ORIGINAL ARTICLE

A national survey of radiation oncologists and urologists on prediction tools and nomograms for localized prostate cancer

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Abstract

Purpose Although prediction tools for prostate cancer (PCa) are essential for high-quality treatment decision-making, little is known about the degree of confidence in existing tools and whether they are used in clinical practice from radiation oncologists (RO) and urologists (URO). Herein, we performed a national survey of specialists about perceived attitudes and use of prediction tools.

Methods In 2017, we invited 940 URO and 911 RO in a national survey to query their confidence in and use of the D'Amico criteria, Kattan Nomogram, and CAPRA score. The statistical analysis involved bivariate association and multivariable logistic regression analyses to identify physician characteristics (age, gender, race, practice affiliation, specialty, access to robotic surgery, ownership of linear accelerator and number of prostate cancer per week) associated with survey responses and use of active surveillance (AS) for low-risk PCa.

Results Overall, 691 (37.3%) specialists completed the surveys. Two-thirds (range 65.6–68.4%) of respondents reported being "somewhat confident", but only a fifth selected "very confident" for each prediction tool (18.0–20.1%). 19.1% of specialists in the survey reported not using any prediction tools in clinical practice, which was higher amongst URO than RO (23.9 vs. 13.4%; $p < 0.001$). Respondents who reported not using prediction tools were also associated with low utilization of AS in their low-risk PCa patients (adjusted OR 2.47; $p = 0.01$).

Conclusions While a majority of RO and URO view existing prediction tools for localized PCa with some degree of confidence, a fifth of specialists reported not using any such tools in clinical practice. Lack of using such tools was associated with low utilization of AS for low-risk PCa.

Keywords Active surveillance · Decision aids · National survey · Prostate cancer · Shared decision-making

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Abbreviations

AMA	American Medical Association
AS	Active surveillance
CAPRA	Cancer of the Prostate Risk Assessment
PCa	Prostate cancer
RO	Radiation oncologists
SDM	Shared decision-making
URO	Urologists

Introduction

Clinical practice guidelines call for physicians and patients to engage in shared decision-making (SDM) for treatment decisions about localized prostate cancer (PCa) [1–3]. At present, there is no single superior treatment for localized PCa, and different forms of primary therapy (surgery, brachytherapy and external beam radiation therapy) are associated with potential changes in treatment-related quality of life, such as urinary incontinence and erectile dysfunction [4–7]. Moreover, active surveillance (AS) is now considered a preferred option for many men with low-risk PCa or limited life expectancy [1, 8]. Decision-making for men diagnosed with localized PCa constitutes a highly complex process and requires patients making trade-offs about cancer control and quality of life. Ideally, key components to high-quality treatment decisions include patients understanding the likely aggressiveness of their cancer, their own life expectancy, and their current quality of life and individual preferences and values.

Prediction tools have been developed and validated to facilitate risk stratification and help assist with treatment decisions for men with newly diagnosed PCa [9, 10]. Seminal treatment prediction tools include Kattan nomogram, D'Amico criteria, and the Cancer of the Prostate Risk Assessment (CAPRA) Score [11–16]. All of these prediction tools aim to accurately risk stratify patients to predict important outcomes such as remaining disease free after primary treatment (surgery or radiation therapy), adverse pathologic features following radical prostatectomy (extra-prostatic extension, seminal vesicle invasion, or lymph node metastasis), and cancer-related mortality. Many of these prediction tools are also readily available to patients and providers for facile clinical implementation. However, the perceived confidence and clinical use of such prediction tools by radiation oncologists (RO) and urologists (URO) is not well known. Addressing this important question is needed to improve SDM and better inform treatment decisions. In this context, we performed a national survey of RO and URO to elucidate the confidence and use of prediction tools in clinical practice for localized PCa. We also aimed to assess whether use of such prediction tools related to utilization of active surveillance (AS).

