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Original Research Article

Effects of primary care physician density, urologist presence, and insurance status on stage of diagnosis for urologic malignancies

Kristy D. Nguyen[a], Zain Z. Hyder[a], Marshall D. Shaw[a], Sarah B. Maness[b], Michael S. Cookson[a], Sanjay G. Patel[a], Kelly L. Stratton[a,*]

[a] Department of Urology, University of Oklahoma HSC, Oklahoma City, OK, United States
[b] Department of Health and Exercise Science, University of Oklahoma, Norman, OK, United States

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ABSTRACT

Objective: To evaluate effects of PCP density, insurance status, and urologist presence on stage of diagnosis for urologic malignancies. Cancer stage at diagnosis is an important outcome predictor. Studies have shown an inverse relationship to primary care physician (PCP) density and insurance coverage with stage of cancer diagnosis.

Methods: Data was obtained from OK2Share, an Oklahoma Central Cancer Registry, for bladder, kidney, and prostate cancer from 2000 to 2010. Physician data was obtained through the State Licensing Board. The 2010 national census was used for population data. High PCP density was defined as greater than or equal to the median value: 3.17 PCP/10,000 persons. Chi-square and multivariate logistic regressions were used to analyze effects of PCP density, insurance status, and urologist presence on advanced stage diagnosis.

Results: 27,086 patients were identified across 77 counties. As PCP density increased by 1 PCP/10,000 persons, the odds ratios (OR) of an advanced stage at diagnosis were 0.383, 0.468, 0.543 for bladder, kidney, and prostate cancer respectively. Compared to private insurance, being uninsured had OR of 1.61 and 2.45 respectively for kidney and prostate cancers. The OR of an advanced stage diagnosis for bladder and prostate cancer were 3.77 and 1.73, respectively, in counties with a urologist.

Conclusions: Increased PCP density and insurance coverage reduced the odds of an advanced diagnosis. Implementation of policies to improve access to healthcare including through increasing PCP density and reducing the number of uninsured patients should result in diagnosis at an earlier stage, which will likely improved cancer-related outcomes.

1. Introduction

Urologic malignancies comprise 38% of newly diagnosed cancers in US males; 16% of deaths in males due to malignancies are urologic. Prostate cancer (PCa) is the most commonly diagnosed malignancy and the second most common cause of cancer death [1]. One quarter of all cancer survivors, and more than half of male cancer survivors in the US had a urologic malignancy [2]. In less than 10 years, the number of overall survivors with a urologic malignancy will increase to one third [3].

The stage of any malignancy at diagnosis is an important predictor of outcome. Factors including screening protocols such as those for colorectal cancer have been shown to decrease the stage at diagnosis [4]. PCa screening protocols have been under debate in terms of risks versus benefits. Some studies such as the Prostate, Lung, Colorectal and Ovarian study (PLCO) have shown no reduction in mortality with 13 years of follow-up [5]. Other studies such as the European Randomized Study of Screening for Prostate Cancer (ERSPC) found a 20% relative reduction in mortality with 11 years of follow-up [6].

Studies have shown that an increase in primary care physician (PCP) density decreases the stage of diagnoses in malignancies such as breast and colorectal [7,8]. A study of an Ohio database showed the inverse relationship between PCP densities and stage at diagnosis held true for many common malignancies including PCa [9]. The state of Oklahoma has 54.85% of need met for primary care physicians corresponding with a population of 1,204,308 in a health professional shortage area. Thus placing it in an intermediate category among other states, with Connecticut having only 12.5% of need met ranging to Delaware with 93.84% of its need met [25]. Insurance type also has an effect on stage of diagnosis. A study showed that patients at “Safety-

* Corresponding author at: 3816 S. Sequoia Ave, Broken Arrow, OK 74011, United States.
E-mail addresses: kpnguyen90@gmail.com (K.D. Nguyen), zain-hyder@ouhsc.edu.com (Z.Z. Hyder), marshall-shaw@ouhsc.edu (M.D. Shaw), smaness@ou.edu (S.B. Maness), michael-cookson@ouhsc.edu (M.S. Cookson), sanjay-patel@ouhsc.edu (S.G. Patel), Kelly-Stratton@ouhsc.edu (K.L. Stratton).

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Net" hospitals without insurance had higher rates of advanced breast and colorectal cancer in comparison to patients with insurance. For that study, patients with Medicaid had similar rates of advanced stage diagnosis as privately insured patients [10]. Another study showed that non-Medicaid insurance decreased the likelihood of an advanced stage cancer diagnosis for the 10 most lethal cancers including PCa [11].

Studies on the effects of urologist density on stage of diagnosis are largely absent. However, there are studies on how urologist density affects mortality. Results vary between urologic malignancies. One study showed that urologist density on PCa mortality varied based on geographic region [12]. Another study showed that lower urologist density increased the mortality of kidney cancer (KCa) but had no effect on bladder cancer (BCa) or PCa mortality in the state of Illinois [13]. National patterns of urologist density demonstrate 63% of US counties lack a urologist, with the nonmetropolitan and rural counties making up the majority of Oklahoma showing a significant deficit in providers [24].

Thus we aimed to see if the previously described effects of increased PCP density and insurance status on stage of diagnosis held true for three major urologic malignancies (bladder, kidney, and prostate) in the state of Oklahoma. We also asked if the presence of a urologist impacts the stage of diagnosis.

