



## Cost effectiveness analysis of a randomised trial of acupuncture for chronic headache in primary care

David Wonderling, Andrew J Vickers, Richard Grieve and Rob McCarney

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- 3 Melchart D, Linde K, Fischer P, Berman B, White A, Vickers A, et al. Acupuncture for idiopathic headache. *Cochrane Database Syst Rev* 2001;(1):CD001218.
- 4 Tunis SR, Stryer DB, Clancy CM. Practical clinical trials: increasing the value of clinical research for decision making in clinical and health policy. *JAMA* 2003;290:1624-32.
- 5 International Headache Society. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Cephalalgia* 1988;8:1-96.
- 6 Kee WG, Steedman S, Middaugh SJ. Medication quantification scale (MQS): update of detriment weights and medication additions. *Am J Pain Management* 1998;8:83-8.
- 7 Tfelt-Hansen P, Block G, Dahlof C, Diener HC, Ferrari MD, Goadsby PJ, et al. Guidelines for controlled trials of drugs in migraine: second edition. *Cephalalgia* 2000;20:765-86.
- 8 Melchart D, Thormaehlen J, Hager S, Liao J, Linde K, Weidenhammer W. Acupuncture versus placebo versus sumatriptan for early treatment of migraine attacks: a randomized controlled trial. *J Intern Med* 2003;253:181-8.
- 9 Vincent CA. A controlled trial of the treatment of migraine by acupuncture. *Clin J Pain* 1989;5:305-12.
- 10 Schulz KF, Chalmers I, Hayes RJ, Altman DG. Empirical evidence of bias. Dimensions of methodological quality associated with estimates of treatment effects in controlled trials. *JAMA* 1995;273:408-12.
- 11 Allais G, De Lorenzo C, Quirico PE, Airola G, Tolardo G, Mana O, et al. Acupuncture in the prophylactic treatment of migraine without aura: a comparison with flunarizine. *Headache* 2002;42:855-61.
- 12 White AR, Eddleston C, Hardie R, Resch KL, Ernst E. A pilot study of acupuncture for tension headache, using a novel placebo. *Acupuncture Med* 1996;14:11-5.
- 13 Karst M, Rollnik JD, Fink M, Reinhard M, Piepenbrock S. Pressure pain threshold and needle acupuncture in chronic tension-type headache—a double-blind placebo-controlled study. *Pain* 2000;88:199-203.
- 14 Karakurum B, Karaalin O, Coskun O, Dora B, Ucler S, Inan L. The “dry-needle technique”: intramuscular stimulation in tension-type headache. *Cephalalgia* 2001;21:813-7.
- 15 Karst M, Reinhard M, Thum P, Wiese B, Rollnik J, Fink M. Needle acupuncture in tension-type headache: a randomized, placebo-controlled study. *Cephalalgia* 2001;21:637-42.
- 16 Lenhard L, Waite P. Acupuncture in the prophylactic treatment of migraine headaches: pilot study. *N Z Med J* 1983;96:663-6. (Accepted 21 January 2004)

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## Cost effectiveness analysis of a randomised trial of acupuncture for chronic headache in primary care

David Wonderling, Andrew J Vickers, Richard Grieve, Rob McCarney

### Abstract

**Objective** To evaluate the cost effectiveness of acupuncture in the management of chronic headache.

**Design** Cost effectiveness analysis of a randomised controlled trial.

**Setting** General practices in England and Wales.

**Participants** 401 patients with chronic headache, predominantly migraine.

**Interventions** Patients were randomly allocated to receive up to 12 acupuncture treatments over three months from appropriately trained physiotherapists, or to usual care alone.

**Main outcome measure** Incremental cost per quality adjusted life year (QALY) gained.

**Results** Total costs during the one year period of the study were on average higher for the acupuncture group (£403; \$768; €598) than for controls (£217) because of the acupuncture practitioners' costs. The mean health gain from acupuncture during the one year of the trial was 0.021 quality adjusted life years (QALYs), leading to a base case estimate of £9180 per QALY gained. This result was robust to sensitivity analysis. Cost per QALY dropped substantially when the analysis incorporated likely QALY differences for the years after the trial.

**Conclusions** Acupuncture for chronic headache improves health related quality of life at a small additional cost; it is relatively cost effective compared with a number of other interventions provided by the NHS.

