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Research Article

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The Contingent Valuation of Pain in Healthcare and Welfare Economics

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Abstract

The estimation of the monetary value of pain informs issues such as the cost-effectiveness of clinical interventions or the estimated compensation for injuries. However, there are various methodological approaches to assigning a monetary value to pain in which this study aims to address. This review covers the literature to compile all the relevant methodologies used in relevant pain valuation studies and identifies the common characteristics that define these cases.

Keywords: Willingness-to-Pay, Contingent Valuation, Subjective Wellbeing, Pain, Monetary Value, Cost-Benefit, Cost-Effectiveness.

Manuscript Introduction

Despite significant advances in both economic and healthcare research over the past decades, the contingent valuation of pain or discomfort remains relatively undefined. It is known that pain or discomfort following injury or illness is not limited to physical symptoms but instead encompasses other psychosocial variables that are not readily quantified by existing pain assessment scales [1].

Pain, irrespective of whether it is in the physical or the psychosocial sense, will invariably lead to the decline of health-related quality of life, productivity, presenteeism, absenteeism, direct medical costs, and other related economic and non-economic losses [2, 3].

To fully capture the various manifestations of pain after injury or illness, physical pain experienced by the subject, psychological suffering caused to the subject's family, grief, and societal and economical setbacks experienced, are all within the process of approximating the full economic burden of pain [4]. Among the various valuation methods conceived to measure the overall costs of pain, perhaps the most widely accepted methods are the contingent valuation method (CVM) and the willingness-to-pay (WTP) measures of value.

The CVM, proposed by Ciriacy-Wantrup is a non-market valuation method most commonly utilized in environmental cost-benefit analysis and impact assessment; however, subsequent studies have determined that the CVM has a broader field of application, spanning from occupational health to healthcare intervention and policy [5, 6]. Typically, CVM studies provide respondents with information about a hypothetical intervention or treatment that would reduce the likelihood of a future adverse outcome. Respondents would then provide information about the economic sacrifice they would be willing to take to support such an intervention or treatment. In healthcare economics, for instance, respondents would detail how much money they are willing to spend to support an intervention that would decrease the prospects of suffering from postoperative pain. It is in this regard that CVM's primary advantage over other conventional preference methods lie in its ability to to capture non-use values, or assigned values that are unrelated to current or future use [7, 8]. Despite this key advantage which popularized the CVM in welfare economics and in pain research, major criticisms in the literature have surfaced which primarily focus on the measure's reliability and validity [9, 10].

WTP, a measurement founded on the theory of utility maximization, is another method widely used in the context of welfare and healthcare economics. Over recent decades, the WTP has enjoyed continued enthusiasm by welfare and healthcare economists alike, partly due to the various key advantages WTP has over CVM in health-economic research. Specifically, WTP allows for a more comprehensive valuation of benefits than quality-adjusted life-years (QALY's) and allows for a more careful review and specification of the scenario descriptions provided in surveys [11, 12]. In typical WTP studies, respondents are asked to propose an amount of economic sacrifice to attain a specified increase in the level of utility, or the amount of money income to be given up to prevent

adverse outcomes in the future [7]. WTP establishes patient preferences and measures how much patients value a specific clinical outcome by determining how much patients are willing to pay for an intervention that alleviates the intangible dimensions of diseases, such as patient pain and suffering.

Regardless of the methodology, estimating the monetary value of pain informs issues such as the cost-effectiveness of clinical treatments and compensation for injuries. Despite the need for a valid and reliable measure, there isn't a definitive or universally accepted way to assign a value to physical and other aspects of pain. Therefore, this review aims to cover the literature and compile all the relevant methodologies used in cases relevant to the monetary valuation of pain.