Methods

Survey design and sample

Our research team initially developed a pilot questionnaire to assess the confidence and clinical utilization of three validated PCa prediction tools. The survey began with several items inquiring about the clinical practice and respondent demographics. Survey items queried specialists about the type of practice (community practice, academic, or other), compensation structure (billing only, salary, salary plus bonus, or other), whether the practice owned a linear accelerator to deliver radiation therapy (yes or no) or had access to robotic surgery (yes or no), and if the they saw patients in a multidisciplinary clinic. A survey item also asked respondents to report the estimated number of newly diagnosed PCa patients seen in their own practice weekly (0, 1–2, 3 or more). The survey also inquired about the percentage of patients with low-risk PCa managed by active surveillance (AS) in their own clinical practice, where respondents could select one of the following: < 5%, 5% to 10%, 11% to 15%; or > 15%.

The next section aimed at assessing the confidence and clinical use of several commonly cited and validated prediction tools. We determined a priori to elicit the perceptions of the following contemporary prediction tools—the D'Amico criteria, Kattan nomogram and CAPRA Score. This section began with a brief description stating, *We would like your expert opinion about prediction tools for risk stratifying localized prostate cancer. Please select only <u>one response</u> for each question.* The first survey item of this section asked specialists to *Please rate your degree of confidence in the following prediction tools to accurately predict prostate cancer severity for localized prostate cancer.* The survey items queried respondents about their confidence in D'Amico criteria, Kattan Nomogram and CAPRA Score, irrespective of clinical use in practice. Respondents could select one of the following responses—very confident, somewhat confident, somewhat unconfident, and very unconfident—for each prediction tool/nomogram. The next survey item asked *Which prediction tool do you routinely use in your clinical practice for men diagnosed with localized prostate cancer?* Respondents could select one of the following: D'Amico criteria, Kattan Nomogram, CAPRA Score, Other, and I don't use a prediction tool. Upon preliminarily developing the pilot survey, a radiation oncologist and urologist then qualitatively reviewed our pilot survey to critically assess appropriateness and responses. Upon completion, we finalized our survey instrument for mailing to respondents ("Appendix").

From the American Medical Association (AMA) Physician Masterfile, we were provided a random sample of radiation oncologists and urologists in 2016. We restricted the survey sample to physicians specializing in radiation

oncology or urology, aged less than 65 years, completed residency, primarily involved in patient care, and practiced in the United States from the AMA Masterfile. Information provided from the database included date of birth, race, gender, and geographic region. The Mayo Clinic and Case Western Reserve University Institutional Review Boards considered our study exempt.

Survey implementation

We initially tested the pilot survey from a single mailing in a random sample of 100 RO and 100 URO. This pilot wave from a single mailing included a cover letter, cash incentive ($10) and pilot survey yielding a response rate of 33%. Upon review of the pilot mailing, some minor changes were made to the survey items. From January to July of 2017, we then fielded a four-wave mail survey of RO ($n = 915$) and URO ($n = 940$) about prediction tools/nomograms. The initial wave included a cover letter, a small cash incentive ($10), and survey. Non-responders were mailed only a cover letter and survey for subsequent waves.

Statistical analysis

Survey responses about the confidence and use of PCa prediction tools, and use of AS in clinical practice represented the primary outcomes of our study. We used descriptive statistics to characterize the respondents and survey responses. Bivariate associations were tested by Pearson's chi-squared test to assess for differences in physician characteristics and survey responses. Multivariable logistic regression models were also used identify differences by physician characteristics (age, gender, race, practice affiliation, compensation structure, geographic region, specialty, access to robotic surgery, practice ownership of linear accelerator, access to multidisciplinary clinic, and number of PCa patients per week) with survey response items regarding self-reported lack of use in prediction tools or nomograms for localized PCa. We also performed multivariable logistic regression to test for the association of low use of AS ($<5\%$) and physician characteristics and whether specialists use prediction tools in clinical practice. We used Stata MP 14.0 to perform all statistical analysis (College Station, Texas). A two-sided p value of ≤ 0.05 defined statistical significance.

