

# Comparing the cost of nurse practitioners and GPs in primary care: modelling economic data from randomised trials

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## ABSTRACT

### Background

The role of nurse practitioners in primary care has recently expanded. While there are some outcome data available for different types of consultations, little is known about the relative cost.

### Aim

To compare the cost of primary care provided by nurse practitioners with that of salaried GPs.

### Design of study

Synthesis, modelling, and analysis of published data from the perspective of general practices and the NHS.

### Data sources

Two published randomised controlled trials.

### Method

A dataset of resource use for a simulated group of patients in a typical consultation was modelled. Current unit costs were used to obtain a consensus mean cost per consultation.

### Results

Mean cost of a nurse practitioner consultation was estimated at £9.46 (95% confidence interval [CI] = £9.16 to £9.75) and for a GP was £9.30 (95% CI = £9.04 to £9.56) according to salary and overheads, that is, from the perspective of general practices. From the NHS perspective, which included training costs, the estimated mean costs were £30.35 (95% CI = £27.10 to £33.59) and £28.14 (95% CI = £25.43 to £30.84) respectively. Sensitivity analysis suggested that the time spent by GPs contributing to nurse practitioners' consultations (including return visits) was an important factor in increasing costs associated with nurse practitioners.

### Conclusion

Employing a nurse practitioner in primary care is likely to cost much the same as employing a salaried GP according to currently available data. There is considerable variability of qualifications and experience of nurse practitioners, which suggests that skill-mix decisions should depend on the full range of roles and responsibilities rather than cost.

### Keywords

cost of care; family practice; nurse practitioner; primary health care; skill mix.

## INTRODUCTION

Nurse practitioners are increasingly employed in a variety of primary care settings, including general practice surgeries, NHS walk-in centres, and out-of-hours primary care centres. Factors leading to

these developments include the need to increase service capacity to meet rising demand, and initiatives to improve access and provide a wider range of primary care services. Recent interest in substituting nurse practitioners for GPs may be driven by a goal to reduce costs while achieving similar outcomes.<sup>1,2</sup>

Several randomised controlled trials have compared the work of nurse practitioners and GPs in dealing with 'same-day' patients in primary care. Two systematic reviews showed that nurse practitioners' consultations led to greater patient satisfaction and provided equivalent quality of care, but that nurse consultations were longer and generated more investigations.<sup>3,4</sup>

The relative efficiency of employing nurse practitioners and GPs was not addressed in the systematic review<sup>3</sup> because the studies included in

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the review used different approaches for estimating and valuing resources. The issue of relative efficacy has become particularly relevant with the increased number of GPs wishing to have a limited, salaried commitment, rather than working as a self-employed partner.<sup>5</sup> Consequently, general practices are more commonly presented with a direct choice between employing a salaried GP or a nurse practitioner.

Attempting to compare the costs of nurse practitioners and GPs is complex because of the different ways in which practitioners are trained and employed in general practice. Comparisons will depend on the way in which practitioners are employed, the type of work they do and whether costs are assessed from the perspective of individual general practices or the NHS as a whole.<sup>6</sup>

### Objective

To estimate the cost difference of employing an extra salaried GP or nurse practitioner to deal with excess patient demand from two different perspectives: that of a general practice and the NHS as a whole.

## METHOD

### Participants and setting

Data were extracted from the most appropriate trials in the systematic review<sup>3</sup> and combined into a model of resource use. The model was established to estimate resource use for a typical same-day primary care consultation, regardless of whether the consultation was given by a GP or nurse practitioner. As the focus of the analysis was the cost of an extra employee, only variable costs were included. It was assumed that infrastructure costs and related overheads would be the same, irrespective of the type of practitioner employed. The analysis followed the conventional approach of economic analysis costing: identification of resources used; measurement of resources; and application of unit costs to arrive at a valuation. A

sensitivity analysis was used to test the impact of different variables and to assess the robustness of the results. All analyses were conducted using Microsoft Excel®.

### Identification and measurement of resource use

All randomised controlled trials in the systematic review were scrutinised to identify UK primary care studies with cost analyses. Resources that can incur costs in a typical consultation were identified, for example, GP and nurse practitioner time, investigations carried out, tests ordered, prescriptions issued, and referrals to secondary care. The original studies provided summary statistics of items such as mean length of consultation, number of investigations, and number of prescriptions.

