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Exploring Variation in the Receipt of Recommended Active Surveillance for Men with Favorable-Risk Prostate Cancer

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Study Need and Importance: Reasons explaining why men on active surveillance (AS) for favorable-risk prostate cancer do not receive all recommended surveillance testing are poorly understood. We leveraged a statewide registry of men with favorable-risk prostate cancer in Michigan to 1) describe contemporary trends in receipt of surveillance testing and 2) examine the influence of provider (urologist and primary care provider [PCP]) and patient factors on variation in receipt of recommended surveillance.

What We Found: We examined receipt of recommended surveillance testing among 246 men with favorable-risk prostate cancer. We defined receipt based on the Michigan Urological Surgery Improvement Collaborative's (MUSIC) low-intensity criteria, which include annual prostate specific antigen testing, and prostate biopsy or magnetic resonance imaging every 3 years. During 3 years of AS, just over half of men (56.5%) received all recommended surveillance testing (69.9% annual prostate specific antigen testing, 72.8% magnetic resonance imaging/biopsy; see Figure). We found that a substantial amount (19%) of the variation in receipt was attributed to individual urologists. We did not find significant associations between provider visits to either the urologist or PCP and receipt.

Limitations: MUSIC as a quality improvement collaborative only includes urology practices in the state of Michigan, which may limit generalizability. We also did not assess downstream outcomes related to not receiving the recommended testing due to limited availability of data for followup. Given that AS as a management strategy requires followup testing to be effective, this will be an important next step for future studies.

Interpretation for Patient Care: Receipt of surveillance testing meeting MUSIC's low-intensity criteria among men with favorable-risk prostate cancer was suboptimal. Recognizing the influence of urologists on receipt of recommended testing, it will be important to support urologists through resources at the point of care delivery and integrated into routine clinical flow. Additionally, PCPs may be an underutilized resource for improving adherence to surveillance protocols. Exploring how to leverage visits with PCPs to positively influence receipt appears warranted.

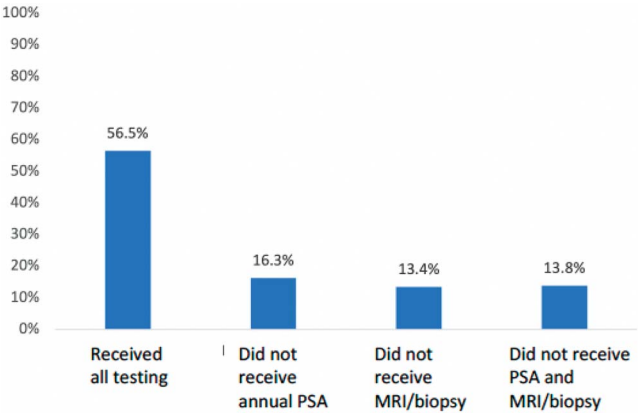

Figure. Distribution of receipt of recommended surveillance testing.

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Exploring Variation in the Receipt of Recommended Active Surveillance for Men with Favorable-Risk Prostate Cancer

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Purpose: Men on active surveillance for favorable-risk prostate cancer do not receive all the recommended testing. Reasons for variation in receipt are unknown.

Materials and Methods: We combined prospective registry data from the Michigan Urological Surgery Improvement Collaborative, a collaborative of 46 academic and community urology practices across Michigan, with insurance claims from 2014 to 2018 for men on active surveillance for favorable-risk prostate cancer. We defined receipt of recommended surveillance according to the collaborative's low-intensity criteria as: annual prostate specific antigen testing and either magnetic resonance imaging or prostate biopsy every 3 years. We assessed receipt of recommended surveillance among men with ≥36 months of followup (246). We conducted multilevel analyses to examine the influence of the urologist, urologist and primary care provider visits, and patient demographic and clinical factors on variation in receipt.

Results: During 3 years of active surveillance, just over half of men (56.5%) received all recommended surveillance testing (69.9% annual prostate specific antigen testing, 72.8% magnetic resonance imaging/biopsy). We found 19% of the variation in receipt was attributed to individual urologists. While increasing provider visits were not significantly associated with receipt, older men were less likely to receive magnetic resonance imaging/biopsy (≥75 vs <55 years, adjusted odds ratio 0.07; 95% confidence interval 0.01–0.81).

