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Prostate cancer screening practices and diagnoses in patients age 50 and older, Southeastern Michigan, pre/post 2012

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ABSTRACT

Introduction. Studies investigating the regional impact of the 2012 U.S. Preventive Services Task Force (USPSTF) recommendation against the use of prostate specific antigen (PSA) screening for prostate cancer have been limited.

Methods. A retrospective cohort study was conducted on men age 50 years and older in Southeastern Michigan pre (n = 3647) and post (n = 3618) USPSTF recommendation. PSA screening, transrectal ultrasound, and prostate biopsy rates were evaluated pre/post using a generalized piecewise linear model with a Poisson distribution, and log link. A knot was placed at year 2011 to estimate pre/post slope coefficients. Generalized estimating equations were used to estimate the marginal probability of a prostate diagnosis as a logistic function of pre and post-period, and comorbidities.

Results. PSA utilization significantly increased (β = 0.28; 95% CI: 0.25, 0.31) during the pre-period, but significantly decreased in the post-period (β = −0.29; 95% CI: −0.34, −0.25). Prostate biopsies decreased pre (β = −0.16; 95% CI: −0.25, −0.08) and did not change post (β = 0.01; 95% CI: −0.09, 0.12). Transrectal ultrasounds were stable pre (β = 0.16; 95% CI: −0.03, 0.35) and significantly decreased post (β = −0.27; 95% CI: −0.50, −0.04). Patients in the post-period had a decreased probability of having a diagnosis of prostate cancer (OR: 0.81; 95% CI: 0.74–0.89) compared to the pre-period.

Conclusion. Our study demonstrates how PSA tests are still being frequently used in Southeastern Michigan. Further research is needed to better understand regional variation in prostate cancer screening practices in the U.S.

Introduction

Prostate cancer is the most common solid malignancy in men in the U.S. According to the American Cancer Society we can expect to see approximately 220,800 new cases of prostate cancer and 27,540 prostate cancer-associated deaths in 2015 (Siegel et al., 2015). One in seven men will receive a prostate cancer diagnosis during their lifetime with the majority of men presenting after the age of 65 (Siegel et al., 2015). As the second leading cause of cancer-related death in the U.S., it is estimated that one in every 38 men will die of prostate cancer (Siegel et al., 2015).

Screening practices for prostate cancer have been a hot topic for debate over the last decade. In May of 2012, the U.S. Preventive Services Task Force (USPSTF) published a final recommendation against the use of prostate specific antigen (PSA) screening for prostate cancer in all men in the general U.S. population (Moyer, 2012). The USPSTF arrived at this conclusion based off of evidence demonstrating a small reduction in prostate cancer mortality 10–15 years post PSA screening, but also an immense association between PSA screening and risk of harm in the form of overdiagnosis and overtreatment (Schroder et al., 2009; Andriole et al., 2009). Although many professional associations have followed suit with similar recommendations regarding PSA screening (Qaseem et al., 2013), research has shown that urologists, oncologists and even consumers may disagree with this change in practice (Kim et al., 2014; Squiers et al., 2013). The American Urological Association (AUA) currently recommends PSA screening after informed decision-making in high-risk (e.g., positive family history or African American race) men ages 40–54 and in all men ages 55–69 (Ballentine et al., 2013).

Since publication of the USPSTF recommendation for the discontinuation of PSA screening in asymptomatic men of all ages, early evidence suggests a significant drop-off in the proportion of men receiving PSA screening in the U.S. (McCarthy, 2015; Cohn et al., 2014; Werntz et al., 2015; Yates et al., 2015). These results have not been universal, however (Hamoen et al., 2013). To better understand the regional impact of the 2012 USPSTF recommendation, we evaluated the occurrence of PSA screenings, prostate ultrasounds, prostate biopsies, and prostate cancer diagnoses in Southeastern Michigan pre/post 2012. We hypothesized

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that we would observe a decrease in the proportion of men receiving PSA screenings, prostate ultrasounds, prostate biopsies, and prostate cancer diagnoses in the years following the 2012 USPSTF recommendation.