Methods

A systematic search of the literature was conducted from July to August 2020 to identify monetary valuation cases in the area of pain from electronic databases. Literature published in English was identified through three electronic databases: PubMed, Web of Science, and Google Scholar Throughout the search for literature on the monetary valuation of pain, search terms and research processes and methodology were documented. Preliminary screening for relevant literary work was conducted by searching the electronic databases with the search terms and those that included the designated search terms went through a full-text assessment to determine if they were relevant to the review. Specifically, search terms were broken down into two primary categories, 1) monetary valuation and 2) pain. Any work on the previously mentioned electronic databases that included "pain" alongside "preference," "valuation," "contingent valuation," "subjective wellbeing," "willingness to pay," "Cost-benefit analysis (CBA)," and "value" were incorporated. As previously stated, literature that included the search terms were then determined if they were relevant to the study through a full-text assessment.

Following the full-text assessment, two exclusion criteria were applied: first, papers which did not report the results of the valuation were excluded from the final selection of the literature. These studies did not report the valuation method used and instead addressed the concepts and theories regarding the monetary valuation of pain. Second, papers which did not reference health outcomes or interventions in their measurement of monetary valuation were also omitted from the review.

After duplicate results were removed, the remaining literature were analyzed and relevant information such as title, study design, instrument used to measure pain, acute/chronic, body parts, average value, and valuation method were extracted and documented on a spreadsheet. Information that was not reported by authors was marked as "not specified."

Results

The preliminary search using the search terms resulted in 75 literary works and after the subsequent full-text assessments, application of the exclusion criteria mentioned, and the removal of duplicate findings, 30 cases were determined to be eligible for the review. Of the 30 monetary valuation cases found, 29 (97%) were full journal articles and 1 (3%) was an abstract.

Regarding the study design the cases utilized to conduct the valuation of pain, 20 (67%) were prospective studies, 4 (13%) were cross-sectional, 3 (10%) were randomized-controlled trials, and 1 (3%) each for experimental, retrospective, and observational study designs. Of the 4 cross-sectional studies, 3 were randomized and 1 was non-randomized. Instruments used to measure pain were also extracted and recorded. Moreover, the instrumental categories are not mutually exclusive as studies could employ several instruments to measure pain. In terms of what instruments were used, the majority of cases utilized a unidimensional scale which includes the Numerical Rating Scale (NRS) and the Visual Analog Scale (VAS). Specifically, 7 (23%) of the cases utilized NRS, 4 (13%) VAS, 2 (7%) EuroQol-5-Dimension Questionnaire (EQ-5D), 2 (7%) Short-Form Pain Scale, and 8 (27%) of cases did not specify the instrument(s) used. Aside from the unidimensional scales mentioned, some multidimensional scales were used such as the Migraine Disability Assessment Test (MIDAS) and the Pain Disability Index. Regarding the nature of the pain studied, 12 (40%) of the cases measured acute pain, 17 (57%) measured chronic pain, and 1 (3%) case studied both acute and chronic pain.

All the cases were found to utilize the WTP method to assign a monetary value on pain. Details of the body part studied and average value assigned to the pain are summarized in Table 1.

