



Time-driven activity-based costing of low-dose-rate and high-dose-rate brachytherapy for low-risk prostate cancer

Annette M. Ilg^{1,*}, Aaron A. Laviana¹, Mitchell Kamrava², Darlene Veruttipong², Michael Steinberg², Sang-June Park², Michael A. Burke³, Douglas Niedzwiecki⁴, Patrick A. Kupelian², Christopher Saigal¹

¹Department of Urology, Institute of Urologic Oncology, David Geffen School of Medicine at University of California, Los Angeles, CA

²Department of Radiation Oncology, David Geffen School of Medicine at University of California, Los Angeles, CA

³Performance Excellence, Los Angeles Health System, University of California, Los Angeles, CA

⁴Operative Services, Los Angeles Health System, University of California, Los Angeles, CA

ABSTRACT

PURPOSE: Cost estimates through traditional hospital accounting systems are often arbitrary and ambiguous. We used time-driven activity-based costing (TDABC) to determine the true cost of low-dose-rate (LDR) and high-dose-rate (HDR) brachytherapy for prostate cancer and demonstrate opportunities for cost containment at an academic referral center.

METHODS AND MATERIALS: We implemented TDABC for patients treated with I-125, pre-planned LDR and computed tomography based HDR brachytherapy with two implants from initial consultation through 12-month followup. We constructed detailed process maps for provision of both HDR and LDR. Personnel, space, equipment, and material costs of each step were identified and used to derive capacity cost rates, defined as price per minute. Each capacity cost rate was then multiplied by the relevant process time and products were summed to determine total cost of care.

RESULTS: The calculated cost to deliver HDR was greater than LDR by \$2,668.86 (\$9,538 vs. \$6,869). The first and second HDR treatment day cost \$3,999.67 and \$3,955.67, whereas LDR was delivered on one treatment day and cost \$3,887.55. The greatest overall cost driver for both LDR and HDR was personnel at 65.6% (\$4,506.82) and 67.0% (\$6,387.27) of the total cost. After personnel costs, disposable materials contributed the second most for LDR (\$1,920.66, 28.0%) and for HDR (\$2,295.94, 24.0%).

CONCLUSIONS: With TDABC, the true costs to deliver LDR and HDR from the health system perspective were derived. Analysis by physicians and hospital administrators regarding the cost of care afforded redesign opportunities including delivering HDR as one implant. Our work underscores the need to assess clinical outcomes to understand the true difference in value between these modalities. © 2016 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords: Time-driven activity-based costing; Brachytherapy; Value-based care; Prostate neoplasms; Cost analysis

Introduction

Despite controversies regarding the detection and management of prostate cancer, its public health burden remains high. Roughly 80% of new prostate cancer cases are diagnosed at the local stage (1). The cost to payers for providing care for men diagnosed with localized disease is substantial (2). Without a consensus for the optimal treatment of low-risk prostate cancer, management varies tremendously, including active surveillance, brachytherapy, external beam radiation therapy, cryotherapy, and radical prostatectomy (3). In an environment where “value-based

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Conflicts of interest: None.

* Corresponding author. Department of Emergency Medicine, Harvard Affiliated Emergency Medicine Residency at Beth Israel Deaconess Medical Center, One Deaconess Road, Rosenberg 2, Boston, MA 02215. Tel.: +1-440-670-4200; fax: +1-617-754-2350.

E-mail address: amilg@bidmc.harvard.edu (A.M. Ilg).

care” is being championed by both public and private payers (4), the financial risk of providing care may be increasingly placed on providers. Health care “value” is generally defined as a state in which efforts are made to improve the “numerator” clinical outcomes while reducing the “denominator” health care cost. While many provider organizations have developed programs to improve safety, quality of care, and patient-centered outcomes (5), few studies have elucidated the relative cost to deliver prostate cancer treatments from the provider perspective (6).