Summary statistics were used to model consensus estimates for the use of each type of resource. A  $\gamma$  distribution was generated, with a mean and standard deviation (SD) matching the original randomised controlled trial, for each item (for example, number of prescriptions issued per consultation) and each study. The  $\gamma$  distribution is widely used in cost analyses and was chosen for this study because it has a non-negative, positively skewed pattern as is commonly observed in resource use data.<sup>7</sup>

A random sample, the same size as the published study sample, was taken from each of the distributions to arrive at a dataset for a simulated group of patients. Thus a dataset was obtained for each item of resource use in each study that mimicked the original data. Data for each item of resource use were pooled across the studies to arrive at a combined set of data. This process of creating a simulated dataset enabled us to derive consensus means and SDs for each item of resource, which were necessary in order to estimate confidence intervals for overall costs.

### Valuation of resource use

Each item of resource use was valued by multiplying the amount by an appropriate unit cost. From a practice perspective, the cost of clinical time was valued as salary plus on-costs of superannuation and national insurance. From an NHS perspective, the cost of qualifications and training were also included.<sup>8</sup> The cost of a GP's time was based on a survey of advertisements for salaried GPs in *Pulse* and the *British Medical Journal* over 3 months during the financial year 2003–2004 (October, November, and December); London weighting was excluded. The cost of nurse practitioners' time was taken from Curtis and

## How this fits in

Primary care patients are more satisfied with nurse practitioner care than GP care, and on some indicators nurses may offer better quality care. However, little is known about the relative cost of providing nurse practitioner and GP services. This study demonstrates that the relative costs of nurse practitioners and GPs are similar, indicating the importance of matching skills and experience with roles and responsibilities.

**Table 1. Data sources for resource use.**

	Study			
	Kinnersley <sup>10</sup>		Venning <sup>11</sup>	
	Mean	SD	Mean	SD
First consultation				
Time (minutes)	•••	••	•••	•••
Advice (minutes)	•••	••	•••	••
Investigations and X-rays (number)	•••	•	•••	••
Prescriptions (number)	•••	•	•••	••
Referrals to secondary care (number)	•••	•	•••	••
Return consultation				
Who seen at first consultation	•••		•••	
	Mean	SD	Mean	SD
Number	•••		•••	
Time (minutes)	•••	•	•	•
Advice (minutes)	•	•	•	•
Investigations and X-rays (number)	•••	•	•	•
Prescriptions (number)	•••	•	•	•
Referrals to secondary care (number)	•••	•	•	•

••• = Reported by the authors. •• = Derived from the reported results. • = Derived indirectly from the reported results.

Netten.<sup>8</sup> Cost per minute of consultation time for GPs and nurse practitioners was estimated by taking into account the numbers of hours worked each year and an estimate of non-contact time. Curtis and Netten's<sup>8</sup> estimates for nurse practitioner working hours and non-contact time were used for both nurses and salaried GPs to preserve consistency. The costs of other items of resource use were taken from the published studies and were inflated using the Retail Prices Index for 2004.<sup>9</sup>

**Sensitivity analysis**

One-way sensitivity analyses were conducted by adjusting the model to test the impact of three variables: GPs' and nurse practitioners' salaries; the cost of training GPs and nurse practitioners; and the time spent by a GPs in nurse consultations.

**Table 2. Resource use by item for GP and nurse practitioner consultations.**

	GP consultation (n = 1367)		NP consultation (n = 1293)	
	Mean (SD)	95% CI	Mean (SD)	95% CI
GP time (minutes)	8.71 (4.70)	8.46 to 8.96	2.76 (4.34)	2.53 to 3.00
NP time (minutes)	0.65 (1.13)	0.59 to 0.71	13.21 (5.92)	12.89 to 13.53
Investigations and X-rays	0.12 (0.56)	0.09 to 0.15	0.17 (0.58)	0.14 to 0.21
Prescriptions	0.88 (1.56)	0.80 to 0.96	1.00 (1.74)	0.91 to 1.10
Referrals	0.06 (0.33)	0.05 to 0.08	0.06 (0.31)	0.04 to 0.08

NP = nurse practitioner.