Results

Overall, 691 (37.3%) specialists completed the surveys with similar response rates from RO and URO (35.7 vs. 38.7%; $p = 0.18$). The mean age of respondents was 53.8 years old (SD 7.1). As shown in Table 1, most respondents from the survey sample were male and Caucasian. In addition, many

Table 1 Respondent characteristics ($n = 691$)

Covariates	Percent
Female	12.6
Race	
White	84.3
African-American	1.4
Asian-American	12.8
Other	1.5
Type of practice	
Community	77.1
Academic	16.5
Other/government	7.7
Compensation structure	
Billing	39.1
Salary with/without bonus	56.9
Other	4.0
Specialty	
Radiation oncologists	47.3
Urologists	52.7
Geographic region	
Northeast	20.1
Midwest	22.2
South	35.6
West	22.1
Access to robotic surgery	74.7
Practice ownership of linear accelerator	41.8
Access to multidisciplinary PCa clinic	14.6
Number of patients diagnosed PCa seen per week	
0	9.3
1–2	70.9
≥ 3	19.8
Percentage of low-risk PCa patients on AS (%)	
< 5	7.9
5–10	19.0
11–15	15.3
> 15	57.8

specialists practiced in a community setting, received compensation from a salary (with/without bonus) and saw one or more newly diagnosed PCa patients per week. While a majority estimated that more than 15% of their low-risk PCa patients receiving AS, 7.9% of specialists reported having < 5% of their low-risk prostate cancer patients managed this way.

In assessing the degree of confidence of prediction tools, most specialists described having some confidence for D'Amico criteria, Kattan nomogram, and CAPRA score (Fig. 1). While approximately two-thirds described being somewhat confident, only 18.0%–20.1% rated them as being very confident. The degree of confidence in responses for each prediction tool/nomogram did not vary by physician
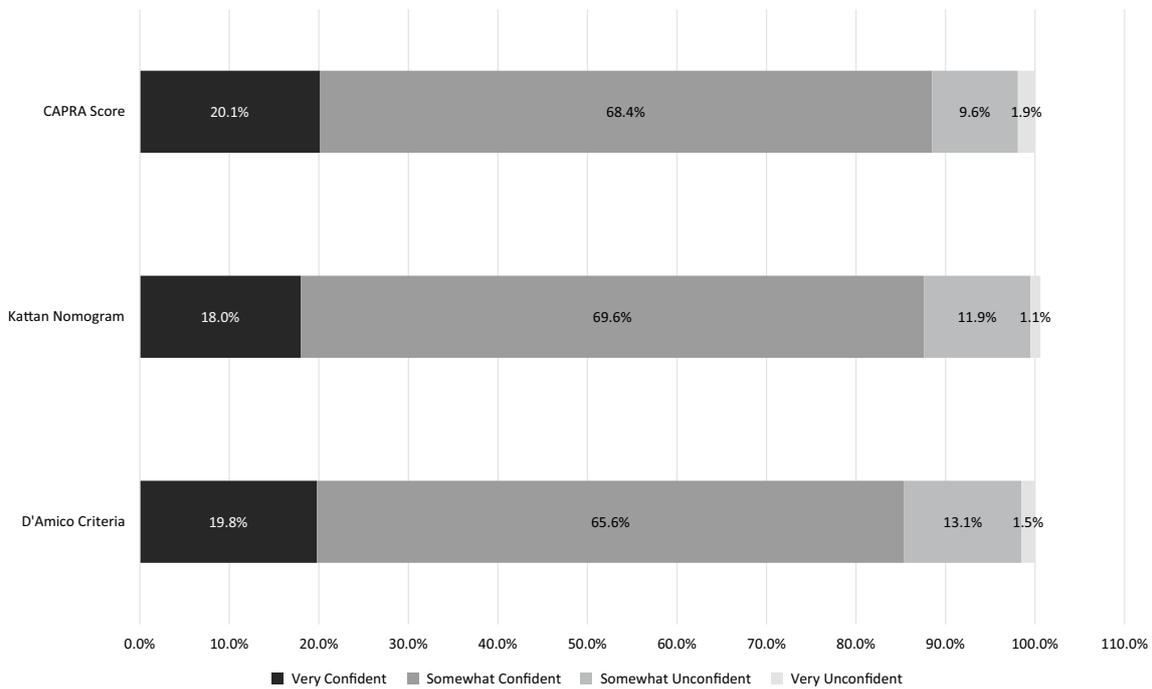
Fig. 1 Degree of confidence of different prediction tools and nomograms for localized prostate cancer