### Introduction

Migraine and chronic tension headache represent a considerable societal burden in terms of costs to the health service and costs of lost productivity because of reduced effectiveness and time off work.<sup>1-4</sup> A decade ago the annual costs to the health service were estimated to be between £23m<sup>1</sup> and £30m,<sup>2</sup> and have probably increased since, given the prescription of

more expensive drugs (such as the triptans). A much greater burden is the cost to the economy of lost productivity: in the early 1990s this was estimated to be between £250m<sup>2</sup> and £611m<sup>4</sup> annually.

Interest is increasing in acupuncture as an approach for chronic headache disorders. Although several randomised studies have been conducted,<sup>5</sup> few reliable data are available on the cost effectiveness of this intervention. We present a cost effectiveness analysis carried out alongside a randomised trial that seeks to assess the value for money of acupuncture for chronic headache.

### Methods

In the trial 401 patients aged 18-65 who reported an average of at least two headaches per month were recruited from general practices in England and Wales and randomly allocated to receive either up to 12 acupuncture treatments over three months from appropriately trained physiotherapists or usual care alone.<sup>6</sup>

For the purposes of this evaluation we assume that the acupuncture intervention is provided in the community by the NHS; hence we measure costs from both an NHS perspective and a societal perspective. We measured effectiveness in terms of the quality adjusted life years (QALYs) gained. For our base case, we have taken a conservative approach by excluding savings in productivity costs and by adopting a time horizon of 12 months, the length of the trial follow up. We measured costs in UK prices (£) for 2002-3. We used a single index measure of health related quality of life (HRQoL)—the SF-6D—to calculate HRQoL for each patient at baseline, three months, and 12 months from patients' responses to the SF-36 at each of these time points.<sup>7</sup>

The patients themselves reported unit costs associated with non-prescription drugs and private health-

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Cost effectiveness. Values are means (standard deviations) unless otherwise indicated

	Acupuncture arm n=136	Control arm n=119	Mean difference‡(95% CI)
NHS cost (£)*	289.65 (165.86)	88.65 (130.28)	205.34 (169.33 to 241.35)
Patient cost (£)	113.75 (258.24)	128.56 (426.56)	-15.91 (-86.24 to 54.42)
Total cost (£)†	403.40 (356.69)	217.20 (486.00)	189.42 (102.24 to 276.61)
Quality adjusted life years (QALYs)	0.727 (0.119)	0.708 (0.112)	0.021 (0.001 to 0.040)

Incremental cost per QALY gained: £9951 (NHS cost); £9180 (total cost).

\*Excluding prescription drug costs. †Total cost (£)=NHS cost+ patient cost. ‡Adjusted for baseline variables.

care visits. We inflated these costs to 2003 levels.<sup>8</sup> See [bmj.com](http://bmj.com) for unit costs.

To estimate the cost of the study intervention, we took the standard cost for an NHS community physiotherapist<sup>9</sup> and multiplied it by the contact time for each individual patient with the physiotherapist trained in acupuncture.

We used using linear regression with age, sex, diagnosis (migraine or non-migraine headache), severity of headache at baseline, number of years of headache disorder, site, and baseline SF-6D as covariates to estimate differences between groups for cost and effectiveness on the intention to treat principle. We used the net benefit approach to estimate parametric cost effectiveness acceptability curves.<sup>10 11</sup> Net benefit analysis usually requires any gain in outcome (for example, QALYs) from an intervention to be valued by using the ceiling ratio,  $\lambda$ , defined as the decision makers' willingness to pay for an additional unit of health outcome, and from this any additional costs are subtracted. A  $\lambda$  equal to £30 000 per QALY is a threshold of cost effectiveness consistent with decisions that have been taken by the National Institute for Clinical Excellence.<sup>12</sup> The cost effectiveness acceptability curves show the probability that the incremental cost effectiveness is below  $\lambda$ , for a range of values of  $\lambda$ .

For the base case we conducted no imputation for cases missing HRQoL data; therefore the cost effectiveness analysis sample was those patients who reported SF-36 completely in all three questionnaires and for whom QALYs could therefore be calculated. Data on use of resources and cost were available for a larger sample of cases, and for these variables we report statistics for all responding patients.

We conducted sensitivity analyses to test the robustness of the results to changes in the base case assumptions. See [bmj.com](http://bmj.com) for details.

## Results

The baseline characteristics for the patients who completed the SF-36 on all three occasions were similar for both the acupuncture arm (n = 136) and control arm (n = 119). This group forms our sample for our base case analysis of cost effectiveness. See [bmj.com](http://bmj.com) for resource use, HRQoL, and cost from all responding individuals.