**RESULTS**

**Identification and measurement of resource use**

Two studies fulfilled the criteria of being UK primary-care based, and including a cost analysis.<sup>10,11</sup> Kinnersley *et al*<sup>10</sup> conducted a study in 10 practices with 1368 patients requesting a same-day consultation. Based on the cost of clinical staff time alone, they found that nurse practitioner consultations were significantly more expensive, despite their lower salary, because they took longer.<sup>12</sup> The study conducted by Venning *et al*<sup>11</sup> covered 20 practices and 1292 patients. They found no significant difference in overall costs from the perspective of the NHS. Both studies included data about follow-up consultations within 2 weeks of the initial consultation, and assigned the cost of these to the clinician who gave the initial consultation. Evidence from the systematic review suggested that in a primary care setting there was a small but significant difference in the number of return consultations with patients seen by nurse practitioners compared to GPs, with the greater number of return consultation seen in the nurse practitioners group – with consequent implications for costs. The authors of both studies were contacted to obtain more detailed information than was available in the published papers.

From the practice perspective, clinical staff time and on-costs, excluding training costs, are the only items of resource use that are relevant. For the NHS perspective, additional items include training costs and the cost of investigations and X-rays, prescriptions, and referrals.

The data available for inclusion in the model of resource use varied between the two studies (Table 1). In general, more information was available about the first consultation than follow-up visits. Mean values for resource use were derived from the total costs reported and the most appropriate estimate of unit costs. If SDs were not reported, they were derived from the best available data from either study.

Mean resource use for each item was calculated for a GP consultation and a nurse practitioner consultation (Table 2 and Supplementary Table 2). Total clinical time for a GP consultation, including return visits to either a GP or a nurse, was 9.36 minutes (95% CI = 9.10 to 9.62), compared with 15.97 minutes (95% CI = 15.57 to 16.38) for a nurse practitioner consultation, including return visits to either a GP or a nurse. Of the total clinical time relating to a nurse practitioner initial consultation, 2.76 minutes (17%) was GP time, which includes the time spent on patients returning to see a GP within 2 weeks of the initial consultation

(1.91 minutes), as well as time asking advice and getting prescriptions signed (0.85 minutes).

### Valuation of resource use

Costs per item varied between GPs and nurse practitioners. For salary costs alone, the cost of a minute of GP time is just over twice that of a nurse practitioner (Table 3). Training costs, as estimated by Curtis and Netten<sup>8</sup> represent an additional 36% for a doctor and 20% for a nurse; thus from the NHS perspective, the cost per minute of GP time is 2.3 times that of a minute of nurse practitioner time.

Estimates of the cost of a typical consultation were calculated by multiplying volume of resource use (Table 2 and Supplementary Table 2) by cost per item (Table 3). The baseline results are given in Table 4 (Supplementary Table 4). The null hypothesis, that there is no difference between costs of the two types of consultations, was tested (Table 5). From the perspective of a general practice, looking to employ an extra clinician to deal with excess demand, the mean cost of a consultation with a nurse practitioner would be £0.16 (1.71%) more than a consultation with a GP. Thirty per cent of the cost of the nurse consultation relates to the cost of GP time within that consultation and any follow-up consultations. From the perspective of the NHS, the mean cost of a nurse practitioner consultation is again greater than that of a GP consultation, the difference being £2.21 (7.85%). A *t*-test was performed and, as the data were non-normal, 95% confidence intervals were calculated for bootstrapped data (1000 replications). Estimations derived from 1000 replications of the original pooled data, a process known as 'bootstrapping'. Both analyses suggest that there is no evidence of a difference between the cost of the consultations from practice and NHS perspectives.

**Table 3. Cost per item used to estimate the cost of a GP and nurse practitioner consultation.**

	GP (£)	NP (£)
Salary	61 567 <sup>a</sup>	30 321 <sup>b</sup>
On-costs	9831	4581
Salary and on-costs	71 398	34 902
Cost per minute (practice perspective)	1.03	0.50
Qualifications and training	25 732 <sup>b</sup>	6915 <sup>b</sup>
Cost per investigations and X-ray: first consultation	18.99 <sup>c</sup>	13.67 <sup>c</sup>
Cost per investigations and X-ray: follow-up consultation	17.67 <sup>c</sup>	17.67 <sup>c</sup>
Cost per prescription: first consultation	4.45 <sup>c</sup>	5.68 <sup>c</sup>
Cost per prescription: follow-up consultation	4.76 <sup>c</sup>	4.76 <sup>c</sup>
Cost per referral: first consultation	146.21 <sup>c</sup>	194.35 <sup>c</sup>
Cost per referral: follow-up consultation	158.24 <sup>c</sup>	158.24 <sup>c</sup>
Cost per minute (NHS perspective)	1.40	0.60