specialty ($p = 0.10$). In the survey item inquiring about use of prediction tools or nomograms in clinical practice (Fig. 2), 19.1% reported not using any such tools with this being higher amongst URO than RO (23.9 vs. 13.4%; $p < 0.001$). Although the D'Amico criteria were the most commonly cited tool used in clinical practice, RO more commonly used this prediction tool compared to URO (47.2 vs. 19.6%; $p < 0.001$). Both RO and URO had similar responses regarding the use of the Kattan nomogram (23.0 vs. 21.5%; $p = 0.79$). However, URO demonstrated a higher use of the CAPRA score compared to RO (20.9 vs. 14.0%; $p = 0.003$).
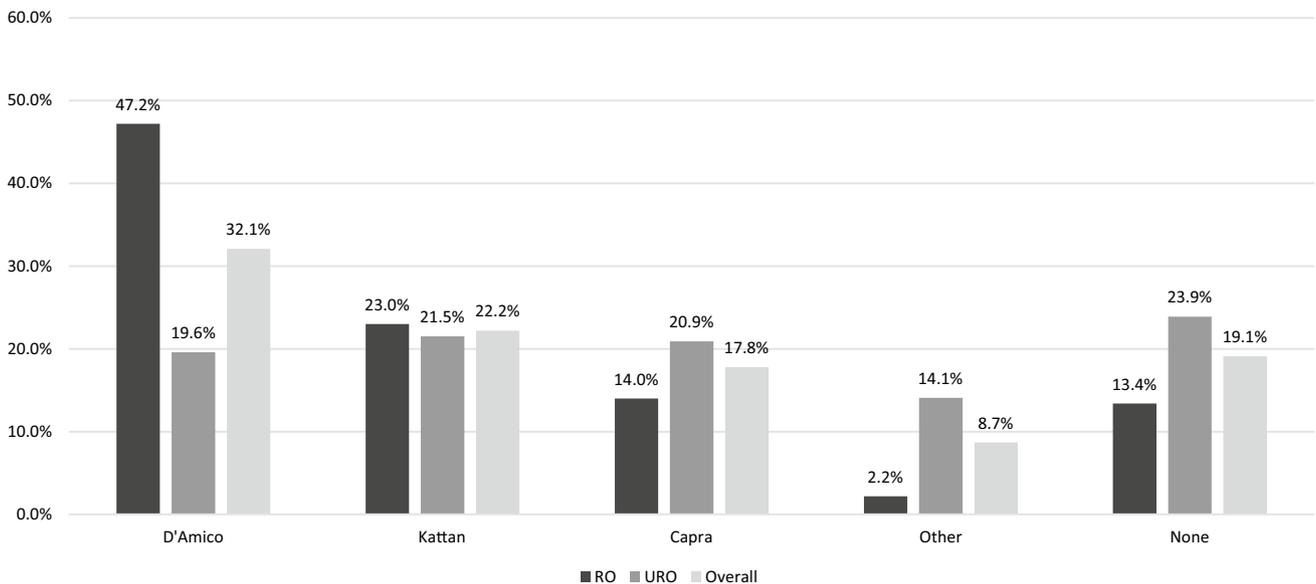

Fig. 2 Self-reported use of prediction tools and nomograms in clinical practice overall and by physician specialty

Table 2 Multivariable logistic regression of specialist characteristics associated with lack of use in prediction tools and nomograms for localized prostate cancer in clinical practice

