Cost-effectiveness of different strategies to manage patients with sciatica

Deborah Fitzsimmons [a], Ceri J. Phillips [a,*], Hayley Bennett [a], Mari Jones [a], Nefyn Williams [b], Ruth Lewis [b], Alex Sutton [c], Hosam E. Matar [d], Nafees Din [b], Kim Burton [e], Sadia Nafees [b], Maggie Hendry [b], Ian Rickard [f], Claire Wilkinson [b]

[a] Swansea Centre for Health Economics, Swansea University, Swansea, UK
[b] North Wales Centre for Primary Care Research, Bangor University, Wrexham, UK
[c] Department of Health Sciences, Leicester University, Leicester, UK
[d] Sheffield Teaching Hospitals, Sheffield, UK
[e] Spinal Research Institute, University of Huddersfield, Huddersfield, UK
[f] Patient representative, Betws-y-Coed, UK

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

A R T I C L E   I N F O

A B S T R A C T

The aim of this paper is to estimate the relative cost-effectiveness of treatment regimens for managing patients with sciatica. A deterministic model structure was constructed based on information from the findings from a systematic review of clinical effectiveness and cost-effectiveness, published sources of unit costs, and expert opinion. The assumption was that patients presenting with sciatica would be managed through one of 3 pathways (primary care, stepped approach, immediate referral to surgery). Results were expressed as incremental cost per patient with symptoms successfully resolved. Analysis also included incremental cost per utility gained over a 12-month period. One-way sensitivity analyses were used to address uncertainty. The model demonstrated that none of the strategies resulted in 100% success. For initial treatments, the most successful regime in the first pathway was nonopioids, with a probability of success of 0.613. In the second pathway, the most successful strategy was nonopioids, followed by biological agents, followed by epidural/nerve block and disk surgery, with a probability of success of 0.996. Pathway 3 (immediate surgery) was not cost-effective. Sensitivity analyses identified that the use of the highest cost estimates results in a similar overall picture. While the estimates of cost per quality-adjusted life year are higher, the economic model demonstrated that stepped approaches based on initial treatment with nonopioids are likely to represent the most cost-effective regimens for the treatment of sciatica. However, development of alternative economic modelling approaches is required.

© 2014 International Association for the Study of Pain. Published by Elsevier B.V. All rights reserved.

1. Introduction

Understanding the clinical effectiveness and cost-effectiveness of different management strategies for sciatica is important in order to prevent patients with acute or sub-acute symptoms developing a more chronic condition that is resistant to treatment and likely to incur high health care, socioeconomic costs, and impact on patient outcomes. It is well accepted that taking into account value for money is important in health care decision-making. This requires formal assessments of best available

evidence on cost-effectiveness, and where necessary, undertaking economic modelling studies if there is a lack of good quality evidence.

Within the United Kingdom (UK), the prevalence of sciatica has been reported as 3.1% in men and 1.3% in women [11], accounting for <5% of lower back pain cases presenting in primary care [23]. A large population study based in Finland found a lifetime prevalence of 5.3% in men and 3.7% in women [9]. Some cohort studies have reported that most patients will have a resolution of their sciatica over a period of weeks to months, with 30% having persistent, troublesome symptoms at 1 year, with 20% out of work and 5%–15% requiring surgery [2,24]. However, another cohort study found that 55% still had symptoms of sciatica 2 years later, and 53% after 4 years (which included 25% who had recovered after 2 years but had relapsed by 4 years) [20]. As the sciatica becomes

chronic (>12 weeks), or with recurrent episodes, it becomes less responsive to treatment [16]. The cost of sciatica to society in the Netherlands in 1991 was estimated at United States (US) $128 million for hospital care, US$730 million for absenteeism, and US$708 for disablement [22]. According to 2013 prices, these would be US$219,490,000 (£136,524,000), US$125,178,000 (£778,614,000), and US$1,214,056,000 (£755,149,000), respectively.

There is no agreed clinical definition for sciatica, and it is commonly considered a symptom rather than a disease. It is characterised as being distinguishable from nonspecific low back pain by specific clinical features. These include a unilateral well-localised leg pain, with a sharp, shooting, or burning quality that approximates to the dermatomal distribution of the sciatic nerve down the posterior lateral aspect of the leg, and usually radiates to the foot or ankle. It is often associated with numbness or paraesthesia in the same distribution [4,7].

