Healthcare Cost-Effectiveness Analysis for Older Patients: Using Cataract Surgery and Breast Cancer Treatment Data

Chapter 1

Introduction

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Introduction

The percentage of elderly, over the age of 65, in the U.S. population will be changing dramatically over the next 20-30 years. Currently Americans over the age of 65 constitute 12% of the population, 32.6 million individuals [1]. More specifically, 7% of Americans are between the ages of 65-74, 4% between the ages of 75-84, and 1% over the age of 85 [1]. By 2020, the Baby Boomer generation, representing the increase in births in the United States during the 1950’s and 60’s, will be in their age of retirement. As a result, the population age 65-74 will increase 74% between 1990-2020, while the population under 65 will increase only 24% [2]. As the Baby Boomer generation ages, it is expected that the elderly will constitute about 1 in 5 Americans. By 2030, there will be 70.2 million Americans over the age of 65 with the largest increase occurring in the sub-segment of individuals aged 75-84 [3].

The changing demographics over the next three decades will have significant consequences for Medicare and national policy. Medicare’s growth in spending is outpacing its growth in revenue. Most of the revenue in Medicare is generated from a 2.9% payroll tax, which has not changed since 1986 [4]. The population increase among the elderly is projected to increase the number of Medicare beneficiaries by 77%, from the present 40 million to 70 million by 2025 [4]. Medicare spending will almost double and may cause the Medicare Trust Fund to run out of money. Furthermore, the impact of these changes is likely to also be felt by beneficiaries, for whom out of pocket expenses are likely to rise by 80% over the next several decades [4]. Among poor elderly persons, it is estimated that the proportion of income spent on health expenses will rise from 51% to 71% by 2025 [4].

Given the economic impact of future health care expenditures by our growing elderly population, a concerted effort needs to be made to define high quality yet cost-effective medical therapy for older patients. Determining appropriate care has historically been achieved using clinical trials, which when published form a collective called “evidence-based literature”. Most clinical trials to date have not included a large number
of older patients. Older patients tend to have medical co-morbidities and functional disabilities. In addition, the elderly individuals may be less likely to comply with the stringency of a clinical trial protocol [5]. There is also a perception that older patients may be more susceptible to side effects or complications [6]. Since pharmaceutical companies sponsor many clinical trials seeking FDA approval, there has been a tendency to select younger, healthier populations that are easier to manage and more apt to show benefit, either in terms of life expectancy or disease free survival.

The under-representation of those over 65 in clinical trials limits the benefit of drug therapy in these populations [7]. One example pertains to the use of non-steroidal anti-inflammatory drugs, NSAIDS. Older patients who have degenerative musculoskeletal diseases commonly use NSAIDS. However, in leading trials evaluating NSAIDs, only 2% of patients were 65 years of age or over and less than 0.1% were over 75 [8]. Even when older patients are included in clinical trials, they are generally younger, healthy and predominantly male. Frail older persons are rarely included in drug trials even though they are commonly given the drugs of interest. For example, in trials evaluating donepezil therapy for Alzheimer’s disease, only patients between the ages of 65-74 were chosen. Moreover, individuals with associated co-morbid conditions common to patients over the age of 65 were excluded [9]. Considering that many patients with dementia are frail elderly individuals with multiple comorbidities, it is unclear how to extend benefits and anticipate toxicity from this type of trial for the average older patient with dementia. The external validity of any trial, particularly those involving the elderly, is very important. A trial should be designed to develop or contribute to generalizable knowledge [10].

Thus, for many diseases impacting the elderly individuals, there is a lack of “evidence-based” literature [11] [12]. To help determine appropriate care, policymakers and medical researchers have two options: (1) perform clinical studies specifically on an older population or (2) extrapolate evidence from younger patients to older patients. Each of these strategies has its disadvantages.