<sup>a</sup>Advertisements in Pulse and the British Medical Journal for a salaried GP. Mean salary on offer, excluding London weighting, for 3 months during the financial year 2003–2004 (October, November, and December). <sup>b</sup>Curtis and Netten.<sup>8</sup> <sup>c</sup>Venning et al,<sup>9</sup> inflated to 2004. Inflated using the Retail Prices Index for 2004.<sup>9</sup>

### Sensitivity analysis

Results of the sensitivity analysis suggest that while the assumptions made in the main analysis are robust from an NHS perspective, relaxing some of the variables affects results from the practice perspective (Table 6 and Supplementary Table 6). The greatest change is seen when the contribution of GP time in a nurse consultation (including a return visit to consult a GP) is halved: the mean difference falls from £0.16 (nurse more expensive) to £-1.26 (GP more expensive), with strong evidence suggesting the nurse practitioner consultation is cheaper. Changing the salaries of GPs and nurse practitioners affects the results to some degree, with the nurse practitioner salary having the greatest effect.

**Table 4. Baseline results: estimated cost of a typical GP and nurse practitioner consultation.**

	GP consultation (£) (n = 1367)		NP consultation (£) (n = 1293)	
	Mean (SD)	95% CI	Mean (SD)	95% CI
Practice perspective				
GP time	8.97 (4.84)	8.72 to 9.23	2.84 (4.47)	2.60 to 3.09
NP time	0.32 (0.57)	0.29 to 0.35	6.61 (2.96)	6.45 to 6.77
Cost per consultation	9.30 (4.89)	9.04 to 9.56	9.46 (5.41)	9.16 to 9.75
NHS perspective				
GP time, including training	12.21 (6.59)	11.86 to 12.56	3.87 (6.08)	3.54 to 4.20
NP time, including training	0.39 (0.68)	0.35 to 0.42	7.92 (3.55)	7.73 to 8.11
Investigations prescriptions and referrals	15.54 (50.44)	12.87 to 18.22	18.56 (59.21)	15.33 to 21.78
Cost per consultation	28.14 (50.96)	25.43 to 30.84	30.35 (59.50)	27.10 to 33.59

Practice = salary plus on-costs used to calculate cost of clinical time. NHS = cost of qualifications and training also included to calculate cost. NP = nurse practitioner.

**Table 5. Strength of evidence against the null hypothesis that there is no difference in cost of a GP and nurse practitioner consultation.<sup>a</sup>**

	Baseline results (£)		P-value (t-test)	Bootstrapped results (£)	
	Mean difference in cost	95% CI		Bootstrapped difference in cost	95% CI
Practice perspective	0.16	-0.23 to 0.55	0.427	0.16	-0.21 to 0.52
NHS perspective	2.21	-2.00 to 6.41	0.303	2.30	-1.94 to 6.65

<sup>a</sup>Positive difference indicates nurse consultation is more expensive. Practice = salary plus on-costs used to calculate cost of clinical time. NHS = cost of qualifications and training also included to calculate cost.

**DISCUSSION**

**Summary of main findings**

Results suggest that employing nurse practitioners to provide first-line care in UK general practice is likely to cost the same or slightly more than employing doctors. This is the case from the perspective of general practices and the NHS. The sensitivity analysis shows that, from the perspective of the NHS, these findings are robust under most assumptions. From the perspective of a general practice, halving the amount of time spent by GPs with patients who originally consulted nurses, results in the greatest reduction in the cost of a nurse practitioner. In the future, GP involvement in nurse practitioner consultations is likely to be reduced as nurses gain wider experience and as the regulation of nurse prescribing is relaxed.<sup>13</sup> The contribution of GP costs to initial nurse consultations was mostly from follow-up consultations with GPs within 2 weeks of initial consultations. This may be a result of patient choice, or the relative availability of GPs and nurses for follow-up consultations.