Conclusions: Nearly half of men on active surveillance for favorable-risk prostate cancer did not receive all recommended surveillance. While urologists

Abbreviations and Acronyms

AS = active surveillance
BCBSM = Blue Cross Blue Shield of Michigan
MRI = magnetic resonance imaging
MUSIC = Michigan Urological Surgery Improvement Collaborative
PCP = primary care provider
PSA = prostate specific antigen

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Conflict of Interest: Lauren P. Wallner: Dr. Wallner has a consulting relationship with Gilead Sciences (unrelated to the topic of this paper), and also is the chair of the DSMB for the EPICs study at Kaiser Permanente (5R01CA249419). Ted A. Skolarus: Dr. Skolarus receives author royalties from UpToDate for prostate cancer survivorship chapter. He is supported by grants R01 CA242559 and R37 CA222885. Arvin K. George: Lina Medical, Philips Medical, Nanospectra Biosciences. Archana Radhakrishnan, Arvin K. George, Bradley H. Rosenberg, Paul Abrahamse and Sarah T. Hawley: no relevant conflicts of interest.

Ethics Statement: This study was deemed exempt by the University of Michigan Institutional Review Board.

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substantially influenced receipt of recommended testing, exploring how to leverage patients and their visits with their primary care providers to positively influence receipt appears warranted.

Key Words: watchful waiting, prostate-specific antigen, urologists, biopsy, primary health care

Over the past decade, national guidelines have evolved to recommending active surveillance (AS) as the primary management strategy for favorable-risk prostate cancer.[1,2] This shift from previously recommended, more invasive treatments—surgery or radiation—to AS is an effort to promote a strategy that maximizes survival benefit while reducing adverse sequelae. As a result, the number of men with prostate cancer choosing AS has steadily increased.[3–5] AS as a management strategy requires receipt of several components, including regular monitoring with physical examinations (including digital rectal examination), prostate specific antigen (PSA) testing and tumor burden assessment with prostate biopsy or magnetic resonance imaging (MRI). While several large studies have demonstrated the effectiveness of AS (as compared to surgery or radiation), the key to the success of AS as a management strategy is ensuring receipt of all of the recommended surveillance testing.[6–10]

However, research suggests receipt of recommended surveillance testing is suboptimal.[11] For example, receipt of surveillance testing based on 3 different protocols (Johns Hopkins, Sunnybrook and Prostate Cancer Research International Active Surveillance) demonstrated only 11% of men received all the testing recommended by Sunnybrook/Prostate Cancer Research International Active Surveillance, while only 5% received all the testing recommended by Johns Hopkins.[12] Reasons explaining why men do not receive all recommended surveillance testing are poorly understood. While the importance of urologist recommendations at the time of initial treatment decision making are well documented, to our knowledge the influence of the urologist on variation in receipt of surveillance testing is less studied.[13,14] Patient factors have also been shown to contribute to variation.[12] Traditionally cancer specialists (ie urologists and radiation oncologists) have managed all aspects of AS; however, in the setting of growing national calls for team-based cancer care delivery—where cancer specialists (eg urologists) collaborate with primary care providers (PCPs) to provide high-quality cancer care—the potential influence of PCP on receipt of recommended surveillance is unknown.[15–17]

To address these knowledge gaps, we leveraged a statewide registry of men with favorable-risk prostate cancer in Michigan to 1) describe contemporary trends in receipt of surveillance testing, and 2) examine the influence of provider (urologist and PCP) and patient factors on variation in receipt of recommended surveillance.

