

# A Cost-Benefit Analysis Using Contingent Valuation Techniques: A Feasibility Study in Spinal Surgery

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## ABSTRACT

**Objectives:** To carry out a pilot study to demonstrate the feasibility of the contingent valuation (CV) approach to identify net benefits gained from spinal interventions; and to conduct a formal cost-benefit analysis (CBA) using a retrospective study design. The study design is a CBA feasibility study using a CV survey with ex post willingness-to-pay/willingness-to-accept (WTP/WTA) questions. The CBA study was carried out in the specialty of spinal surgery.

**Summary of Background Data:** Although increasing data are gathered on the societal costs of low back pain, little information is available on how patients “value” the benefits of surgery or whether interventions in this area are indeed cost-beneficial. CV surveys are used in CBA to elicit the consumer’s monetary valuations for program benefits.

**Materials and Methods:** A total of 115 patients after lumbar fusion, discectomy, or decompression were asked to respond to an ex post questionnaire on their WTP/WTA for their respective intervention. Additional questions addressed socio-demographics, household income, and clinical outcome. WTP/WTA was related to the actual intervention costs and clinical outcome. The WTP and cost data were then combined within a formal CBA framework with associated 95% confidence intervals generated using bootstrapping methods.

**Results:** The response rate was 91.3% (n = 105). 89.5% were satisfied/very satisfied with the treatment. 76.2% found

the result of the operation was good/excellent and 75.7% would choose the operation for a given hypothetical intervention cost. Mean stated WTP was 20% lower than the actual operation costs (not known to respondents) for spinal fusion, although it was 37% higher for discectomy and 10% higher for decompression. The individuals’ financial situation was the strongest predictor for WTP. Pain improvement, present pain, duration of hospitalization, and estimated intervention costs were significant independent predictors in the expected direction for the WTP, having controlled for socio-demographic and financial confounding variables.

**Conclusion:** This study explored the feasibility of the CV approach for spinal interventions. The approach produced results suggesting positive net benefits with their associated levels of variability for discectomy and decompression, indicating that such surgery is cost-beneficial within a CBA framework, but this conclusion is not supported in the case of spinal fusion. Nevertheless, to improve reliability of the net-benefit estimates for these interventions, we recommend further studies comparing in particular ex ante and ex post WTP methods.

**Keywords:** contingent valuation, cost-benefit analysis, discectomy, spinal decompression, spinal fusion, spinal surgery, willingness to pay.

## Introduction

Costs for spinal surgery have risen substantially over the last two decades because of a variety of factors. Demographic changes, advances in technology, unclear indications, and financial incentives for the involved parties may have had synergistic effects [1]. Despite the frequent use of spinal interventions, scientific evidence for their therapeutic efficacy compared to natural history and nonoperative treatment is sparse. This is

particularly true for instrumented fusion for degenerative disc disease, one of the most costly spinal interventions [2]. In addition, there is little evidence on the valuations patients place on such surgery. Further, limited health-care resources increasingly demand that evidence is obtained not only on therapeutic efficacy of treatment modalities but also on costs.

Consequently, an increasing number of health-economic studies are being published in the field of spinal surgery. Recently, the cost-effectiveness and cost-utility of several spinal interventions have been explored [3–6]. Nevertheless, we are not aware of any cost-benefit analysis (CBA) using the contingent valuation (CV) approach with willingness to pay (WTP) in the field of spinal surgery, even though this approach

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10.1111/j.1524-4733.2007.00282.x

has at least three key advantages in health care over other methods [7]: 1) WTP is theoretically founded in welfare economics; 2) WTP enables a more comprehensive valuation of benefits than quality-adjusted life-years; and 3) CBA allows questions of allocative efficiency to be addressed (not just within health care but across government sectors).

In practice, however, there is still a debate on the validity of data obtained from WTP trials. On the one hand, WTP has been found to be a valuable approach to assess patients' benefits in health care [8–15; P. Shackley and C. Donaldson, 2001, unpublished], and it has also been shown that WTP is not inferior in terms of applicability, understandability, or test–retest reliability to other techniques [16–28]. On the other hand, validity and reproducibility of the different methods used to elicit WTP have been found to be critical issues requiring further investigation before being definitely used in health-care decision-making [29].

