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Management workshop

Cost effectiveness in new technologies

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1. Introduction

For the past several decades it has become obvious that the unconstrained cost of health care is not compatible with the long-term economic viability of developed countries and even less in developing countries. When the goal is to cure and provide quality of care to the largest number of patients at the lowest cost, the means to achieve this end needs to be particularly reviewed in our field. The measurement of quality is a relatively new science, which requires a large amount of resources to develop and collect the necessary information. Fully developed and tested quality measures are only available for some of the most common conditions or processes of health care delivery. Basically, the concept of increasing quality in health care delivery is based on the premise of patient outcomes as a function of cost.

Greater quality by this definition can be provided by improving outcomes while holding costs the same, providing similar outcomes at a reduced cost, or some combination of better outcomes and reduced cost.

A number of methodologies have been developed to assess the relative cost-effectiveness of different interventions in the hope of making rationale choices based on the best evidence available. However, the best management strategy frequently depends on the perspective of the analysis, and for individual patients, does not take into account the emotional and economic factors that complicate medical decision making.

Despite the intense interest in health care expenditures in developed countries, far less information is available on the economic considerations of medical care in third-world countries.

Global oncology spending will reach $75Bn by 2015, rising at a much slower rate than in the past five years, as existing targeted therapies have already been widely adopted in most developed markets, some major products will be exposed to generic competition, and new products, with the potential to extend lives, will add treatment options in several major tumors, but will not contribute to significantly higher spending. Our specialty is no less than the oncology counterpart regarding the rising cost of cancer care as technology to delivered targeted therapies becomes necessary and available.

Cost-effectiveness analysis can be used to help set priorities for funding health care programs. For each intervention, the costs and clinical outcomes associated with that strategy must be compared with an alternate strategy for treating the same patients. If an intervention results in improved outcomes but also costs more, the incremental cost per incremental unit of clinical outcome should be calculated.[1]

Steps for how to calculate cost:

1. The first step is demonstration of efficacy of the technique.
2. The second step involves assessment of effectiveness.
3. The third step assesses efficiency or cost effectiveness which considers both the effectiveness of the health care intervention as well as the resources required to deliver the intervention.
4. The fourth step considers the issue of availability of services to locations accessible to patients who require them.
5. The fifth, and often overriding step in a policy analysis concerning the evaluation of a health care technology, considers distribution, that is, an examination of who gains and who loses by choosing to allocate resources to one health care program instead of another.

Cost–utility was defined as cost in dollars for a particular therapy per unit clinical outcome, defined as the median survival in quality-adjusted life-years (QALYs). For all sites it is required for all treatments to be equivalent and provide long-term efficacy with similar toxicity, but lower cost.

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2. Cost of systemic chemotherapy

When comparing costs of radiotherapy and systemic chemotherapy, it is like comparing night and day. Costs of chemotherapy are in the billions in USA, as opposed to costs of radiotherapy, which is a minimal fraction of that cost.

A recent article describes the magnitude of this problem: "...provision of more aggressive care by physicians, the prolongation of the period of treatment and patient survival, and ... an aging population, are important drivers of the rising costs." Regarding the cost value dissociation, in cancer management many factors are involved including imaging, radiotherapy, surgical procedures, etc.[2]

In a recent report from the IMS Institute for Healthcare Informatics, in the United States oncologic drugs led all classes in drug spending in 2011, at $23.2 billion. Spending on targeted agents grew by $1.1 billion, higher than the $0.8 billion spending increase in 2010.[3]

Some medications have marginal benefits that can be measured in a few weeks (or days) of additional life, with associated toxicities so high prices may not be justified by the limited benefits of these drugs. While the pharmaceutical companies have the capacity to decide the cost of these drugs United States market, that favors the development of minimally beneficial drugs at very high costs to the insurance companies and tax payers. An example of this exact situation is "sipuleucel-T (Provenge)," an agent for metastatic prostate cancer, which only shows a median survival of 4 months.[4] The price tag of Provenge is $93,000 for the required three doses. If Radiation Oncologists use an alternative such as Samarium 153 single IV of radioisotope dose for extensive metastatic disease the price for this procedure is approximately $5000.00 with a 6 month pain control period.[5]

In the USA's current healthcare market, most patients are not responsible for payments. These funds originate from the taxes charged to the citizens that usually cover about 70–80% of the medical costs in patients older than 65 years.[6] In younger patients, private insurances cover part of this cost. If the patient have has no health insurance, they are forced to pay "out-of-pocket," or not receive treatment at all.

With increasing costs, cost-sharing arrangements, also referred to as copayments, as a method to decrease usage has become very common and patients are responsible for paying a part of the treatment cost. The insurance plans with high deductibles are very common now-a-days.[7]

A study from Bernard et al. shows that cancer patients have a greater financial burden than patients with other chronic illnesses; 13% of the cancer patients spend at least a 20% of their income on healthcare costs and insurance.[8]

Modern technologies in radiation therapy care show similarities in chemotherapy drugs' high cost regarding the reimbursement and approval by insurance companies. Unfortunately, the approval of these procedures lies in the hands of uninformed or misinformed consultants whom approve or deny these modalities of therapy based on capricious intent. Radiation therapy using modern technology result in high cure rate at both a far less cost and toxicity that some of the drugs appearing up in the market, which demonstrate minimal advantages sometimes such as survival of few weeks at impressively high cost not only financial, but also physical health.

3. Technological advances: improving technology can decrease cost

Major technological progress certainly comes at a higher cost, and there are many concerns regarding the value of that progress. On the other hand, the newer equipment and resources costs associated with cutting-edge radiation oncology technologies can be partly mitigated by shorter treatment courses. Better tumor control, less toxicity, and fewer treatment courses decrease the indirect costs of cancer care, including lost time and economic productivity secondary to treatment-related and cancer-related illness and death.

4. Some specific examples of how new technologies in radiation therapy is cost effective

4.1. *Radiation therapy techniques: SBRT*

Because SBRT is used in more clinical situations, it is imperative to assess its cost-effectiveness as well as its efficacy. SBRT employing image guidance, high-precision dose delivery, more accurate target definition with better anatomical and biological imaging, and the possibility of dose verification during treatment via dose-adaptive radiation therapy permits a higher probability of tumor control.

4.2. *Cost effectiveness in APBI vs. WBRT*

Multiple regimens using EBRT, 3D, IMRT vs. brachytherapy, HDR multilumen, single lumen and/or interstitial brachytherapy were compared and demonstrated that APBI was the most cost effective for treating early breast cancer.[9]

4.3. *Prostate cancer*

The incremental cost of using daily IGRT when using IMRT is moderate and it is reasonable when is to be used when precision and high doses of radiation are needed. This cost can be overcome with the use of hypofractionation using 25 rather than the commonly used 45 fractions.[10,11]

> If we invest in new technology our gain can be seen in the following example of capital equipment investment in a radiation oncology department: the most costly piece of equipment is the linear accelerator. If we start with a capital equipment investment of $4.1 million, we can estimate $4.4 million in gross annual revenue assuming 289 patients completing a course of radiation therapy, which will give us a $2.6 million in year 1 net income, which assumes operational expenses of $1.8 million. For the following year we have an estimated $356 thousand in incremental net income, which assumes an increase of 63 new patients than in the previous year. *Information – Courtesy of Varian Medical Systems*

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