Patients in the acupuncture arm had on average 4.2 hours of contact with a study acupuncturist. Two patients in the control arm were treated by one of the study acupuncturists, and 18 patients in the acupuncture arm did not attend for acupuncture. Thirty patients in the acupuncture arm and two in the control arm visited an acupuncturist for further acupuncture (either NHS or private). Hence the cost of the study acupuncture sessions was augmented by the cost of additional acupuncture sessions.

We found small but statistically significant reductions in expenditure on visits to general practitioners and complementary or alternative medications. Differences in other cost components did not reach significance. After further analysis we excluded costs for prescription drug costs from the cost effectiveness analyses. However this is unlikely to have an important influence on the cost effectiveness estimates.

We noted an improvement in QALYs over the 12 months in the acupuncture group but not in controls, with the difference between groups reaching significance (P = 0.02). We estimated the mean health gain to be 0.021 QALYs, equivalent to eight quality adjusted days (table).

We estimated the mean incremental cost of the acupuncture intervention to the NHS to be £205 per patient, excluding the impact on prescription drugs (table). This was offset slightly by a small reduction in direct patient costs (over the counter medication and visits to practitioners of complementary and alternative medicine). Overall this equates to an additional total cost of £9180 per QALY gained, including patient costs.

Figures 1 and 2 show the probability that the intervention is cost effective (under our base case assumptions) for a range of cost effectiveness ceilings. At a ceiling of £30 000 per QALY gained, the

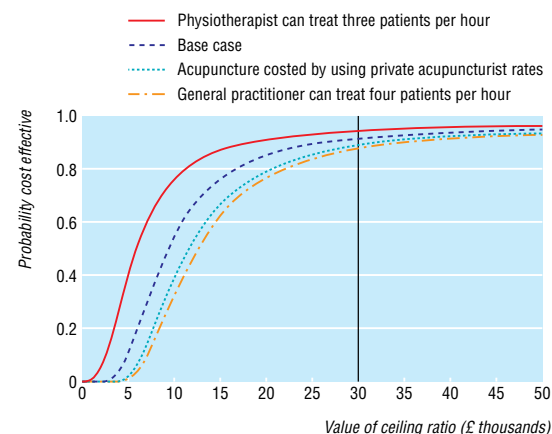


Fig 1 Cost effectiveness acceptability curve with sensitivity analysis for acupuncture unit cost

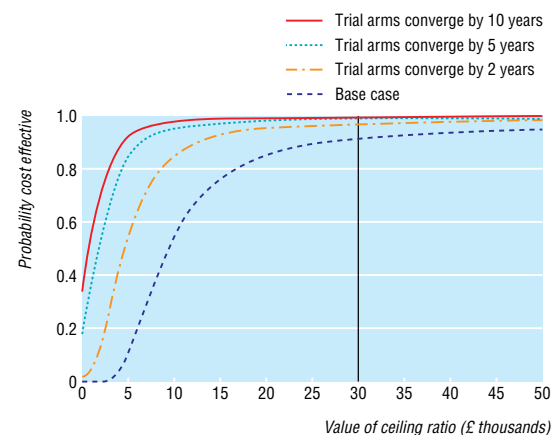


Fig 2 Cost effectiveness acceptability curve with sensitivity analysis for duration of effect

probability that acupuncture is cost effective is 92%. The figures also show how cost effectiveness changes for several different scenarios (see [bmj.com](http://bmj.com)). Given the relative value of a general practitioner's time, acupuncture by physiotherapists represents better value for money. Even if a general practitioner can manage to treat four patients in an hour this is still less cost effective than a physiotherapist treating two per hour (the base case scenario).

We saw a marked improvement in cost effectiveness associated with the inclusion of productivity costs. However, this represents an underestimate of the cost per QALY since the quality of life measure will in part reflect this improved productivity, especially with respect to increased leisure time. Estimated cost effectiveness was also improved by the projection of effects beyond one year and the assumption that acupuncturists could improve their throughput by dealing with patients simultaneously. Cost effectiveness was not markedly different when we used private acupuncture costs. Similarly, imputing values for cases with missing data did not greatly influence the results. Under none of the scenarios did the central estimate of cost indicate overall cost savings.

## Discussion

Acupuncture led to increases in both QALYs and health service costs. We estimated the incremental cost effectiveness to be £9180 per QALY gained. The estimated improvement in quality of life correlates with the observed reductions in headache severity and frequency.