A variety of surgical and nonsurgical treatments have been used to treat sciatica, with systematic reviews finding evidence for the clinical effectiveness of invasive treatments such as epidural steroid injection, chemonucleolysis, and lumbar diskectomy in the treatment of sciatica, but they found insufficient evidence for less invasive treatments such as bed rest and analgesia. No indirect comparisons across separate trials were made for examination of cost-effectiveness [12].

Based on the findings of a systematic review of both clinical effectiveness and cost-effectiveness [12], the aim of this paper is to estimate the relative cost-effectiveness of different treatment regimens for managing patients with sciatica. A further aim is to inform future economic modelling approaches to assess the relative cost-effectiveness of treatment regimens for sciatica.

2. Methods

Secondary research methods were used to undertake a model-based economic evaluation. The first stage utilised the results of a systematic review to synthesise estimates of clinical effects. The second stage involved the construction of the model, followed by evaluation of the base case and testing the robustness of the base-case findings to changes in assumptions in the data through sensitivity analyses.

2.1. Systematic review

A systematic review was undertaken according to the methodology reported in the Centre for Reviews and Dissemination report [3] and the *Cochrane Handbook for Systematic Reviews of Interventions* [10]. Studies examining clinical effectiveness and those evaluating cost-effectiveness were reviewed separately.

Major electronic databases (eg, MEDLINE) and several Internet sites, including trial registries (eg, Cochrane Central Register of Controlled Trials), were searched from inception up to December 2009. Any comparative study or full economic evaluation was considered for inclusion. Studies involving adults who had sciatica or lumbar nerve root pain diagnosed clinically or confirmed by imaging were eligible, with a requirement for leg pain to be worse than back pain. To ensure consistency, this population also formed the basis for the economic model. Studies that included participants with lower back pain were included only if the findings for patients with sciatica were reported separately. Any intervention or comparator used to treat sciatica was included. Data were extracted by one reviewer and checked by a second reviewer. Quality assessment was conducted independently by 2 reviewers. Disagreements (8 papers were queried for the health economics review) were resolved by discussion and, when necessary, a third reviewer was consulted.

Table 1
Treatments considered within pathways.

Pathways	Treatments (as defined by the level 2 categorisation of treatments performed in the MTC meta-analysis) [12]
Initial treatments	Inactive control Usual care Education/advice Activity restriction Alternative/nontraditional (acupuncture) Nonopioids Opioids
Intermediate treatments	Manipulation Traction Passive physical therapy Active physical therapy Biological agents
Invasive therapies	Epidural/nerve block Disk surgery

MTC, mixed treatment comparison.

For the review of clinical effectiveness, interventions were grouped into 18 treatment categories (Table 1). Pair-wise (standard) meta-analyses were initially conducted followed by mixed treatment comparison (MTC) analysis. Analysis considered 3 main outcomes: global effect (including absence of pain), reduction in pain intensity (measured using a continuous scale), and improvement in function based on a composite condition-specific outcome measure as continuous data using weighted mean difference and standardised mean difference, respectively.

Missing study-level outcome data, where feasible, were dealt with by inputting replacement values from published data such as SDs derived from SEs [10]. Where mean values were unavailable but medians were reported, these were used instead. If SDs for baseline values were available, these were substituted for missing SDs. For studies that did not report sufficient data to derive the SDs, they were imputed using the weighted mean [8], which was calculated separately for each intervention category. For the pair-wise analysis, the data were analysed according to 3 follow-up intervals: short (⩽6 weeks), medium (>6 weeks to 6 months), and long term (>6 months).

MTC meta-analyses were carried out to enable the simultaneous comparison of all treatment modalities for sciatica at a single follow-up interval (closest to 6 months). The analyses were conducted for the 3 main outcome domains, for all study designs, and then after excluding observational studies and nonrandomised trials. Prior to performing the MTC, checks were undertaken as to whether or not the included studies formed a closed network using level 2 treatment categorisations with insufficient data to use individual (level 3) treatments as nodes. This meant that level 2 categorisations were used in the economic model. A full report of the MTC methods are reported elsewhere [12].

Studies evaluating mixed treatments (or combination therapy) were excluded because of the uncertainty regarding the extent of interaction between the combined interventions. The analyses were performed by the Multi-parameter Evidence Synthesis Research Group in the Bayesian framework [17], and the modelling computed with Markov chain Monte Carlo stimulation methods using WinBUGS [25].

The search for economic evaluations was conducted in parallel to the clinical effectiveness review. Given the nature and lack of homogeneity between included economic evaluations, a narrative review was performed on the included studies, with overall