Methods

A retrospective cohort study was conducted on all adult male patients age 50 years and older insured by the Beaumont Employee Health Plan (BEHP) to study the impact of the 2012 USPSTF recommendation on prostate cancer screening (Moyer, 2012). No other inclusion/exclusion criteria were applied to establish the study population. The BEHP is a regional health insurance provider serving Beaumont Health System employees (e.g., physicians, nurses and support staff) and their families (spouses and children) across Southeastern Michigan. Beaumont Health System is composed of three primary healthcare campuses (Royal Oak, Troy, Grosse Pointe) and numerous satellite facilities in greater Detroit. The cohort was stratified from January 1st 2010 to December 31st 2011 and January 1st 2013 to December 31st 2014 to acknowledge time periods of care provided prior to and after the USPSTF recommendation to cease annual PSA screenings in all men. The year 2012 was excluded from the analysis to account for the fact that the USPSTF recommendation was implemented halfway through the year (May 1st) and time was required for this information to be disseminated to, reviewed by, and acted upon by providers. Of note, the May 2012 recommendation was the USPSTF's finalized version of the October 2011 draft recommendation on PSA screening. However, we considered publication of the May 2012 finalized recommendation as a more appropriate indicator for potential change in clinical practice. The Beaumont Health System Research Institute for Human Investigation Committee approved this study (HIC no. 2014-051).

To evaluate potential changes in prostate cancer screening practices we studied the rates of PSA testing and transrectal ultrasound pre/post USPSTF recommendation using current procedural terminology (CPT) codes from administrative billing data. PSA tests were identified using the following CPT codes: 84152 (assay of PSA, complexed), 84153 (assay of PSA), 84154 (total assay of PSA, free) or G0103 (prostate cancer, screening, PSA test). Transrectal ultrasounds were identified using 76872 (ultrasound, transrectal). Changes in prostate biopsy rates were studied using 55700 (biopsy of prostate). International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code 185 (malignant neoplasm of prostate) was used to study prostate cancer diagnoses in outpatient evaluation and management claims pre/post recommendation.

We first performed descriptive analysis and unadjusted comparisons using χ^2 tests for binary variables and *t* tests for continuous variables. We evaluated PSA screening, transrectal ultrasound, and prostate biopsy rates pre/post USPSTF recommendation using a generalized piecewise linear model with a Poisson distribution, and log link. A knot was placed at year 2011, in order to estimate pre and post recommendation slope coefficients. We used generalized estimating equations as an approach to estimate the marginal probability of a prostate cancer diagnosis as a logistic function of pre and post recommendation period, age, and several comorbidities (hypertension, congestive heart failure, coronary artery disease, hyperlipidemia, stroke, arthritis, chronic kidney disease, chronic obstructive pulmonary disease, cancer (other), depression, diabetes and osteoporosis). These comorbidities were adjusted for based on research identifying relevant co-occurring diagnosis that can impact prostate cancer diagnosis and treatment (Post et al., 1999). To account for clustering at the patient level, an independent working correlation structure was chosen based on the Quasilikelihood under the Independence model Criterion (QIC) goodness-of-fit statistic, which was used to compare models with several types of working correlation structures. Finally, a sensitivity analysis was conducted on men age 75 years and older to determine whether PSA testing and prostate cancer diagnoses were different among the eldest of patients and to assess secular trends as these patients were not subject to prior screening recommendations.

Results

A total of 3647 and 3618 men over the age of 50 were identified in the pre and post recommendation periods, respectively (see Table 1). Men in the post-period were found to be significantly younger (54.1 years vs. 56.5 years, $p < 0.001$) and less likely to have prostate cancer (2.9% vs. 2.3%, $p = 0.02$), hypertension (59.9% vs. 63.6%, $p < 0.01$), CHF (3.0% vs. 3.9%, $p = 0.05$), CAD (19.9% vs. 23.3%, $p < 0.001$), other cancer (5.9% vs. 7.1%, $p = 0.05$), hyperlipidemia (58.3% vs. 60.7%, $p = 0.03$) and dementia (0.6% vs. 1.0%, $p = 0.05$).

Table 1
Patient & procedural characteristics pre/post 2012 USPSTF recommendation.