We consider that the base case is likely to be conservative as it excludes cost savings associated with prescription drugs and productivity gains. More importantly, our base case analysis considers only the 12 months of the trial. The effects of acupuncture appear to be persistent as differences between groups were slightly larger at one year than immediately post-treatment. If we include likely QALY differences for subsequent years, then acupuncture appears even better value for money.

Given the relative value of a general practitioner's time, acupuncture by physiotherapists represents better value for money than acupuncture by general practitioners, unless general practitioners can achieve substantially better outcomes or much shorter contact times.

The probability that the programme is cost effective at a ceiling of £30 000 was estimated to be 92% for the base case. This does not take into account the uncertainty owing to imputing missing values, which means that this probability is a slight overestimate. When only complete responders are included in the analysis the probability falls to 84%, but this estimate is biased conservatively.

To our knowledge, this is the first rigorous economic evaluation of acupuncture. Our study, with a relatively large sample size, a randomised comparison arm, and prospective evaluation of costs, has not found overall cost savings for headache patients: we can be fairly certain from our results that acupuncture adds to health service costs for these patients. The question is whether this additional cost is justified by the associated health gains. Even when we use our

## What is already known on this topic

Acupuncture is widely used for chronic pain

A number of small trials, and recently a larger more rigorous trial, indicate that acupuncture is of benefit for chronic headache disorders

No rigorous cost-effectiveness assessments of acupuncture have been previously undertaken

## What this study adds

Acupuncture improves health related quality of life (HRQoL), but increases costs to the health service

Cost effectiveness was estimated to be £9180 per QALY gained, or less if analysis incorporated likely QALY differences for the years after the trial

If decision makers are willing to pay up to £30 000 to gain one QALY then acupuncture in the treatment of chronic headache is highly likely to be cost effective

conservative base case estimate of £9180 per QALY gained, acupuncture for migraine seems to be better value for money than several interventions that have been recommended by NICE.<sup>12</sup> To our knowledge, a cost per QALY analysis has been performed for only one other anti-migraine intervention—sumatriptan compared with oral caffeine and ergotamine—which had a cost per QALY of \$C29 366 (£16 000).<sup>13</sup> Acupuncture therefore compares favourably.

Clinicians, commissioners, and patients should consider acupuncture for migraine and chronic headache as it seems to reduce the severity of headache and improves HRQoL at a small additional cost.

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- 1 Blau JN, Drummond MF. *Migraine*. London: Office of Health Economics, 1991.
- 2 Bosanquet N, Zammit-Lucia J. Migraine: prevention or cure? *Br J Med Econ* 1992;2:81-91.
- 3 Solomon GD, Price KL. Burden of migraine: a review of its socioeconomic impact. *Pharmacoeconomics* 1997;11(suppl 1):1-10.
- 4 Cull RE, Wells NE, Moiechevich ML. The economic cost of migraine. *Br J Med Econ* 1992;2:81-91.
- 5 Melchart D, Linde K, Fischer P, Berman B, White A, Vickers A, et al. *Cochrane Database Syst Rev* 2001;(1):CD001218.
- 6 Vickers AJ, Rees RW, Zollman CE, McCarney R, Smith C, Ellis N, et al. Acupuncture for migraine and chronic tension headache in primary care: a large, pragmatic, randomised trial. *BMJ* 2004;328:000.
- 7 Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *J Health Econ* 2002;21(2):271-92.
- 8 Office for National Statistics. *First release: consumer prices indices May 2003*. London: ONS, 2003.
- 9 Netten A, Curtis L. *Unit costs of health and social care*. Canterbury: Personal Social Services Research Unit, University of Kent and Canterbury, 2002.
- 10 Van Hout BA, Al MJ, Gordon GS, Rutten FF. Costs, effects and C/E-ratios alongside a clinical trial. *Health Econ* 1994;3:309-19.
- 11 Stinnett AA, Mullahy J. Net health benefits: a new framework for the analysis of uncertainty in cost-effectiveness analysis. *Med Decis Making* 1998;18(2 suppl):S68-80.
- 12 Raftery J. NICE: faster access to modern treatments? Analysis of guidance on health technologies. *BMJ* 2001;323:1300-3.
- 13 Evans KW, Boan JA, Evans JL, Shuaib A. Economic evaluation of oral sumatriptan compared with oral caffeine/ergotamine for migraine. *Pharmacoeconomics* 1997;12:565-77.

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