**Strengths and limitations of the study**

This study demonstrated that it is possible to combine findings from two similar randomised

trials, which individually lacked the power to compare costs. The method used has enabled resources to be valued in a consistent way to derive estimates of cost with reasonably narrow confidence intervals, and it has allowed for sensitivity analysis. One limitation is that the trials selected<sup>10,11</sup> were conducted several years ago. It is possible that the work of nurse practitioners has changed since then, although there are no reliable current UK data to substantiate this. Despite the wider employment of nurses in primary care, there is a lack of information about the roles and responsibilities they now undertake. The roles of nurses are likely to vary considerably because as yet there is no regulatory framework in the UK to define the qualifications and competencies of nurses using the title ‘nurse practitioner’; however, this matter is under consultation.<sup>14</sup> Lack of robust information on these issues has implications for workforce planning, education, and general practice management.

Determining training costs proved to be difficult. The training of nurses and GPs at undergraduate and postgraduate levels is funded through a variety of mechanisms, which may not accurately reflect the true costs. The analysis in this study is based on a widely recognised reference source for NHS costs,<sup>8</sup> which treats 50% of junior doctors’ salaries as a training cost because they are funded through an NHS training budget; however, this may not reflect the actual proportion of doctors’ time spent on training rather than patient care. The variability in training and postgraduate experience of nurse practitioners<sup>15</sup> makes estimation of their training costs problematic. The absence of information about the costs of medical training has been recognised.<sup>16</sup> Despite these uncertainties, the training costs of GPs and nurses had relatively little impact on the main findings of the current analysis.

A further limitation of the current analysis is the recognition that an economic assessment of the efficiency of employing nurse practitioners in

**Table 6. Results of one-way sensitivity analyses.**

Variable and assumptions	Perspective	Cost of consultation (£)		Parametric test results (£)			Non-parametric test results (£)	
		mean (SD)	GP mean (SD)	NP in cost	Mean difference 95% CI	(t-test)	P-value difference in cost	Bootstrapped 95% CI
GP salary low: lower quartile of advertised salaries	Practice	8.90 (4.69)	9.34 (5.26)	0.42	0.04 to 0.80	0.031	0.42	0.37 to 0.51
NP salary low: one grade lower	Practice	9.26 (4.88)	8.80 (5.25)	-0.46	-0.85 to -0.08	0.018	-0.47	-0.84 to -0.08
NP salary high: one grade higher	Practice	9.33 (4.90)	10.12 (5.59)	0.79	0.39 to 1.19	<0.001	0.78	0.41 to 1.17
GP time in NP consultation halved	Practice	9.30 (4.89)	8.03 (3.75)	-1.26	-1.60 to -0.93	<0.001	-1.26	-1.58 to -0.94

comparison with GPs requires knowledge of outcomes as well as costs.<sup>17</sup> There is evidence that nurse practitioner consultations are associated with some benefits in terms of patient satisfaction, but there is limited evidence about other health outcomes.

### Comparison with existing literature

In discussions about skill-mix of practitioners, it is important to distinguish between substitution and diversification. Substitution replaces one type of professional with another to increase efficiency by improving outcomes, reducing costs. Diversification is the process of introducing new professional groups to widen the range of skills that can be accessed.<sup>18</sup> Growth in the employment of nurse practitioners has both of these elements. This study focuses on substitution and relates to GPs and nurses providing first contact care. Results are in agreement with the findings of the recently published Cochrane review that examined the substitution of doctors by nurses in primary care.<sup>4</sup>

First contact consultations represent only some of the work of primary care and practices may decide to employ a GP or a nurse because of specific skills or consulting styles (diversification). For example, nurse consultations are longer than doctor consultations and recent evidence suggests this extra time is often used to provide more information about applying treatments.<sup>19</sup> Practices need to employ GPs and nurses, so the challenge is to identify the most appropriate balance of professionals to cover the full range of primary care activity.

The employment of nurse practitioners to provide first contact care in UK general practice is likely to cost the same or more than the employment of salaried GPs, according to currently available data. The decision to employ one type of professional rather than the other should depend on the extent to which they offer other necessary skills or fulfil other responsibilities in general practice rather than cost.

### Supplementary information

Supplementary information accompanies this article at <http://www.rcgp.org.uk/Default.aspx?page=2482>

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### Ethics committee

Ethical approval was not required

### Competing interests

The authors have stated that there are none

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