Performing clinical trials on the older patients is often a difficult endeavor. In many large aging trials participants are purposefully selected to reduce the risk of sub-optimal adherence and retention. This selection often involves excluding those with
barriers such as transportation needs, sensory deficits, functional dependence, major diseases limiting life expectancy, or apparent psychological distress [13]. Recruiting older patients often requires patience and utilization of a mixture of approaches including: phone, referrals, solicitations, presentations, media, mailings, and fliers [14, 15].

Many elderly patients have varying cognitive or functional impairment, which makes using traditional outcome measures difficult [16]. There is a higher rate of non-response, refusal, and loss to follow-up [17]. Furthermore, if benefit has been shown for a treatment in previous trials in younger patients, it may be unethical to repeat this trial over again in the elderly. There are also issues pertaining to appropriate informed consent among elderly patients [18, 19]. Finally, a policy of repeating all or most previous clinical trials for the elderly is costly.

On the other hand, extending data from younger patients to older patients may be inaccurate even after accounting for longevity. It is quite common for medical practitioners to extrapolate clinical trials data without realizing the inherent assumptions required for such extrapolation to be valid. Extrapolation with supporting data, termed as “off-support” has been discussed greatly among social scientists and felt to be often misleading [20]. The most common assumption in regards to extrapolation is the “invariance assumption” [20]. The invariance assumption assumes a similar behavior or outcome “off-support” as that demonstrated by the data. A sub-type of this type of assumption is temporal invariance which is routinely applied to predict the future [20].

In addition to decreased longevity, the elderly have more comorbidity and functional disability. It is not certain whether the biology of many illnesses is similar among older and younger patients. Furthermore, older patients may have a different response and toxicity profiles to treatment. In addition, older patients are likely to have different preferences for health states than younger patients, placing more weight on quality of life than longevity. The elderly are a heterogeneous population for whom age alone may be insufficient to predict benefit from treatment.

Clinical trials and evidence-based analysis based on previous work do not need to be mutually exclusive of one another. It is possible to use prior literature in a decision analysis framework to determine the upper and lower bounds of expected cost and benefit
in elderly patients and create models to take into account longevity, co-morbidity, functional status, and preferences. These analyses would identify the questions for which there is the most uncertainty and clinical importance justifying the expense of a clinical trial.

The purpose of this dissertation is to explore the use of both clinical trials and evidence-based decision models in performing cost-effectiveness analysis in elderly patients. For some diseases, such as cataract surgery, the majority of patients tend to be older. Therefore, previous studies focusing on younger patients do not exist. Important therapeutic and policy questions can only be addressed through a clinical trial. Other diseases, such as breast cancer, involve a wider age range of patients from early 40s to 90s. For such diseases, there is a literature of clinical trials on younger patients and the young elderly, 60 – 70. This previous literature can be used to develop decision analysis models to help define pertinent questions and areas for further research (i.e., clinical trials).

This dissertation is broken up into two main parts, demonstrating two different approaches to cost-effectiveness in an older population, a clinical trial and modeling from existing data. One part focuses on a randomized clinical trial on cataract surgery. The other part develops an evidence-based decision analysis model on the cost-effectiveness of treating older patients with early breast cancer. The cataract surgery section has two sub-components: (a) a methodological section focusing on strategies to deal with question non-response among the older patients on the Heath Utilities Index Mark 3, HUI3, questionnaire, and (b) a cost-effectiveness analysis based on a randomized clinical trial of older patients with cataracts comparing up-front surgery versus watchful waiting in patients who have relatively good visual functioning. The breast cancer section focuses on an evidence-based decision analysis for older patients, >65, who have newly diagnosed early stage breast cancer. This analysis will include models taking into account longevity, comorbidity, frailty, and simulated preferences.

Many policy decisions will be made in the future pertaining to the provision of health among elderly patients. A broad set of approaches will be required to determine the cost-effectiveness of specific therapies in this population. These approaches will range from clinical trials to elaborate modeling using a combination of existing data and
assumptions. The dissertation provides two examples using these approaches in performing cost-effectiveness analysis among the elderly.