MATERIALS AND METHODS

Setting

Supported by Blue Cross Blue Shield of Michigan (BCBSM), the Michigan Urological Surgery Improvement Collaborative (MUSIC) was established in 2011 as a physician-led improvement collaborative aimed at improving urological care. It includes a diverse group of 46 urology practices and comprises over 90% of urologists in the state. Each MUSIC practice has obtained an exemption or approval by their local Institutional Review Board for participation in the collaborative. MUSIC maintains a prospective, clinical registry. Trained data abstractors from each MUSIC practice enter a standardized set of data elements into the registry by reviewing a patient's medical chart. This includes treatment (ie surgery, radiation, AS, watchful waiting).

Study Population

We merged MUSIC data with BCBSM insurance claims data based on birthdates, biopsy encounter date (±7 days between MUSIC and BCBSM), procedure codes for prostate biopsy and associated diagnosis codes of prostate cancer. We achieved an 80% match rate and found no statistically significant differences comparing demographic (age, race, zip code) and clinical (comorbidities, year of diagnosis) characteristics between those patients who matched vs not (data not shown). Our analytic cohort included all men with favorable-risk prostate cancer (Gleason 3+3 or low-volume 3+4) who selected AS for their primary management between 2014 and 2018 (1,600, Figure 1). We only included patients with at least 3 years of followup care to capture receipt of recommended surveillance as per MUSIC's low-intensity criteria (246; described in Measures below).

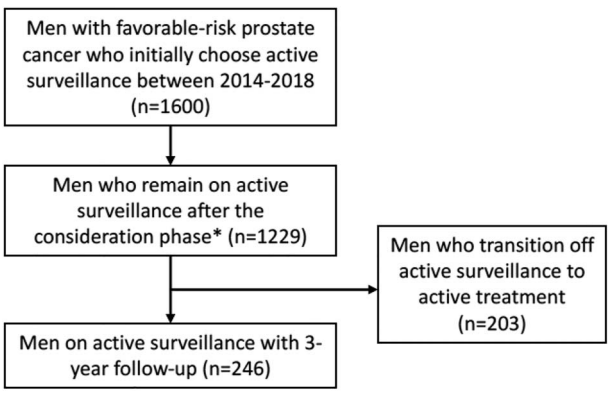

Figure 1. Study cohort flow diagram.

Measures

Receipt of Recommended Surveillance Testing. MUSIC has developed a Roadmap for Management of Men with Favorable-Risk Prostate Cancer, which outlines surveillance testing recommended under both a high- and low-intensity protocol. The MUSIC registry data do not capture what type of AS a patient is placed on, low intensity or high intensity. For purposes of this analysis, we defined receipt of recommended surveillance testing based on the low-intensity criteria, given this was the minimum testing, imaging and biopsy considered appropriate AS followup. The low-intensity criteria include 1) annual PSA testing and 2) prostate biopsy or MRI every 3 years. We therefore specified the outcome receipt of recommended surveillance testing during 3 years of AS as 3 PSA tests and 1 MRI or biopsy (MRI/biopsy). In comparison, the high-intensity criteria include 1) PSA every 6 months and 2) prostate biopsy or MRI every year.

Attending Urologist. We used BCBSM claims data to identify the patient's urologist. Patients were linked to the urologist they saw most frequently while on AS. If a patient did not see a urologist during 3 years of AS, then they were linked to the urologist they saw prior to starting AS. We linked 98% of patients in our sample to a urologist.

Provider Visit. We used CPT® (Current Procedural Terminology) and provider specialty codes to determine urologist and PCP visits from BCBSM claims data. We determined the frequency of visits to the urologist and PCP during 3 years of AS. We only included visits to the patient's established PCP (defined as the same PCP on record for up to 12 months prior to the patient's prostate cancer diagnosis) to minimize capturing acute visits where discussion of AS would be unlikely.