	Pre USPSTF recommendation	Post USPSTF recommendation	Test statistic, p-value
Patients			
Total, N	3647	3618	–
Age, mean	56.5	54.1	<0.001
Prostate cancer, %	2.9% (n = 208)	2.3% (n = 164)	$X^2 = 5.12$, 0.02
Hypertension,%	63.6 (n = 2318)	59.9 (n = 2170)	$X^2 = 9.9$, <0.01
Congestive heart failure, %	3.9 (n = 141)	3.0 (n = 109)	$X^2 = 3.9$, 0.05
Coronary artery disease, %	23.3 (n = 851)	19.9 (n = 722)	$X^2 = 12.2$, <0.001
Cancer (other), %	7.1 (n = 257)	5.9 (n = 214)	$X^2 = 3.8$, 0.05
Hyperlipidemia, %	60.7 (n = 2215)	58.3 (n = 2108)	$X^2 = 4.6$, 0.03
Stroke, %	4.0 (n = 146)	3.5 (n = 126)	$X^2 = 1.4$, 0.24
Arthritis, %	26.2 (n = 957)	25.2 (n = 911)	$X^2 = 1.1$, 0.3
Chronic kidney disease, %	6.6 (n = 242)	5.9 (n = 215)	$X^2 = 1.5$, 0.22
Dementia, %	1.0 (n = 37)	0.6 (n = 22)	$X^2 = 3.7$, 0.05
Depression, %	5.9 (n = 214)	6.4 (n = 231)	$X^2 = 0.8$, 0.36
Diabetes, %	23.9 (n = 872)	22.8 (n = 824)	$X^2 = 1.3$, 0.25
Osteoporosis, %	1.3 (n = 46)	1.1 (n = 39)	$X^2 = 0.5$, 0.47
Procedures			
Biopsy, %	12.6	8.1	<0.001
PSA, %	72.1	79.3	0.48
Transrectal ultrasound, %	4	3.3	0.15

In regard to average utilization rates, 72.1% of men received annual PSA screenings in the pre-period compared to 79.3% in the post-period ($p = 0.48$). Prostate biopsies were conducted in 12.6% of men pre and 8.1% post (<0.001), while transrectal ultrasounds were carried out in 4.0% pre and 3.3% post ($p = 0.15$) ($p = 0.65$, see Table 1).

PSA utilization significantly increased ($\beta = 0.28$; 95% CI: 0.25, 0.31) during the pre-period, but significantly decreased in the post-period ($\beta = -0.29$; 95% CI: −0.34, −0.25). Prostate biopsies decreased pre ($\beta = -0.16$; 95% CI: −0.25, −0.08) and did not change post ($\beta = 0.01$; 95% CI: −0.09, 0.12). Transrectal ultrasounds were stable pre ($\beta = 0.16$; 95% CI: −0.03, 0.35) and significantly decreased post ($\beta = -0.27$; 95% CI: −0.50, −0.04) (Table 2). Patients in the post-period had a decreased probability of having a diagnosis of prostate cancer (OR: 0.81; 95% CI: 0.74–0.89) compared to the pre-period (Table 3).

A total of 142 men age 75 years and older were identified in the pre and post-period for the sensitivity analysis. Among these older men, the average rate of PSA testing in the pre-period was 6.9% compared to 8.6% in the post-period ($p = 0.44$). PSA utilization remained stable in both the pre-period ($\beta = -0.24$; 95% CI: −0.95, 0.46) and post period ($\beta = 0.40$; 95% CI: −0.46, 1.26). These patients had an equal probability of having a prostate cancer diagnosis in the post-period compared to the pre-period (OR: 1.23; 95% CI: 0.36, 4.13). The overall proportion of men with a prostate cancer diagnosis in the pre-period was 10.6% compared to 4.2% in the post-period ($X^2 = 0.04$, $p = 0.84$).

Table 2
Pre/post 2012 USPSTF recommendation slopes (95% CIs) by procedure type.

Prostate cancer screening type	Pre-intervention	Post-intervention	p-Value[a]
Prostate biopsy	−0.16 (−0.25, −0.08)	0.01 (−0.09, 0.12)	0.05
Prostate specific antigen	0.28 (0.25, 0.31)	−0.29 (−0.34, −0.25)	<0.0001
Transrectal ultrasound	0.16 (−0.03, 0.35)	−0.27 (−0.50, −0.04)	0.04

[a] Significance of estimated difference between pre- and post-intervention slopes. CI: confidence intervals