

# Declining use of brachytherapy for the treatment of prostate cancer

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## ABSTRACT

**PURPOSE:** To analyze the recent trends in the utilization of external beam radiation therapy (EBRT) and brachytherapy (BT) for the treatment of prostate cancer.

**METHODS AND MATERIALS:** Using the Surveillance, Epidemiology, and End Results (SEER) database, information was obtained for all patients diagnosed with localized prostate adenocarcinoma between 2004 and 2009 who were treated with radiation as local therapy. We evaluated the utilization of BT, EBRT, and combination BT + EBRT by the year of diagnosis and performed a multivariable analysis to determine the predictors of BT as treatment choice.

**RESULTS:** Between 2004 and 2009, EBRT monotherapy use increased from 55.8% to 62.0%, whereas all BT use correspondingly decreased from 44.2% to 38.0% (BT-only use decreased from 30.4% to 25.6%, whereas BT + EBRT use decreased from 13.8% to 12.3%). The decline of BT utilization differed by patient race, SEER registry, median county income, and National Comprehensive Cancer Network risk categorization (all  $p < 0.001$ ), but not by patient age ( $p = 0.763$ ) or marital status ( $p = 0.193$ ). Multivariable analysis found that age, race, marital status, SEER registry, median county income, and National Comprehensive Cancer Network risk category were independent predictors of BT as treatment choice (all  $p < 0.001$ ). Moreover, after controlling for all available patient and tumor characteristics, there was decreasing utilization of BT with increasing year of diagnosis (odds ratio for BT = 0.920, 95% confidence interval: 0.911–0.929,  $p < 0.001$ ).

**CONCLUSIONS:** Our analysis reveals decreasing utilization of BT for prostate cancer. This finding has significant implications in terms of national health care expenditure. © 2014 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

## Keywords:

Prostatic neoplasms; Radiation; Brachytherapy; Utilization; Health expenditures

## Introduction

Patients diagnosed with prostate cancer have a number of management options available to them and, in certain situations, deferring treatment altogether may be recommended (1). Historically, the major forms of treatment include surgical management and radiation therapy, which includes external beam radiation therapy (EBRT) and

brachytherapy (BT). The development of the ultrasound-guided, transperineal technique in the 1980s led to the rapid adoption of BT for the treatment of prostate cancer a decade later. As a result, previous patterns of care analyses had demonstrated increasing use of BT relative to EBRT (2–7). Over the past decade, however, we have witnessed the development of sophisticated EBRT techniques, such as intensity-modulated radiation therapy (IMRT) that, within a short period of time, have replaced the use of conventional EBRT for the treatment of prostate cancer (8, 9). Whether the proliferation of these novel EBRT techniques has impacted the utilization of BT has not previously been demonstrated.

The Surveillance, Epidemiology, and End Results (SEER) database is a cancer registry overseen by the National Cancer Institute that collects information regarding patient demographics, tumor characteristics, treatment

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course, and patient survival from approximately 26% of the U.S. population (10). One of its many roles is to allow for assessment of national patterns of cancer care. Using the SEER database, we sought to analyze recent trends in the utilization of EBRT and BT for the treatment of prostate cancer.

## Methods and materials

The SEER database (“SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2011 Sub [1973–2009 varying]”) was queried using SEER\*Stat software, version 7.1.0 to identify men aged 20 years and older diagnosed with locoregionally confined, microscopically confirmed prostate adenocarcinoma (ICD-O-3 morphology code 8140) between 2004 and 2009 (the most recent data available at the time of our analysis). This specific time period was chosen given the limitations of the SEER database before 2004 (including lack of information regarding modern prognostic variables, such as Gleason Score and prostate-specific antigen [PSA]). Only men with known T-stage, Gleason Score, and PSA who could be categorized as low, intermediate, or high risk according to the National Comprehensive Cancer Network (NCCN) risk stratification scheme (1) were included. Unfortunately, during this era, the SEER database only captured the Gleason Score at the time of surgery (vs. at the time of biopsy) for men treated with prostatectomy. Therefore, the individual patient risk stratification could not be determined for these patients. Men who were previously diagnosed with another cancer were excluded as this could potentially impact the choice of local treatment. As all patient information in the SEER database is deidentified, this study was exempt from institutional review board evaluation.