Patient Characteristics. Patient demographic and clinical characteristics abstracted from the MUSIC registry included age, race (White, Black, Other), Gleason score at time of diagnosis, PSA at time of diagnosis, body mass index, comorbidities (AIDS, congestive heart failure, chronic pain, chronic obstructive pulmonary disease, connective tissue disease, cardiovascular disease, diabetes, hemiplegia/paraplegia, other cancer, myocardial infarction, peripheral vascular disease, spinal cord injury, ulcer disease) and life expectancy.[18,19]

Statistical Analysis

Descriptive statistics were used to summarize patient demographic and clinical characteristics. We also described the distribution of provider visits (urologist and PCP) and our key primary outcome (receipt of recommended surveillance testing). We performed a series of 3 analyses to understand the influence of the urologist, provider visits and patient characteristics on receipt of recommended surveillance testing. First, we calculated the urologist-level variation in receipt of recommended surveillance. We used a multilevel model of receipt of recommended surveillance testing in which patients were clustered within urologists. In this model, we measured the intraclass correlation coefficient, which is the ratio of the variance between urologists to the total variance of the model. Second, we examined the association between provider visits (urologist and PCPs separately) and receipt of recommended surveillance testing. We used multivariable logistic regression models to examine patient demographic and clinical characteristics associated with provider visits, and then associations between provider visits and receipt of recommended surveillance testing, accounting for physician clustering. Lastly, we examined associations between patient demographic and clinical characteristics and receipt of recommended surveillance testing (including provider visits), accounting for physician clustering. All models were run separately for receipt of all recommended surveillance testing and receipt of each component of surveillance testing (3 PSAs and 1 MRI/biopsy).

This study was deemed exempt by the University of Michigan Institutional Review Board.

Table 1. *Patient baseline demographic and clinical characteristics*

Total pts	246
Mean yrs age (SD)	66.4 (8.2)
No. yrs age range (%):	
<55	14 (5.7)
55–64	69 (28.1)
65–74	122 (48.6)
≥75	41 (16.7)
No. race (%):	
White	211 (85.8)
Black	22 (8.9)
Other	13 (5.3)
No. Gleason score:	
3+3	219 (89.0)
3+4	27 (11.0)
Mean PSA (SD)	6.2 (4.8)
Mean kg/m^2 BMI (SD)	29.0 (4.8)
No. kg/m^2 BMI range (%):	
<25	42 (17.8)
25–29.9	107 (45.3)
≥30	87 (36.9)
No. comorbidities (%):*	
0	185 (75.2)
1+	61 (24.8)
No. yrs life expectancy/expected 10-yr survival (%):	
<10	20 (8.1)
≥10	226 (91.9)

BMI, body mass index.
* Comorbidities include AIDS, congestive heart failure, chronic pain, chronic obstructive pulmonary disease, connective tissue disease, cardiovascular disease, diabetes, hemiplegia/paraplegia, other cancer, myocardial infarction, peripheral vascular disease, spinal cord injury and ulcer disease.

RESULTS

Table 1 describes our cohort. Men, on average, were 66 (SD 8.22) years old. The majority were White (85.8%). Most patients had Gleason 3+3 disease and PSA 6.20 ng/ml (SD 4.84) at the time of diagnosis. Three-quarters of the patients did not have any additional comorbidities and 91.9% had a greater than 10-year life expectancy.

Figure 2 shows the distribution of receipt of recommended surveillance testing as based on MUSIC's low-intensity criteria. About half of the men in the cohort (56.5%) received all the recommended surveillance testing. Among those men who received the recommended MRI or biopsy, 58% had a biopsy only, 6% had an MRI only, and 37% had both a biopsy and MRI. Lack of annual PSA testing accounted for the majority of patients with nonreceipt of

