

Economics, Innovation, and Quality Improvement in Neurosurgery



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KEYWORDS

- Economics • Quality improvement • Innovation • Neurosurgery • Cost effectiveness • Cost utility
- Willingness to pay

KEY POINTS

- Innovation to improve patient care is a cornerstone of neurologic surgery; these improvements often are measured in quality outcome metrics while economic metrics are frequently held to lesser consideration.
- As the strain of limited health care resources grows, assessment of the cost incurred to improve quality has become increasingly more important; the means of assessing innovations in terms of economic measures are reviewed, and the considerations for willingness-to-pay thresholds are discussed.
- Innovations within neurosurgery are presented in a framework structured on quality and economic metrics; this provides a conceptual means for neurosurgeons and policy makers to assess current innovations and to highlight areas in which further investigation and cost assessment are needed.

INTRODUCTION

The highly specialized and complex nature of neurologic surgery is inherently associated with slim margins for error and the ever-present potential of life-altering adverse events. This has driven innovation within the field since the early days of Harvey Cushing,¹ and an implicit obligation to provide or incorporate new ideas, technologies, or surgical techniques has remained a cornerstone of the specialty. In the modern era of evidence-based medicine, these improvements in quality are measured in clinical outcome metrics such as length of survival, disease-free survival, and quality of life. Conversely, the inclusion of innovations that specifically optimize efficiency and focus on economic measures is less ingrained in the traditions and training of neurosurgeons.

Austerity measures in the face of the recent global economic downturn, beginning in the first decade of the 21st century, have been implicated in a decline in access and quality of patient care.² Although it seems that government investment in health care services is back on the increase, an aging population and increasing life expectancies will continue to drive health care expenditures to higher levels. In 2005, aggregate health care expenditures were US \$5572 per capita—of these, \$1615 per capita was surgical specific. Aggregate health care expenditures are predicted to increase to \$8832 per capita by 2025 with \$2561 per capita being surgical specific. Put in other terms, aggregate health care expenditures will comprise one-fourth of the US economy in 2025 and surgical-specific expenditures will comprise one-fourteenth. The predicted growth

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between 2005 and 2025 is nearly 60%.³ Innovations that reduce the costs and improve the efficiency of patient care are needed to obviate impending critical stresses on the health care system. Investigations that combine endpoints for quality and economic metrics are essential to evaluate these new innovations. However, studies of this nature are the exception rather than the norm in the neurosurgical literature.

The aim of this article is 2-fold. First, the authors present a summary of the current tools for evaluating the gains in quality afforded by innovations in neurosurgery in terms of cost effectiveness and review the factors that determine willingness to pay for quality gains. Second, examples are provided from the specialty organized in a conceptual framework based on quality of care and economic metrics. This framework highlights areas in which innovation has enhanced quality and concomitantly improved costs and calls attention to areas in which further assessment is needed.

ASSESSING QUALITY AND ECONOMICS IN NEUROSURGERY

Increasing costs and government pressures for increasing accountability of health care expenditures have driven a movement toward value-based health care systems in which effectiveness and cost of care must both be taken into consideration. The ultimate goal is to implement innovations that provide maximal improvement in quality at minimal cost. To address this from an evidence-based perspective, numerous means of quantifying and optimizing health-related quality of life (HRQoL) and cost effectiveness have been devised and are used with increasing frequency to assess innovations.

Health-Related Quality Outcomes in Neurosurgery

The value of an individual's HRQoL is determined by incorporating health and functional status along with overall quality of life factors such as socioeconomic status and social support.⁴ This defines the multifactorial influence that a disease or treatment has had on an individual. HRQoL is typically quantified through 1 of 2 means: health status instruments or preference-based instruments.

Health status instruments generally take the form of multiple-choice questionnaires that quantify a patient's quality of life based on several domains and provide a summative score representative of their overall HRQoL. Health status instruments such as these are valuable but do not convey important information about a patient's own valuation of their current health state. Preference-based

HRQoL instruments take this into account directly by having a patient assign a value to their current health state or indirectly through statistical inference. By the indirect approach, the individual describes their current health in multiple domains through completion of a questionnaire, and then a predetermined utility function is used to calculate a preference value. Such an instrument, often used within neurosurgery, is the EuroQoL-5D. This instrument is based on the 5 domains of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.⁵ The single value produced by the utility function is generally expressed on a scale of 0 to 1. Zero represents death and 1 represents perfect health. This value can be used as a weighting factor for a year of life in a current health state. If a patient has a state of health with a preference score of 0.5 before an intervention and the preference score increases to 0.7 after an intervention, they have gained 0.2 utility units per year. This weighting factor is the basis of the commonly reported quality-adjusted life year (QALY) and can be used in standardized calculations of the cost of improving quality.⁶ This will be discussed further in the next discussion.

Economic Evaluation in Neurosurgery

When assessing the total cost of an innovation, numerous expenditures need to be accounted for such as the direct upfront costs to the health care system, costs of associated complications, third-party payer costs, and lost opportunity costs including time away from work, school, and family. These provide a basis for assessment of the economics of a new innovation, which may be conducted by several techniques.

The most simplistic of these is a cost minimization analysis, whereby the quality outcomes of a new innovation have already been determined to be equivalent to the standard of care. In this case, the costs associated with the new innovation can be directly compared with the costs of the standard of care to determine which is more efficient from an overall perspective. An example of this type of analysis in the literature is a comparison of simple decompression versus anterior subcutaneous transposition for the treatment of ulnar neuropathy. Both treatments were deemed equally effective in a prospective, randomized, controlled trial.⁷ The direct and indirect costs of the procedures were then compared in a separate cost minimization analysis, which led to the conclusion that a simple decompression was associated with significantly lower costs than an anterior subcutaneous transposition (€1124 vs €2730, in 2005).⁸

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