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Seminars Article

Cost and cost-effectiveness studies in urologic oncology using large administrative databases

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Abstract

Objective: Urologic cancers are not only among the most common types of cancers, but also among the most expensive cancers to treat in the United States. This study aimed to review the use of CEAs and other cost analyses in urologic oncology using large databases to better understand the value of management strategies of these cancers.

Methods: A literature review on CEAs and other cost analyses in urologic oncology using large databases.

Results: The options for and costs of diagnosing, treating, and following patients with urologic cancers can be expected to rise in the coming years. There are numerous opportunities in each urologic cancer to use CEAs to both lower costs and provide high-quality services. Improved cancer care must balance the integration of novelty with ensuring reasonable costs to patients and the health care system.

Conclusion: With the increasing focus cost containment, appreciating the value of competing strategies in caring for our patients is pivotal. Leveraging methods such as CEAs and harnessing large databases may help evaluate the merit of established or emerging strategies.

Keywords: cost-effectiveness; cost analysis; urologic cancer; urologic oncology

Introduction

Urologic oncology entails the management of prostate, bladder, kidney, and testis cancer. According to the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (NCI) [1], the annual incidences of prostate, bladder, and kidney cancers rank the third, sixth, and eight, respectively, among the most common types of cancers in the United States. Moreover, the numbers of new cases of kidney and testis cancers are likely to increase in the near future [1]. Owing to advancements in high technology and prolonged longevity, the survival rates of these cancers have increased in the last 3 decades [1]. According to the NCI, there will be over 18 million cancer survivors in 2020, representing a 30% increase from the number of survivors in 2010 [2].

Urologic cancers are among the most expensive cancers to treat and one study reported that prostate, bladder, and kidney cancers are the fifth, ninth, and tenth most expensive cancers to treat in the United States and that their annual costs are projected to reach $18.53, $5.38, and $ 7.56 billion, respectively, in 2020 [3]. These cancers in combination may therefore be responsible for considerable consumption of health care owing to the costs of diagnosis, treatment, and posttreatment surveillance care. In fact, when examined on a per patient basis, bladder cancer has been described as one of the most expensive cancers during a patient's lifetime in part owing to the need for ongoing cystoscopic surveillance [4]. The treatment of these cancers can place substantial economic burden on the health care system, as well as on the patient. A growing body of evidence has described the term financial toxicity to connote the negative sequelae of rising cancer treatment costs on mental well-being, adherence to therapy, and clinical outcomes [5,6]. Given the prevalence and cost of caring for patients with urologic cancers, it is critical to evaluate the value of different cancer diagnostic approaches and treatments.

Several methods have been used to better understand and control the economic burden of urologic cancers. A large number of studies have investigated associated costs of specified malignancies [3,4,7–10]. Among these studies,

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cost-effectiveness analysis (CEA) plays an important role by incorporating costs and health outcomes together to maximize the optimal allocation of limited health care resources. The underlying theory of CEAs is based on the economic, clinical, and humanistic outcomes model, which advocates that any disease management should aim to achieve balanced outcomes so that gains in one outcome would not sacrifice the opportunity gains in other outcomes and that the overall gains can be maximized and optimized [11]. CEA is an effective tool for studying costs and while paying attention to issues to health-related quality of life (HRQoL). In this review, we discuss the use of CEAs and other cost analyses in urologic oncology using large databases to better understand the value of management strategies in these cancers.

Examples of CEA in urologic oncology

The management of urologic cancers may be complex and subject to variations management as well as surveillance. For example, in prostate cancer the use of magnetic resonance imaging (MRI) is emerging as a valuable tool in the diagnosis of prostate cancer which may help men avoid an unnecessary biopsy while also increasing the detection of clinically significant cancers [12]. However, despite these advantages, MRI may require additional costs if it used in addition to conventional transrectal ultrasound-guided prostate biopsy [13]. Several studies have examined the cost-effectiveness of MRI in a variety of clinical scenarios and have suggested that incorporation of this technology is a cost-effective tool in the diagnosis of men with prostate cancer [14–16]. Moreover, with more advanced technology becoming commonplace in the treatment of prostate cancer, such as through robotic surgery or proton beam therapy, continuing to examine the financial consequences will be critical [17].

In kidney cancer, for example the cost-effectiveness of nivolumab has been examined in comparison to everoliums for second line treatment in patients with advanced renal cell carcinoma (RCC) [18]. Also, others have examined the cost-effectiveness of pazopanib as compared to sunitinib as first line treatment for metastatic RCC in the United Kingdom [19], as well as in Canada, [20] and the United States [21]. In bladder cancer for example, variation in the cost of radical cystectomy has been described [22] and the cost-effectiveness of robotic cystectomy has been studied [23]. For testicular cancer, 1 study examined the cost-utility of testicular self-examination in the setting of considering the cost for management of advanced disease [24]. Throughout urologic oncology there remain ample opportunities to utilize cost-effectiveness analysis to better study the economic impact of various diagnostic and management strategies.

Definition and types of CEA

The term of CEA has a broad and a narrow definition [25]. The broad definition interprets CEA as a type of full economic evaluation where both the costs and consequences of treatments are examined. This in turn is further divided into 3 categories, which are cost-benefit analysis (CBA), CEA (the narrow definition), and cost-utility analysis (CUA). These 3 types of analyses share the same overarching objective (i.e., evaluating the value of a strategy by relating costs to health outcomes) and method of obtaining and calculating costs but differ in effectiveness measures.

Effectiveness (i.e., benefits) of CBAs is measured in monetary terms and multidimensional [25]. For example, the effectiveness can compass both mortality and morbidity as long as they are quantified in a monetary term. CBAs allow a direct comparison of benefits and costs in the same unit. They can determine if a strategy generates net saving by calculating the net benefit or the ratio of benefit to cost. A major disadvantage of CBAs is the debate regarding the approach to and ethics of assigning a monetary value to the effectiveness such as mortality. In contrast, the effectiveness measures of CEAs (the narrow definition) are always in natural units (e.g., life-years gained), which are unidimensional [25]. Only 1 outcome can be assessed at a time. Though clinicians and decision-makers may be more familiar with the natural-unit terms of health outcomes, the use of CEAs is limited by the fact that comparisons cannot be made across CEAs with different measures of effectiveness. In CUAs, effectiveness is frequently measured by quality-adjusted life years (QALYs), which is a multidimensional measure that incorporates both the quantity of life (mortality) and quality of life (morbidity) simultaneously [25]. One QALY equals 1 year in perfect health or more than 1 year with less than perfect health. In addition to the multidimensionality, this unified effectiveness measure facilitates the comparison of different strategies for different diseases. Therefore, CUAs are recommended over CBAs and CEAs by the Panel on Cost-Effectiveness in Health and Medicine [26] and are well represented in the literature of urologic oncology [7,8,10]. Some studies also reported CEA results as a supplementary analysis [27–31]. In the rest of this article, the term "CEA" refers to the broad definition of CEA.

Incremental cost-effectiveness ratio and willingness-to-pay threshold

Findings of a CEA are usually presented in the form of incremental cost-effectiveness ratios (ICERs) [25]. The ICER is the metric, incorporating health outcomes and costs, used to determine and describe the value (not just the cost or being "least costly") of a health strategy or intervention compared to a competing option. The ICER is equal to the difference in costs divided by the difference in effectiveness of 2 strategies. To determine if a new strategy is cost-effective compared to its comparator, the ICER is compared to the predetermined willingness-to-pay (WTP)