2. Materials and methods

OK2Share (http://www.health.state.ok.us/ok2share/), the Oklahoma State Department of Health database, was accessed on December of 2014 for bladder, kidney, and prostate cancer diagnoses for both sexes aged 20 years and greater from 2000 to 2010. The database consists of blinded, de-identified data. All selectable races were included: Caucasians, African Americans, Native Americans, Hispanics and "others". Stage was given by in-situ, localized, regional, and distant. In-situ data was removed from analysis. Advanced stage was defined as the presence of regional or distant disease. Insurance status was limited to private, Medicare and uninsured due to inadequate numbers for other types. IRB exemption was obtained.

Number of PCPs was determined by using the Oklahoma State Licensing Board (OSLB) for active internal medicine and family medicine physicians broken down by county of practice. Anything equal to or higher than the median value of 3.17 PCPs/10,000 persons was defined as a "high PCP density" county. This selection of high PCP density was based on other studies similar in nature [7]. Number of urologists were determined by OSLB active urologist and cross-referenced with an active list of American Urologic Association (AUA) urologists in Oklahoma. Urology residents were excluded from the list as they are non-independent providers. Population data was obtained through the 2010 national census. Urban counties were defined by the Office of Management and Budget's list of metro counties.

Statistical program "R" was utilized to perform chi-square tests resulting in odds ratios (OR) with confidence intervals (CI). Multivariate logistic regression for PCP density was performed by pairing advanced diagnosis for each separate cancer with their respective county's PCP density. The pairs were then ordered and a logistic regression was ran. Insurance status analysis was performed by comparing Medicare and uninsured to private insurance in high PCP density counties by Mantel chi-square. Counties with a urologist and without were compared using chi-square. A value of "0" was replaced with the near zero value of "1" to perform approximation calculations where necessary and feasible.

3. Results

From all 77 counties, a total of 27,086 patients' data were obtained after excluding inadequate insurance types. The majority of the study population was Caucasian (92.38%, 85.45%, and 86.07% for BCa, KCa, and PCa respectively) and male (75.71% and 61.31% for BCa and KCa). African American males and females comprised 3.08% and 5.12% of BCa and KCa cases respectively, but African American males comprised 7.73% of PCa cases. Native Americans held only 3.35% and 3.83% of BCa and PCa cases respectively, but held 8.53% of KCa cases. Males had a higher ratio of BCa diagnosis – 75.1% male and 24.29% female; males also had a higher ratio of KCa diagnosis – 61.31% male and 38.69% female (Table 1).

Table 1
Patient Demographics.

	Bladder (n = 2928)	Kidney (n = 3749)	Prostate (n = 20,409)
Male	75.71%	61.31%	100%
Female	24.29%	38.69%	–
Caucasian	92.38%	85.45%	86.07%
African American	3.08%	5.12%	7.73%
Native American	3.35%	8.53%	3.83%
Other/Unknown	1.19%	0.90%	2.37%
High PCP Density	73.87%	75.48%	68.85%
Low PCP Density	26.13%	24.52%	31.15%
Urologist Present	73.93%	75.23%	64.63%
No Urologist	26.07%	24.77%	35.37%

36 (47%) counties were high PCP density; of those 36, 5 were urban. Of the remaining low PCP density counties, 11 were urban (Fig. 1). High PCP density counties held an average of 72.54% of the cancer cases. A logistic of regression of PCP density showed that for each addition of 1 PCP/10,000 persons, BCa, KCa, and PCa had a statistically significant reduction in the likelihood of an advanced stage diagnosis (OR (CI): 0.38 (0.30–0.49), 0.47 (0.40–0.55). 0.54 (0.49–0.57) respectively) (Table 2).

In high PCP density counties with private insurance as the reference point, uninsured KCa and PCa patients had an increased likelihood of an advanced stage diagnosis (OR (CI): 1.61 (1.08–2.52) and 2.45 (1.72–3.49) respectively). No statistical difference was seen in BCa. In comparison to private insurance, Medicare BCa and PCa patients had a decreased likelihood of an advanced stage diagnosis (OR (CI): 0.67 (0.52–0.87), 0.69 (0.62–0.77)) respectively; but KCa patients had an increase likelihood of an advanced stage diagnosis (OR (CI): 1.46 (1.24–1.72)).

19 out of 77 (24.67%) counties had a urologist with the total number of 126 urologists in the state. 18 out of 19 counties were high PCP density. An average of 71.09% of cases were in counties with a urologist. The median value of urologists in those counties was 3.87 urologists per 1,000,000 persons. Presence of a urologist increased the likelihood of an advanced stage diagnosis for BCa and PCa cancer at 3.77 (2.92–4.88) and 1.73 (1.26–1.49) respectively but had no significant effect on KCa (Table 2).

4. Discussion

4.1. Race

The demographics showed that African American men had a higher incidence of PCa in comparison to other urologic malignancies. This finding is in accordance with known trends that African American males have a higher incidence and in some series a higher mortality of PCa in comparison to non-Hispanic white men [1]. Factors contributing to this racial difference in PCa are thought to be due to a combination of elements ranging from genetic variances, opinions towards healthcare, socioeconomic status, and even provider biases [14–16].

Our study also showed that Native Americans had a higher incidence of KCa in comparison to other urologic malignancies. Again this is in accordance with known trends that Native Americans have a higher incidence of KCa with higher mortality in comparison to non-Hispanic Whites [1]. Reasons for the higher incidence are thought to be due to a combination of factors such as an increase in risk factors