Table 1: Overview of pain valuation cases

Number	Title	Study Design	Instrument to Measure Pain	Acute/Chronic Pain	Body Part	Average Value	Valuation Method
1	Heart Disease Patients' Averting Behavior, Costs of Illness, and Willingness to Pay to Avoid Angina Episodes	Prospective	Numerical Rating Scale	Chronic	Heart	40 USD per episode	WTP
2	The Willingness to Pay for Reducing Pain and Pain-Related Disability	Cross-sectional randomized design	Faces pain scale, pain disability index	Acute and Chronic	Not specified	209 USD per month to reduce to moderate disability, 361 USD per month to reduce to mild disability, 225 USD per month to reduce to severe pain, 681 USD to reduce to moderate pain, 1067 to reduce to mild pain, 1428 USD per month to reduce disability and pain to mild	WTP
3	Assessing the Willingness of Parents to Pay for Reducing Postoperative Emesis in Children	Prospective	Not specified	Acute	PONV	50 Euros for a reduction in PONV	WTP
4	Effect of Postoperative Experiences on Willingness to Pay to Avoid Postoperative Pain, Nausea, and Vomiting	Randomized controlled trial	Numerical Rating Scale	Acute	PONV	17 USD before surgery (antiemetics), 17 USD after surgery (antiemetics); 35 USD before and after surgery (analgesics)	WTP
5	Patient perception of monetary value to avoiding unpleasant side effects of anesthesia and surgery	Prospective	Visual Analog Scale	Acute	Postoperative nausea, headache, sore throat	50 to 100 USD to avoid all five side effects of anesthesia and surgery	WTP
6	Estimating the Monetary Value of Relief of Tennis Elbow: A Contingent Valuation Study of Willingness-To-Pay	Randomized controlled trial	Not specified	Chronic	Elbow	695 USD for complete relief of tennis elbow	WTP
7	Feasibility and construct validity of the parent willingness-to-pay technique for children with juvenile idiopathic arthritis	Prospective	Visual Analog Scale	Chronic	Joints	395 for ARTHRO (hypothetical drug that reduces morning stiffness to <5 minutes and provide complete resolution of active arthritis and all joints with limited range of motion) and 109 for NO-STOM-ACHE (a hypothetical drug that prevents abdominal pains, nausea, vomiting, early satiety, and indigestion)	WTP
8	How much are patients willing to pay to avoid postoperative nausea and vomiting?	Prospective	Visual Analog Scale	Acute	PONV	Patients were willing to pay $56 for an antiemetic that would completely prevent PONV, patients who developed nausea were willing to pay $73 for the antiemetic, patients who developed vomiting were willing to pay $100 for the antiemetic	WTP
9	An assessment of the burden of migraine using the willingness to pay model	Prospective	MIDAS	Acute	Head	1 USD for complete relief in 2 hours and 0.25 USD for complete relief in 4 hours	WTP

10	**Patient Willingness to Pay for Reductions in Chronic Low Back Pain and Chronic Neck Pain.**	**Prospective**	**Numerical Rating Scale**	**Chronic**	**Low back, neck**	**45.98 USD per month per 1-point reduction in current pain for chronic low back pain and 37.32 USD for chronic neck pain**	**WTP**
11	Stated preferences for the removal of physical pain resulting from permanently disabling occupational injuries. A contingent valuation study of Taiwan	Prospective	Not specified	Chronic	General occupational injuries	65.1 USD a day under log normal distribution, 69.6 USD a day under Weibull distribution	Contingent Valuation Method, WTP
12	Use of willingness to pay to study values for pharmacotherapies for migraine headache.	Prospective	Verbal Descriptor Scale	Acute	Head	130 USD a month for ideal migraine therapy	WTP
13	Willingness to pay for a QALY based on community member and patient preferences for temporary health states associated with herpes zoster.	Prospective	Numerical Rating Scale	Chronic	Skin	WTP per QALY median: 7000-11,000 USD	WTP
14	Measuring heart patients' willingness to pay for changes in angina symptoms.	Prospective	Likert Scale for Pain	Chronic	Chest	$203 to avoid 4 episodes, $218 to avoid 218 episodes	WTP, CVM
15	Monetary Value of Quality-Adjusted Life Years (QALY) among Patients with Cardiovascular Disease: a Willingness to Pay Study (WTP).	Cross-sectional	EQ-5D, Visual Analog Scale	Chronic	Heart	WTP per QALY: 2799-3599 USD	WTP
16	Urge incontinence. Quality of life and patients' valuation of symptom reduction	Prospective	SF-36 Pain	Chronic	Bladder	27.24 USD per month for 25% reduction in micturition and leakages, 75.92 USD per month for 50% reduction	WTP, CVM
17	Parents' willingness to pay for diminishing children's pain during blood sampling	Prospective	Not specified	Acute	Site of blood sampling and venipuncture	€40 to avoid blood sampling	WTP
18	Gender differences in willingness to pay to avoid pain and their correlation with risk.	Prospective	Duration of cold-pressor test (2 minutes of water immersion is equivalent to 1 pain dose)	Acute	Fingers	Females' WTP median for one pain dose (€2,03) and five pain doses (€7,13). Males' WTP median for one pain dose (€1,20) and five pain doses (€5,00).	WTP
19	Patient preference and willingness to pay for knee osteoarthritis treatments.	Prospective	Numerical rating scale	Chronic	Knee	€35 and €64 more in co-pay for steroid and viscosupplement injections, respectively.	WTP
20	Willingness to pay for arthritis symptom alleviation. Comparison of closed-ended questions with and without follow-up.	Experimental	Numerical rating scale	Chronic	Joints	DKK 637 with followup and DKK 1268 without followup	WTP
21	Feasibility of willingness-to-pay measurement in Chronic Arthritis	Prospective	Not specified	Chronic	Joint	35 USD per week	WTP
22	Treatment satisfaction, willingness to pay and quality of life in Japanese patients with psoriasis.	Cross-sectional	EQ-5D, PASI	Chronic	Skin	Less than ¥5000 per month	WTP
23	Willingness to Pay for Complete Symptom Relief of Gastroesophageal Reflux Disease	Cross-sectional nonrandomized	Gastrointestinal severity rating scale	Chronic	Gastroesophageal	2.5 USD per month for a 1 day reduction in time to onset of relief. 35 USD for an increase in amount of symptom relief from little to some. 110 US per month for an increase in amount of symptom relief from little to complete.	WTP