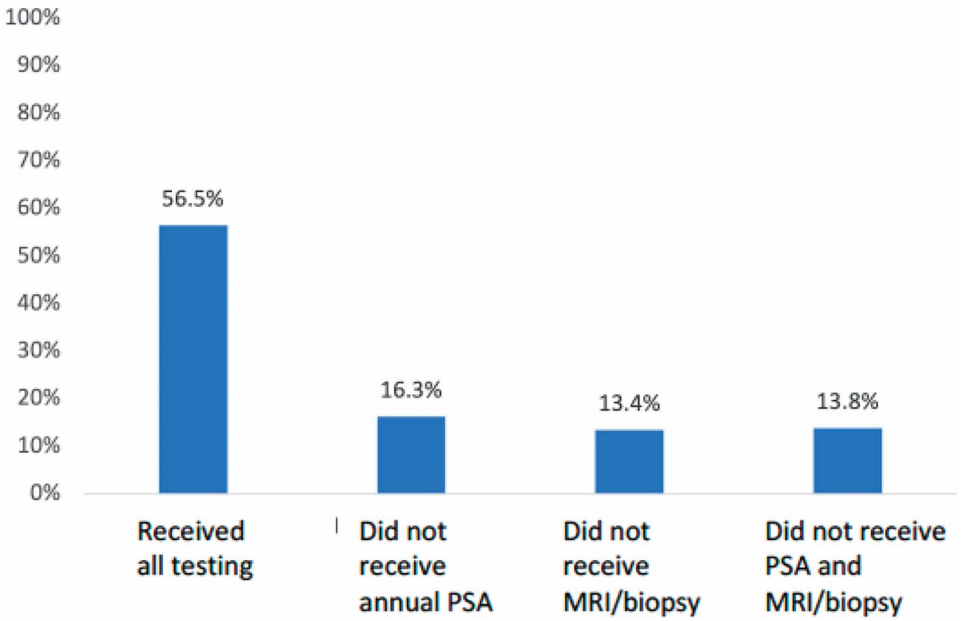

Figure 2. Distribution of receipt of recommended surveillance testing.

recommended surveillance testing (16.3%), while 13.4% did not receive an MRI/biopsy, and 13.8% did not receive the recommended combination of PSA testing and MRI/biopsy.

The results of the influence of the urologist, provider visits and patient characteristics on receipt of recommended surveillance testing are described below.

Influence of Urologist

In our multilevel model of receipt of recommended surveillance testing, we found that the intraclass correlation coefficient was 0.185. This indicates that 18.5% of the variation in receipt of recommended surveillance testing is accounted for by the individual urologist.

Influence of Provider (Urologist and PCP) Visits

Table 2 shows patient characteristics associated with urologist and PCP visits. On average, men had 2.88 urologist visits and 1.72 PCP visits during 3 years of AS. Younger men (<75 years) saw their

Table 2. *Distribution of patient demographic and clinical characteristics by mean PCP and urologist visits during 3 years of AS*

	Mean PCP Visits (SD)	p Value	Mean Urologist Visits (SD)	p Value
Age (yrs):		**0.005**		**< 0.001**
<55	2.8 (4.0)		3.9 (3.1)	
55–64	2.4 (4.0)		4.5 (3.4)	
65–74	0.7 (2.7)		2.1 (3.2)	
≥75	3.0 (7.4)		2.2 (2.8)	
Race:		**0.002**		0.287
White	1.3 (4.0)		2.8 (3.4)	
Black	3.8 (5.0)		4.0 (2.6)	
Other	4.5 (5.8)		2.6 (3.0)	
BMI (kg/m^2):		0.672		0.285
<25	1.6 (3.7)		3.6 (3.6)	
25–29.9	2.0 (5.2)		2.9 (3.1)	
≥30	1.5 (3.5)		2.6 (3.4)	
Gleason score:		0.116		0.091
3+3	1.9 (4.5)		3.0 (3.4)	
3+4	0.5 (1.6)		1.9 (2.8)	
PSA:		0.440		0.861
<4.0	1.3 (3.2)		2.9 (3.6)	
≥4.0	1.8 (4.6)		2.9 (3.3)	
Comorbidities (No.):		**0.008**		0.515
0	1.3 (3.1)		3.0 (3.3)	
1+	3.0 (6.7)		2.6 (3.5)	
Life expectancy/expected 10-yr survival (yrs)		**0.004**		0.419
<10	4.4 (9.7)		2.3 (2.8)	
≥10	1.5 (3.4)		2.9 (3.4)	

Bold indicates statistically significant result at p <0.05. *BMI*, body mass index.