One important distinguishing feature of WTP methods is the elicitation perspective, whether ex ante or ex post. Values are ex ante in the sense that the consumer's expected utility may differ from the realized utility of a particular good compared to ex post values where the state of the world is known. O'Brien and Gafni [30] distinguish between an ex post user-based perspective and an ex ante insurance-based perspective where the ex post user is assumed to be "at the point of consuming some unit of the program being evaluated." Shackley and Donaldson [31] note that, to be more specific, patients are defined as individuals who are "currently diseased," that is, individuals who may be in the process of consuming health care or are waiting to consume health care. O'Brien and Gafni [30] define an ex ante user as someone at risk of contracting a disease and therefore at risk of consuming the treatment programme of interest. In his review of CV studies in health care, Klose [29] states that although the use of ex ante WTP values is consistent with CBA, only about 20% of economic evaluations performed CV from such a state. Shackley and Donaldson [31] categorize the appropriate perspective depending on whether data are collected from patients or the public and for a privately financed good or a publicly financed good. A useful discussion of the theoretical difference between ex ante and ex post WTP is provided by Johannesson [32].

Although interest in WTP has substantially increased in many different areas in health care [7,30,33,34], in the field of musculoskeletal disorders only a few studies have been performed, in studies of cervical spondylotic myelopathy [35], rheumatoid arthritis [36,37], and osteoarthritis [38,39]. Most of them explored methodological aspects, and only one study has empirically assessed the benefits of a surgical intervention, that is, joint arthroplasty for knee and hip osteoarthritis in a group of individuals operated on

because of osteoarthritis [40]. Further to this, no identifiable studies have tested the feasibility of using either ex ante or ex post WTP values within a CBA in the field of musculoskeletal disorders.

Against that background, we opted in this study: 1) to test the feasibility of the ex post WTP approach for the most frequent spinal interventions (discectomy for disc herniation [41], spinal decompression for spinal stenosis [42], spinal fusion for degenerative disc disease [43]), that is, whether or not patients are willing and able to answer such questions; and 2) to make a first estimate from a patient's perspective of the economic net benefit of these interventions within a formal CBA framework.

## Materials and Methods

### Swiss Health-Care System

In the Swiss health-care system everyone must have a basic health-care insurance for which he or she has to pay monthly. The basic health-care insurance covers the costs for a defined set of medical treatments currently also including the interventions under investigation in this study. The set of medical treatments is defined by policymakers of the government. In addition to the general insurance, one can contract private insurances which allow for further health services. The rate to be paid for the basic and additional insurances depends on the insurance company. In public hospitals (as is ours) privately insured patients are partly subsidizing those with a basic insurance as the latter are not cost-covering. The remaining deficit which cannot be covered like this is finally indirectly covered by the public. The ratio of privately/publicly financed health-care costs at our institution is about 30%/70%. Following the study by Shackley and Donaldson [31] where data are collected from patients for a publicly financed good—the closest case to this study—we contend that it is the WTP values of patients (i.e., ex post values) which are relevant because it is the patients who bear the opportunity costs of any decision.

### Population and Study Design

A total of 115 consecutive patients (65 female and 50 male) with a mean age of 59.4 years (range 21–94) were included in the study. Inclusion criteria were: 1) posterior or anterior lumbar interbody fusion (PLIF/ALIF) for degenerative disc disease/spondylolisthesis ( $n = 37$ ), lumbar discectomy for disc herniation ( $n = 39$ ), or lumbar decompression for spinal stenosis ( $n = 39$ ) between 2000 and 2003 in our institution (Orthopaedic University Hospital); 2) failed conservative treatment; 3) followed-up for a minimum of 1 year after surgery as most of the changes after a spinal intervention occur within 1 to 2 years postoperatively (this is the generally accepted follow-up time

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