Covariates (referent)	OR (95% CI)	p value
Age (40–49)		
50–59	1.43 (0.82–2.48)	0.19
60–65	1.91 (1.02–3.58)	0.05
Female (male)	0.56 (0.22–1.38)	0.21
Race (White)		
African-American	0.77 (0.08–6.63)	0.81
Asian-American	1.65 (0.80–3.40)	0.17
Other	0.67 (0.08–5.63)	0.72
Practice affiliation (community)		
Academic	0.90 (0.45–1.79)	0.77
Other	0.92 (0.34–2.43)	0.87
Compensation structure (billing)		
Salary with/without bonus	1.00 (0.61–1.64)	0.97
Other	1.16 (0.38–3.54)	0.78
Geographic region (northeast)		
Midwest	0.92 (0.46–1.84)	0.82
South	1.17 (0.64–2.13)	0.59
West	0.75 (0.36–1.54)	0.44
Specialty (RO)		
URO	2.06 (1.21–3.51)	0.008
Access to robotic surgery	1.34 (0.75–2.41)	0.31
Practice ownership of linear accelerator	1.22 (0.74–2.01)	0.26
Access to multidisciplinary clinic	0.65 (0.32–1.35)	0.26
Number of PCa patients seen per week (0)		
1–2	1.01 (0.39–2.62)	0.97
≥ 3	0.82 (0.02–0.28)	0.72

Specialists reporting that they did not use prediction tools in clinical practice were associated with several physician characteristics on multivariable analysis (Table 2). Respondents who were 60–65 years old showed a higher likelihood of not using any such tools in clinical practice compared to younger specialists aged 40–49 years (OR 1.91; $p = 0.05$). URO also demonstrated higher odds of not using prediction tools/nomograms compared to RO (OR 2.06; $p = 0.008$). On multivariable analysis (Table 3), low use of AS in clinical practice (< 5%) for low-risk PCa was associated with specialists age 60–65 years compared to those 40–49 years (OR 1.91; $p = 0.05$). URO also demonstrated a lower likelihood of having < 5% of their patients on AS compared to RO (OR 0.36; $p = 0.01$). Conversely, our analysis also demonstrated that specialists reporting no use of prediction tools/nomograms correlated with higher likelihood of having low use of AS in clinical practice relative to those who reported using them (OR 2.47; $p = 0.01$).

Discussion

Our national survey study revealed several important details about the utilization of prediction tools and AS for men with low-risk PCa. One novel finding presented here is that both specialties appear to have modest confidence in these specific prediction tools evaluated in our study. We endeavored to address this key knowledge gap since the limited clinical implementation of such tools may be attributable to a lack of confidence in accurately predicting key outcome measures for localized PCa. In a web-based survey of AUA Members, 71% of URO reported using a risk estimation tool in the pretreatment setting for patient counseling and decision-making (with a 10% response rate for this survey) [17]. However, a different national survey of RO and URO found that 55% used nomograms for treatment decisions of localized PCa with similar use across specialties [18]. To some degree, the lack of routine clinical integration of PCa prediction tools is concerning because clinical practice guidelines endorse them as the basis for risk stratification and basis to discuss different disease management strategies [2, 3, 19, 20]. The limited use of such tools by specialists may be attributable in part to a lack of high confidence in the outputs and predicted outcomes to some degree. While a majority of specialists viewed them with some confidence, it is concerning that only a fifth reported high confidence in these specific tools since they have been studied and validated extensively [9, 11, 13–16, 21–24]. One plausible solution in advancing the clinical use of prediction tools is targeted interventions for RO and URO to highlight the importance, reliability and validity in predicting key outcomes of localized PCa.

Another key finding is that a fifth of the specialists reported not using any prediction tools in clinical practice at all. It is reassuring that the proportion of RO and URO reported using these tools increased from previous survey studies [17, 18]. Yet, a high proportion of URO stated that they do not use prediction tools is somewhat alarming given this specialty is integral to diagnosing PCa and having the initial conversations about the approach to care and treatment. Of additional concern is the implicit specialty bias exists where RO and URO often view their primary therapy more favorably for cancer control and treatment-related quality of life documented in previous studies [25–27]. Taken together, these trends may adversely affect decisional quality and limit incorporation of patient preferences and values into treatment selection, especially considering that specialist treatment recommendations represent the driving determinant in the patient decision-making process for localized PCa [28].