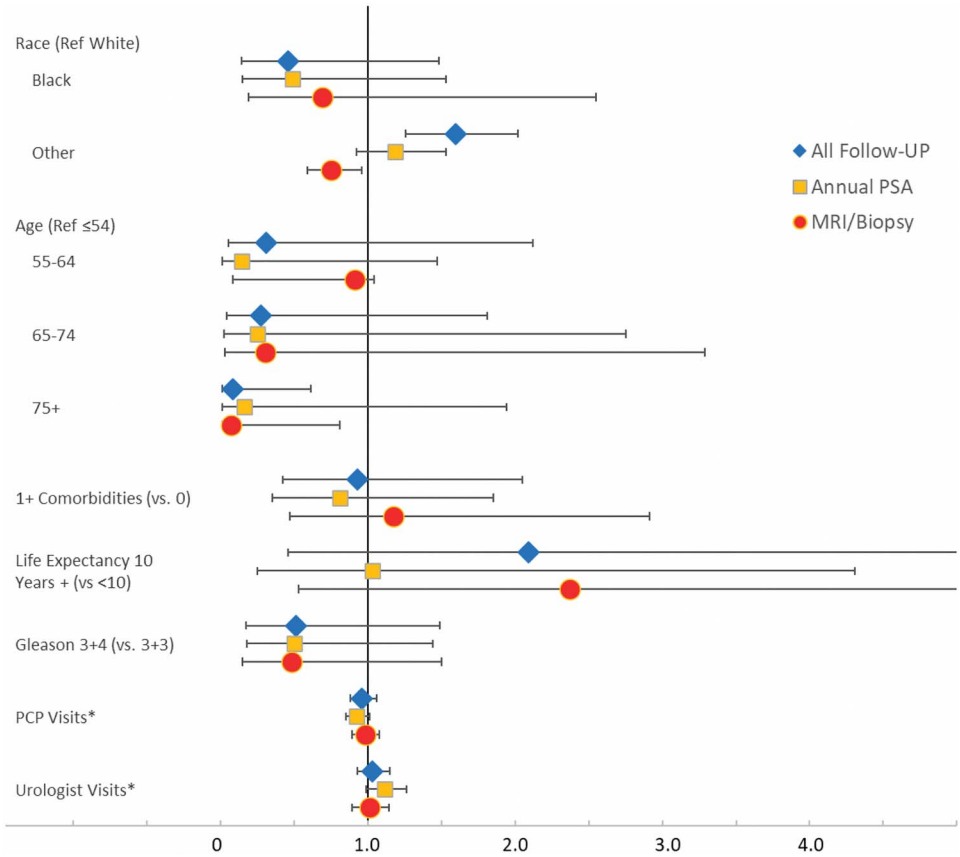

Figure 3. Multivariable logistic regression analysis results examining associations between provider visits and patient demographic and clinical characteristics, and receipt of recommended surveillance testing for all followup components, 3 PSA tests and 1 MRI or biopsy.

urologist more frequently compared to their PCP (3.0 visits vs 1.5 visits respectively, p <0.001). Significantly more PCP visits were seen among Black men (compared to White men: 3.8 visits vs 1.3 visits, p=0.002), men with at least 1 comorbidity (compared to men who had none: 3.0 visits vs 1.3 visits, p=0.008) and men who had a limited 10-year life expectancy (compared to men who had a greater than 10-year life expectancy: 4.4 visits vs 1.5 visits, p=0.004). These results were also significant in a multivariable linear model (results not shown). Increasing provider visits, either urologist or PCP, were not associated with receipt of recommended surveillance testing (eg for receipt of all followup components: urologist visit OR 1.03 [95% 0.93−1.15], PCP visit OR 0.96 [95% CI 0.88−1.06]; Figure 3).

Influence of Patient Characteristics

Compared to men <55 years, men ≥75 years were less likely to receive an MRI/biopsy (OR 0.07; 95% CI 0.01−0.81).

DISCUSSION

In our statewide registry of men with favorable-risk prostate cancer who selected AS as their primary management, slightly more than half received all the recommended surveillance testing according to MUSIC low-intensity criteria. This, however, means that nearly half of men did not receive the minimal recommended testing that is essential for the success of AS as a management strategy.