24	Willingness to pay for reductions in angina pectoris attacks	Prospective	Not specified	Chronic	Chest	SEK 2,500 for 50% reduction in the attack rate for three months with binary approach and about SEK 2,100 using bidding-game technique	WTP, CVM
25	Willingness to pay to avoid metastatic breast cancer treatment side effects: Results from a conjoint analysis	Prospective	Attributes and levels were selected based on the literature and in collaboration with clinicians based on the side effects and severity levels commonly seen in clinical practice when treating MBC patients.	Acute	Hair loss, diarrhea, fatigue, nausea, tingling, pain, infection	3894 USD to avoid severe diarrhea, 3479 USD to avoid hospitalization due to infection, 3211 USD to avoid severe nausea, 2764 to avoid tingling in hands and feet, 2652 USD to avoid severe fatigue, 1853 to avoid obvious hair loss, 1458 to avoid severe pain	WTP
26	Willingness-to-pay to avoid the time spent and discomfort associated with screening colonoscopy.	Prospective	Not specified	Acute	Discomfort (dizziness, abdominal pain, etc.) during screening colonoscopy	14% of subjects selected <$50, 20% chose $50–$99, 33% chose $100–$249, 24% chose $250–$499, 6% chose $500–$999, and 4% chose $1000 or more	WTP
27	Consistency of assessments and willingness to pay for a reduction in morning symptoms over time in patients with rheumatoid arthritis	Prospective	Numerical rating scale	Chronic	Joints	43.3 Euros daily (first assessment) 38.4 Euros daily (second assessment)	WTP
28	Patient preferences for treatment of Achilles tendon pain: Results from a discrete-choice experiment.	Randomized Clinical Trial	Not specified	Chronic	Achilles Tendon	238 Australian Dollars for a 10% increase in the chance of treatment success	WTP
29	Will (or can) people pay for headache care in a poor country?	Retrospective	MIDAS, SF-36	Acute	Head	8 USD per month	WTP
30	Assessing parents preferences for the avoidance of undesirable anesthesia side effects in their children undergoing surgical procedures.	Observational	Numerical rating scale	Acute	PONV and side effects of anesthesia	33.48 USD to avoid pain and 28.89 USD to avoid vomiting	WTP

Discussion

Unsurprisingly, the WTP method was used in all the cases studied. Given the overwhelming preference for the WTP over other contingent valuation methods in the cases included, as well as the key advantages the WTP has over other methods as mentioned previously, this study suggests prospective researchers to utilize the WTP questionnaire to measure the monetary valuation of pain.

While numerous treatments and interventions are known to be cost-effective, limited funding in healthcare calls for critical resource allocation decisions by policy makers [13]. It is in this regard that this literature review serves to inform researchers and policy makers on the methodologies and the study designs that can assist in measuring the full economic burden attributable to various diseases to result in more comprehensive and holistic reviews when considering the expansion of certain intervention programs or the preferential funding of an intervention over another [14-74].

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