.1)	18 (22.2)	7 (8.6)	
Very aggressively	85 (22.8)	101 (27.1)	187 (50.1)		65 (31.9)	47 (23.0)	92 (45.1)	
Most important goal for treatment				<.001				<.001
Preserve quality of life	90 (50.8)	51 (28.8)	36 (20.3)		65 (60.7)	24 (22.4)	18 (16.8)	
Cure	103 (30.8)	75 (22.5)	156 (46.7)		81 (41.8)	34 (17.5)	79 (40.7)	
Other	31 (54.4)	17 (29.8)	9 (15.8)		21 (63.6)	9 (27.3)	3 (9.1)	
Primary decision maker for treatment ^b				.006				.003
Personal, family, other	92 (33.9)	66 (24.4)	113 (41.7)		68 (42.0)	32 (19.8)	62 (38.3)	
Physician	133 (44.3)	79 (26.3)	88 (29.3)		100 (57.5)	36 (20.7)	38 (21.8)	
Primary information source for decisions ^c				.001				.001
Personal, family, other	52 (28.7)	60 (33.1)	69 (38.1)		39 (37.9)	33 (32.0)	31 (30.1)	
Physician	173 (44.6)	84 (21.6)	131 (33.8)		129 (55.4)	35 (15.0)	69 (29.6)	

^aTwo-sided χ^2 test and Fisher exact test. AS = active surveillance; RP = radical prostatectomy; RT = radiation therapy.

^bFour-level response was dichotomized into patient only (little or no input from physician, I make decision after considering doctor's opinion) and shared/physician (doctor and I make decision together, I prefer my doctor to make decision for me).

^cFour-level response was dichotomized into personal family (personal research, opinion of family and friends, other) and physician recommendation.

either surgery or radiation is associated with toxicity and does not improve survival for most patients (4,13). Aggressive treatment has also been considered to be a source of low-value health care. Using the Surveillance, Epidemiology, and End Results–Medicare data for prostate cancer patients aged 70 years or older, a recently published study found that increased use of AS in patients with a Gleason score of 6 or less could reduce annual Medicare costs by \$320 million (14). With the underutilization of AS widely recognized as an important issue, better understanding of factors that influence patient treatment choice can help interventions to further increase appropriate use of AS. This is the motivation of the current study.

Patient treatment choice is a multifactorial process with a complex interplay between fixed and potentially modifiable factors. Prior efforts to identify factors associated with treatment choice using data limited to patient demographics and tumor characteristics (fixed factors) have struggled to adequately explain patient decision making (15). Prior studies investigating patient treatment preferences have suggested that incorporating patient preferences for values and goals (16,17) and shared decision making (18,19) may help guide patient treatment choices. The current study confirms that patient-reported decision factors substantially improve the ability to discriminate between those making and those not making aggressive treatment choice for a low-risk disease.

Our population-based cohort was uniquely able to identify factors that explain why low-risk patients chose aggressive treatment because we specifically collected patient-reported decision-making factors. On multivariable analysis, a patient's aggressive treatment intent appeared to be the most influential factor. Indeed, among patients who indicated a desire to treat the cancer "not very aggressively," 88.4% overall (and 92.2% in the very low-risk subgroup) chose AS. How can we help more low-risk patients get to a place where they feel comfortable with this "not very aggressive" approach, such that AS utilization overall can rise to higher than 80% or even 90%? Further analysis demonstrated that this aggressive treatment intent was associated with a patient's perception of his or her cancer aggressiveness and treatment goal (eg, cure or quality of life). These additional factors were also independently associated with a patient's choice of AS vs aggressive treatment, as was the primary information source for the patient's decisions (physician vs patient and/or family).

One potentially modifiable factor is the patient's understanding of their cancer diagnosis. A prior study reported that patients may have substantial misconceptions about the aggressiveness of their cancer with decisions often driven by fear of uncertainty rather than an evaluation of numerical risk (18). In the current study among patients who (mis)perceived their cancer to be "very aggressive," 88.5% indicated a desire to treat their cancer very aggressively. This is unfortunate, because all patients analyzed in this study had low-risk disease and

Table 3. Multivariable logistic regression examining factors associated with aggressive treatment^a

Factors associated with aggressive treatment	All low risk OR (95% CI)	Very low risk OR (95% CI)
Patient-reported factors		
Treatment intent, reference: not very or moderately aggressive		
Very aggressive	7.09 (4.57 to 11.01)	5.98 (3.39 to 10.54)
Perceived cancer aggressiveness, reference: not aggressive or somewhat aggressive		
Aggressive	4.93 (2.71 to 8.97)	4.32 (1.93 to 9.71)
Most important goal, reference: other		
Cure	1.72 (1.12 to 2.63)	1.52 (0.88 to 2.63)
Primary information source, reference: physician ^b		
Personal, family, other	1.76 (1.10 to 2.82)	1.62 (0.91 to 2.90)
Primary decision-maker, reference: shared/physician ^c		
Patient only	1.31 (0.85 to 2.02)	1.60 (0.93 to 2.75)
Sociodemographic variables		
Race, reference: Caucasian		
Non-Caucasian	0.47 (0.27 to 0.80)	0.52 (0.27 to 1.10)
Age at diagnosis, y	0.94 (0.90 to 0.97)	0.92 (0.88 to 0.97)
Insurance, reference: other		
Medicare	0.57 (0.24 to 1.38)	1.07 (0.34 to 3.38)
Private	0.43 (0.19 to 0.99)	0.73 (0.25 to 2.08)
Education, reference: high school or less		
Some college	1.30 (0.75 to 2.27)	1.38 (0.70 to 2.75)
College graduate	0.84 (0.50 to 1.43)	0.83 (0.43 to 1.61)
Married, reference: yes		
No	1.40 (0.79 to 2.48)	1.15 (0.55 to 2.41)

^aAggressive treatments: radiation therapy, brachytherapy, and radical prostatectomy. CI = confidence interval; OR = odds ratio.