Our study provides a contemporary update to prior work examining rates of followup PSA testing and prostate biopsy among men with favorable-risk prostate cancer in MUSIC from 2012 to 2013.[20] Using the National Comprehensive Cancer Network® guidelines to determine adherence to receipt of AS surveillance testing, the authors found that only 31% of men underwent the recommended testing, with the majority not receiving a followup biopsy. We used MUSIC's low-intensity criteria as our benchmark to determine receipt of surveillance testing. Although the frequency of testing recommended under MUSIC's low-intensity criteria is considered the minimum testing appropriate for AS, nearly half of the men in our cohort still did not receive even this amount of testing. It is also notable that older men were less likely to receive their MRI/biopsy. Whether this reflects truly a lack of receipt of surveillance testing or physician or patient factors (such as consideration of age and life expectancy, patient preference) leading to de-escalation of care is unclear. While over the past decade we have

made tremendous progress in increasing the number of men choosing AS for their primary management, the fact that nearly half do not receive it—even under low-intensity criteria—suggests that ensuring and supporting men receive the recommended testing will be key to its long-term success.

We found that individual urologists explained a substantial amount of the overall variation in receipt of surveillance testing, suggesting that at least some efforts to improve the receipt of testing will need to be directed at the urologist. This is similar to other studies showing the influence of the provider on cancer treatment outcomes, such as the influence of the attending surgeon on the receipt of contralateral mastectomy for women with early-stage breast cancer.[13,21] While considerable research has focused on urologist recommendations at the time of AS treatment decision making, less is known about how urologists can best support men to ensure they receive the recommended surveillance testing. In a qualitative study of men on AS who dropped out of surveillance to undergo active treatment without signs of disease progression, men reported not receiving enough information from their provider about AS or psychological support to deal with their anxiety.[22] Enabling urologists to support patients to maximize receipt of recommended surveillance is necessary. Including resources (eg patient education materials) available for urologists to provide their patients at the point of care delivery and integrated into routine clinical flow (eg followup protocols integrated into the electronic medical record) will be important.[23] Additionally, incentivizing urologists to achieve certain metrics through the use of payer reimbursement can be considered.

We did not find a significant association between provider visits to either the urologist or PCP and receipt of recommended surveillance. However, PCPs may be an underutilized resource for improving adherence to surveillance protocols, especially for vulnerable patients. Indeed, we found that in our sample, Black men, men with comorbidities and men with limited life expectancies had more visits with their PCP while on AS. Prior research has demonstrated the beneficial effect of PCP involvement in cancer care. Among breast cancer survivors, women were more likely to receive their surveillance mammography and preventive care (eg influenza vaccine) when they saw both their PCP and oncologist.[24] Through our own work, we also showed that PCPs are willing to collaborate with urologists to manage men on AS.[25,26] In a national survey of PCPs, 60% reported preferring a shared-care model to order PSA tests for men on AS (compared to 8% who preferred PCP-led vs 32% who preferred urologist-led model). However, how to integrate PCPs into the care delivery of men on AS and what their potential responsibilities could be remains unclear. One possibility is for PCPs to reinforce the importance of adhering to surveillance protocols and address factors such as psychosocial issues that may contribute to nonadherence. Importantly, PCPs can also help to determine when patients who may no longer benefit from AS (ie having more comorbidities, limited life expectancies) should transition to watchful waiting.

Strengths of this study include capitalizing upon the unique quality improvement efforts of MUSIC to improve prostate cancer care across the state of Michigan and combining robust statewide prospective clinical registry data with insurance claims data. There are potential limitations that warrant acknowledgment. First, MUSIC as a quality improvement collaborative includes urology practices only within the state of Michigan, which may limit the generalizability of our findings. However, it includes 46 practices, which are diverse and include academic, private and community practices, reflecting real-world care delivery settings. Second, we did not assess the impact of radiation oncologists in AS management and receipt of recommended testing. Patients can be managed primarily by radiation oncologists, and future studies will need to examine their roles as well. Third, while we were able to assess receipt of at least low-intensity AS during the first 3 years, we did not assess downstream outcomes related to not receiving the recommended testing due to limited availability of data for followup. Given that AS as a management strategy requires followup testing to be effective, this will be an important next step for future studies. Lastly, we used insurance claims data to determine visits to PCPs and cannot comment on the content of the PCP visit itself.