The association of low AS use in clinical practice and lack of using prediction tools merits attention. AS has become the standard of care for the initial management for

Table 3 Multivariable logistic regression of physician covariates associated with low use of active surveillance (< 5%) for low-risk prostate cancer in clinical practice

Covariates (referent)	OR (95% CI)	p value
Age (40–49)		
50–59	2.75 (1.03–7.28)	0.04
60–65	3.05 (1.06–8.79)	0.04
Female (male)	1.22 (0.48–3.12)	0.67
Race (White)		
African-American	0.95 (0.09–9.13)	0.96
Asian-American	0.94 (0.31–2.86)	0.92
Other	3.28 (0.35–30.67)	0.29
Practice affiliation (community)		
Academic	1.03 (0.41–2.54)	0.94
Other	0.25 (0.03–2.12)	0.21
Compensation structure (billing)		
Salary with/without bonus	1.16 (0.55–2.47)	0.68
Other	1.21 (0.22–6.57)	0.82
Geographic region (northeast)		
Midwest	0.77 (0.30–2.00)	0.60
South	0.70 (0.29–1.67)	0.43
West	0.52 (0.18–1.52)	0.24
Specialty (RO)		
URO	0.36 (0.16–0.81)	0.01
Access to robotic surgery	0.56 (0.27–1.15)	0.11
Practice ownership of linear accelerator	1.72 (0.83–3.53)	0.13
Access to multidisciplinary clinic	1.07 (0.42–2.74)	0.87
Number of PCa patients seen per week (0)		
1–2	1.63 (0.44–6.01)	0.45
≥ 3	0.81 (0.19–3.51)	0.78
Self-reported no use of prediction tools or nomogram	2.47 (1.17–5.24)	0.01

incident patients with very low-risk PCa with a greater focus on trying to increase patient acceptance to limit overtreatment [29, 30]. However, barriers in the adoption of AS persist. For instance, a previous study found that while both specialties viewed AS as a safe and effective for low-risk prostate cancer, RO and URO often recommended radiation therapy and surgery for low-risk PCa, respectively [31]. This is particularly relevant given that treatment choice often reflects the specialist recommendation over patient preference and values [28]. One inference from our study is that lack of using prediction tools in clinical practice may limit patient understanding of their PCa severity and real threat to health. Poor patient knowledge has also been correlated with decisional regret [32]. Routine clinical integration of prediction tools may facilitate patient–physician communication and improve patient understanding.

This initial survey raises several other questions about the practical application of PCa prediction tools. There should be further examination into provider rationale and frequency of use. It is plausible that treating providers have other means of expressing PCa risk to patients or have not found a way to seamlessly incorporate this information into the treatment discussion. There is also an opportunity for improvement of prediction tools. It is essential that these prediction tools highlight to the patient relevant health risks (for instance likelihood of metastasis and death), the marginal benefit of treatment, and eligibility for AS. Predictions of post-operative pathologic findings may only serve to confuse patients. Also, we need better discernment of why providers have low/medium confidence in prediction tools when an abundance of evidence supports their validity. Given that older physicians use prediction tools less frequently, one could reasonably conclude that there is an education gap that needs attention. Simple demonstrations of the ease in use may encourage more widespread implementation of predictive nomograms.

Several limitations are worth highlighting from our study. We readily acknowledge that there are other prediction tools available, but were not evaluated in this study [33]. We hypothesized that the tools selected in our survey study would be the most commonly used in clinical practice. To some degree, only 8.7% respondents selecting "other" for a prediction tool in practice supports our reasoning. We also recognize the heterogeneity of outputs in the different