Among the challenges in understanding provider perspective, cost is a lack of a robust costing methodology. Traditional hospital accounting systems have the capability of measuring operational and support services well but do not accurately measure cost at the patient level (7). Cost-shifting across service lines also renders elements of cost opaque. Given the unsustainable trajectory of costs in the health care system (8), a reliable and transparent method of measuring the cost of hospital-related and physician-related services is needed to help providers manage. Time-driven activity-based costing (TDABC) is a recent innovation in costing methodology that allows hospitals and providers to systematically track the cost of a disease across the entire process (9). This methodology accounts for personnel, space, and equipment costs measured as a capacity cost rate (CCR; cost per minute). CCR is defined as the institutional CCR, or the amount used per minute, for every resource involved in the process maps. The CCR is then applied to the average time a patient spends with each resource. Material costs are included as the base cost per disposable resource used.

Low-dose-rate and high-dose-rate (LDR vs. HDR) brachytherapy without external beam radiation therapy and androgen deprivation therapy are two approaches with significantly different care processes. We outlined I-125, preplanned LDR, and computed tomography (CT) based HDR brachytherapy with two fractions delivered through two separate implants. We hypothesized that TDABC was a feasible way to describe provider perspective cost using each form of brachytherapy. We also hypothesized that targets for cost reduction could then be identified, potentially reducing cost in each approach.

Methods and materials

Background and overview

To determine the provider-perspective cost of LDR and HDR, we incorporated the TDABC method as originally described by Kaplan and Anderson at the Harvard Business School (9). Through this methodology, the path of a patient across an episode of care for LDR and HDR was detailed through process maps (Fig. 1). Next, resources used including personnel, space, equipment, and materials were incorporated into each step. All costs associated with purchasing and maintaining these resources were obtained (e.g., for personnel: salary, fringe benefits, and support resources). The time that each resource was available to treat patients was then calculated. With each cost and availability, the CCR was calculated by dividing the total costs of supplying that resource by its available capacity for productive work. Subsequently, the process time or average

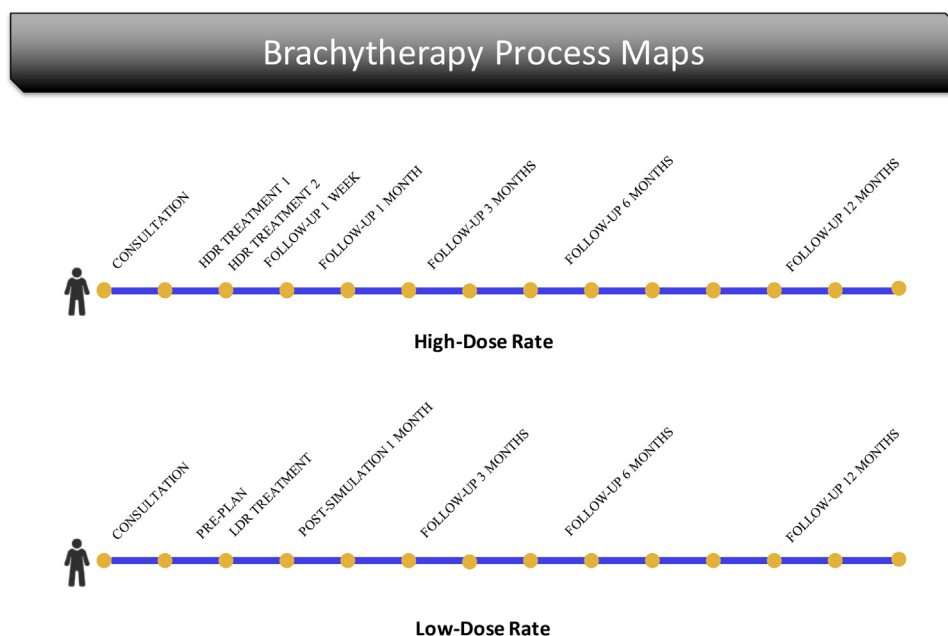


Fig. 1. Macroscopic view of the process map for high-dose-rate and low-dose-rate brachytherapy identifying the major steps involved in treating localized, low-risk prostate cancer from initial consultation through 12 months of follow-up after the intervention.

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