To analyze global trends in diagnosis and treatment, we initially determined the number of patients diagnosed, treated with surgery, and treated nonsurgically with radiation therapy (“beam radiation,” “radioactive implants,” “combination of beam with implants or isotopes,” or “radiation, not otherwise specified [NOS]”) by the year of diagnosis.

To determine the trends in radiation therapy utilization, we further analyzed patients who were treated with radiation therapy. Data on the year of diagnosis, age at diagnosis, race, marital status, SEER registry, median county household income (from the year 2000, the most recent year for which these data were available), T-stage, Gleason Score, and PSA were extracted for all patients. We calculated the proportion of men treated with BT, EBRT, and combination BT + EBRT by the year of diagnosis. The SEER database does not differentiate between the specific form of BT (low- vs. high-dose rate) or EBRT (conventional vs. IMRT vs. proton therapy vs. stereotactic body radiation therapy [SBRT]) used, so we were unable to analyze according to such specific treatment modalities.

For the purposes of analysis, age and median county household income were divided into quartiles (with the first quartile denoting the lowest age/income and the fourth quartile denoting the highest age/income). After noting a decline in the utilization of BT after 2005, logistic regression analysis (with Wald  $\chi^2$  test to determine significance) was used to determine if there was variation in the rate of decline of BT utilization by the available patient/tumor characteristics. Finally, a multivariate logistic regression analysis was performed, including the year of diagnosis as well as all available patient and tumor characteristics, to determine predictors of BT as treatment choice. Patients with missing data were excluded for the multivariate analysis.

Two-sided *p*-values, odds ratios for BT, and their 95% confidence intervals are reported here. All statistical analyses were done at the 0.05 level of significance. Data analyses were performed using SAS software version 9.3 (SAS Institute, Inc., Cary, NC).

## Results

A total of 182,123 men were included in our analysis. The number of patients diagnosed, treated with surgery, and treated with radiation therapy are summarized in Fig. 1. As can be seen, the number of patients diagnosed with prostate adenocarcinoma reached a peak in 2007 and subsequently declined. Correspondingly, the number of patients treated with surgery and radiation therapy also reached in a peak in 2007. Of note, however, the number of patients treated with surgery increased relative to those treated with radiation therapy such that, by 2009, the number of patients treated with surgery outnumbered those treated with radiation therapy.

A total of 75,434 men were treated with radiation therapy between 2004 and 2009. Median age for this cohort was 68 years and 37.6%, 41.5%, and 20.9% had low-, intermediate-, and high-risk prostate cancer according to the

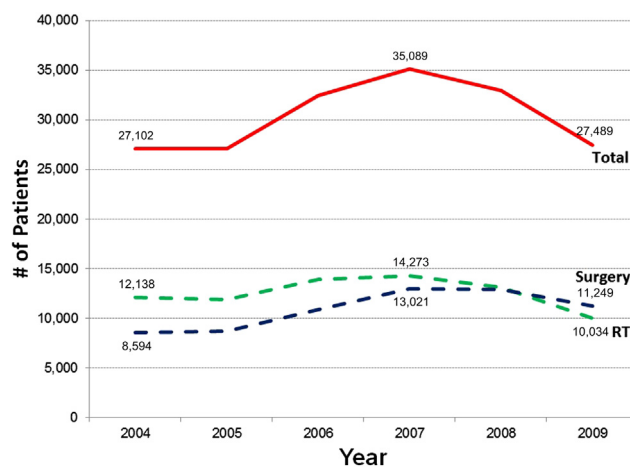


Fig. 1. Total number of patients diagnosed, treated with surgery, and treated with RT (2004–2009). RT = radiation therapy.

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