prediction tools, such as predicting adverse pathologic features or development of metastasis following surgery or prostate cancer-specific mortality. Our survey items specifically did not ask about which of these outcome measures are most clinically relevant and important. As a result, some of the variation in response items may reflect differences in defining the importance of different clinical outcomes. The response rate may have also introduced some selection bias. However, non-responders and responders had similar demographics regarding age (mean age 53.1 {SD 7.1} vs. 53.7 {SD 7.0} years; $p = 0.96$) and gender (13.0 vs. 12.6% female; $p = 0.80$) based on the AMA Masterfile. Since this study obtained the random sample of specialists from the AMA Masterfile, it is possible there may be some bias since our sample may differ from a random sample obtained through their respective specialty societies. It is also essential to recognize that clinical implementation of prediction tools alone do not sufficiently meet SDM for patients considering treatment for localized PCa. Ideally, SDM would integrate estimates of PCa severity from commonly used prediction tools, along with the benefits and harms of surgery, radiation therapy and AS as well as patient preferences and values. Last, we also recognize that the survey relied on self-reported responses to each item which may have introduced some recall bias or not accurately reflect clinical practice.

In summary, our study found that both RO and URO are modestly confident in the D'Amico criteria, Kattan Nomogram, and CAPRA Score for patients diagnosed with localized PCa cancer in the U.S. While RO most often reported using the D'Amico criteria, URO demonstrated more variation in the use of the validated prediction tools. More importantly, a fifth of specialists in the U.S. described not using any prediction tools in clinical practice. This finding was also associated with clinical practices having a low rate of AS for their low-risk PCa patients. Our study calls attention to the need for better integration of prediction tools into routine clinical practice for localized PCa consistent with clinical practice guidelines [1–3]. Moreover, the benefits of widespread clinical implementation of prediction tools may also help reduce treatment regret and improve the patient experience.

Author contributions B. Gershman, P. Maroni, R. J. Volk, B. Konety, L. Bennett, A. Kutikov, M. C. Smaldone: manuscript writing/editing. J. C. Tilburt: protocol/project development/data management/manuscript writing/editing. V. Chen: data analysis/manuscript writing/editing. S. P. Kim: protocol/project development, data management, data analysis, manuscript writing/editing.

Compliance with ethical standards

Conflict of interest None.

Appendix

6-Digit Unique ID on Label:

_ _ _ _ _ _

Instructions: Please check the appropriate box and fill in the blank

SECTION A: YOU AND YOUR PRACTICE

1. Which best describes your primary site of work?

    ☐ Community practice
    ☐ University-affiliated medical center
    ☐ Other, Please specify:_____

2. Which of the following best describes the compensation structure of your clinical practice ?

    ☐ Community practice
    ☐ University-affiliated medical center
    ☐ Other, Please specify:_____

3. How many physicians are in your practice (including yourself)?

    _____ Number

4. On average, how many newly diagnosed prostate cancer patients do you see per week?
    ☐ 0
    ☐ 1 to 3
    ☐ 4 to 6
    ☐ 7 to 10
    ☐ 11 or more

5. My practice owns a linear accelerator to deliver radiation therapy?
    ☐ Yes
    ☐ No

6. My practice has access to a robotic surgical system (Intuitive)
    ☐ Yes
    ☐ No

7. How would you classify your race?
    ☐ Asian or Asian-American
    ☐ Black or African-American
    ☐ White or Caucasian
    ☐ Other, Please specify: _____

SECTION B: RISK STRATIFYING LOCALIZED PROSTATE CANCER

We would like your expert opinion about the different prediction tools available for risk stratifying localized prostate cancer. Please select only <u>one response</u> for each question.

8. Please rate your degree of confidence in the following prediction tools to accurately predict cancer severity for localized prostate cancer.

	Very confident	Somewhat confident	Somewhat unconfident	Very unconfident
D'Amico criteria…………………	☐	☐	☐	☐
Kattan Nomogram……………	☐	☐	☐	☐
CAPRA Score……………………	☐	☐	☐	☐

9. Which risk prediction tool do you routinely use in your clinical practice for men diagnosed with localized prostate cancer?
   - ☐ D'Amico Criteria
   - ☐ Kattan Nomogram
   - ☐ CAPRA Score
   - ☐ Other, Please specify: _____
   - ☐ I don't use a risk prediction tool

10. What percentage of your patients with low-risk prostate cancer choose active surveillance as their primary management strategy?
   - ☐ Less than 5%
   - ☐ 5% to 10%
   - ☐ 11% to 15%
   - ☐ More than 15%

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