^bFour-level response was dichotomized into personal/family/other (personal research, opinion of family and friends, other) and physician recommendation.

^cFour-level response was dichotomized into patient only (little or no input from physician, I make decision after considering doctor's opinion) and shared/physician (doctor and I make decision together, I prefer my doctor to make decision for me).

suggests that better patient education about their diagnosis and prognosis can potentially have a positive impact. Indeed, our study showed that physicians have an important role, as low-risk patients who indicated the physician to be their primary information source were less likely to choose aggressive treatment (Table 3). Not surprisingly, patients who indicated that their most important goal was cure were more likely to desire aggressive treatment. Interventions that help patients accurately understand their diagnosis (ie, low-risk cancer is not aggressive) and that AS actually carries a curative intent—and is just as curative as immediate aggressive treatment—could be opportunities to help more low-risk patients accept and choose AS.

This study has a number of limitations. Although the population-based design of the NC ProCESS cohort improves on generalizability of study findings compared with institutional cohorts, it is possible that patients in North Carolina may have a different decision-making process and priorities compared with patients in other states. In addition, the quantitative data we collected from a relatively large cohort of 599 low-risk patients provided novel insights, however, we did not have qualitative interview data that can be used to complement the quantitative findings. This is an opportunity for future research.

We also acknowledge that the time frame of our analysis (2011–2013) was at a time when active surveillance was not as widely accepted as in current practice. However, the patient decision-making factors we identified remain important as the indications for AS have expanded to include favorable intermediate risk and as many patients continue to choose active treatment even with low-risk cancer. Finally, although validated measures were available for components of our series of patient decision-making factors, such as the Controlled Preference Scale for shared decision making (20), validated measures were not available on many other factors such as perceived aggressiveness and desire for aggressive treatment because of limited prior research. The questions used in this study were specifically created for NC ProCESS. Further work should be done to validate these factors and investigate additional factors that may influence patient decision making.

In a population-based cohort of low-risk prostate cancer patients, patients' aggressive treatment intent, perceived cancer aggressiveness, most important goal, and primary information source were associated with patient choice for AS vs aggressive treatment. Helping more low-risk patients feel comfortable with a “not very aggressive” treatment approach may be especially important to help further increase uptake of AS, which

Table 4. Associations of treatment intent with patient-reported decision-making factors

Patient-reported decision-making factors	All low risk			P ^a	Very low risk			P ^a
	Not aggressively, No. (%)	Moderately aggressively, No. (%)	Very aggressively, No. (%)		Not aggressively, No. (%)	Moderately aggressively, No. (%)	Very aggressively, No. (%)	
How aggressive is your prostate cancer?				<.001				.002
Not very aggressive	72 (15.8)	112 (24.6)	272 (59.6)		53 (17.8)	80 (26.9)	164 (55.2)	
Somewhat aggressive	4 (3.4)	20 (17.1)	93 (79.5)		3 (6.5)	5 (10.9)	38 (82.6)	
Very aggressive	0 (0.0)	3 (11.5)	23 (88.5)		0 (0.0)	1 (10.0)	9 (90.0)	
Most important goal for treatment				<.001				<.001
Preserve quality of life	40 (21.3)	57 (30.3)	91 (48.4)		31 (27.0)	36 (31.3)	48 (41.7)	
Cure	25 (7.2)	64 (18.6)	256 (74.2)		18 (9.0)	39 (19.5)	143 (71.5)	
Other	10 (16.1)	14 (22.6)	38 (61.3)		7 (19.4)	11 (30.6)	18 (50.0)	
Primary decision maker for treatment ^b				.63				.62
Patient	39 (13.9)	60 (21.4)	182 (64.8)		27 (16.1)	37 (22.0)	104 (61.9)	
Shared/physician	37 (11.6)	75 (23.6)	206 (64.8)		29 (15.7)	49 (26.5)	107 (57.8)	
Primary information source for decisions ^c				.24				.32
Personal/family/other	21 (11.2)	36 (19.1)	131 (69.7)		16 (15.0)	21 (19.6)	70 (65.4)	
Physician	55 (13.4)	98 (24.0)	256 (62.6)		40 (16.3)	65 (26.4)	141 (57.3)	

^aTwo-sided χ^2 test and Fisher exact test.

^bFour-level response was dichotomized into patient only (little or no input from physician, I make decision after considering doctor's opinion) and shared/physician (doctor and I make decision together, I prefer my doctor to make decision for me).

^cFour-level response was dichotomized into personal family (personal research, opinion of family and friends, other) and physician recommendation.

may be facilitated by patient education interventions that improve patient understanding of the cancer diagnosis and AS having a curative intent.

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Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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