CONCLUSIONS

In summary, receipt of all surveillance testing meeting MUSIC's low-intensity criteria among men with favorable-risk prostate cancer was suboptimal. Our results suggest that the primary urologist a patient saw plays a critical role in ensuring receipt of all recommended surveillance. As the number of men on AS continues to grow, future research focused on understanding why men do not receive all the recommended AS testing and how to support urologists—potentially through leveraging patients and their visits with PCPs—should be considered.

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EDITORIAL COMMENTS

The MUSIC (Michigan Urological Surgery Improvement Collaborative) registry data showed that only 56.5% (139/246) of the men with a favorable-risk prostate cancer on active surveillance (AS) fully met criteria for low-intensity surveillance testing. The authors characterized this as suboptimal care and suggested that urologists and primary care clinicians (PCPs) could better support AS adherence. However, the adherence rate is difficult to interpret because the study cohort was highly selected. Authors excluded the 203 men who switched to active treatment and the 780 men with less than 3 years of followup. Even then, lack of adherence may not necessarily be problematic. Multivariate analyses found that men ages 75 years and older were less likely to receive all recommended surveillance testing than those younger than 55. Social Security actuarial tables suggest that a 75-year-old man has an 11-year life expectancy.[1] The current American Urological Association guidelines recommend against screening men with less than a 10- to 15-year life expectancy, implying that ongoing AS testing for older men might also not be warranted.[2] Although not statistically significant, the number of PCP visits was inversely associated with AS adherence. Men with greater comorbidity had more PCP visits than those with no comorbidity. Given that the average age of subjects at diagnosis was 66 years, some men might have experienced progression of

existing comorbidities or had new diagnoses during the 3 years of followup. Clinical events decreasing life expectancy would make AS a less viable option and patients may be appropriately prioritizing other medical conditions. The authors also implicitly assume that not being adherent with AS protocols adversely affects prostate cancer outcomes. However, they acknowledge lacking the downstream data to test that hypothesis. The authors do make the important points that men facing treatment decisions for low-risk cancers need to be well informed, which should include understanding the rationale for AS and the potential risks of not being adherent, as well as helped in addressing psychosocial issues that may prevent adherence.

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Despite increasing acceptance of active surveillance (AS) for favorable-risk men, significant barriers remain to its widespread adoption. The authors assessed registry data from the MUSIC (Michigan Urological Surgery Improvement Collaborative), with a focus on adherence to a low-intensity monitoring protocol for AS, defined as annual prostate specific antigen testing, plus either magnetic resonance imaging (MRI) or biopsy every 3 years. They reported that 57% of patients met both prostate specific antigen and MRI/biopsy criteria, while 86% received at least 1 form of monitoring.

The MUSIC data likely provide a more accurate reflection of contemporary practice than the single-institution, closely monitored AS programs that first established the safety of surveillance.[1,2] For example, the Johns Hopkins AS program initially called for yearly surveillance biopsies, with biopsy adherence approximating 90%. While such stringent monitoring would be excessive in the current era, we should be mindful when citing outcomes from these programs during patient counseling.

Several factors support the likelihood that similar outcomes can and will be achieved with lower-intensity monitoring. For one, modeling based on serial prostate biopsies has suggested that true prostate cancer progression (from low-grade to high-grade disease) is a relatively rare event, approximating 1.2%–2.4% per year,[3] a finding consistent with serial sequencing data.[4] Thus, as others have described, the rare patients found to have prostate cancer metastasis or death following AS were likely misclassified prior to enrollment rather than undergoing true cancer progression. While initial misclassification remains a concern, it is far less likely in the current era of better patient selection with MRI and confirmatory testing.[5]

We commend the authors for sharing these important data. Additional followup of these and other population-based registries will better characterize the "real-world" practice of AS and further confirm the safety of various monitoring approaches in the contemporary era.

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