



Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care

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The demands placed on practices mean that they may explore alternative methods of management for same day patients. However, the overall use of resources within the NHS must be considered before widespread changes are made. Nevertheless, the positive outcomes found here suggest that nurses provide a high standard of care to their patients, and this supports their extended role within primary care.

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Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care

P Venning, A Durie, M Roland, C Roberts, B Leese

Abstract

Objective To compare the cost effectiveness of general practitioners and nurse practitioners as first point of contact in primary care.

Design Multicentre randomised controlled trial of patients requesting an appointment the same day.

Setting 20 general practices in England and Wales.

Participants 1716 patients were eligible for randomisation, of whom 1316 agreed to randomisation and 1303 subsequently attended the clinic. Data were available for analysis on 1292 patients (651 general practitioner consultations and 641 nurse practitioner consultations).

Main outcome measures Consultation process (length of consultation, examinations, prescriptions, referrals), patient satisfaction, health status, return clinic visits over two weeks, and costs.

Results Nurse practitioner consultations were significantly longer than those of the general practitioners (11.57 v 7.28 min; adjusted difference

4.20, 95% confidence interval 2.98 to 5.41), and nurses carried out more tests (8.7% v 5.6% of patients; odds ratio 1.66, 95% confidence interval 1.04 to 2.66) and asked patients to return more often (37.2% v 24.8%; 1.93, 1.36 to 2.73). There was no significant difference in patterns of prescribing or health status outcome for the two groups. Patients were more satisfied with nurse practitioner consultations (mean score 4.40 v 4.24 for general practitioners; adjusted difference 0.18, 0.092 to 0.257). This difference remained after consultation length was controlled for. There was no significant difference in health service costs (nurse practitioner £18.11 v general practitioner £20.70; adjusted difference £2.33, -£1.62 to £6.28).

Conclusions The clinical care and health service costs of nurse practitioners and general practitioners were similar. If nurse practitioners were able to maintain the benefits while reducing their return consultation rate or shortening consultation times, they could be more cost effective than general practitioners.

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Introduction

Although use of nurse practitioners is well developed in the United States, it is only in the past 10 years that they have become established in the United Kingdom. A nurse practitioner has been defined as "an advanced level clinical nurse who through extra education and training is able to practice autonomously, making clinical decisions and instigating treatment decisions based on those decisions, and is fully accountable for her own practice."¹ Models of nurse practitioner care have, however, developed in several different ways. In Britain, nurse practitioners working in general practice most commonly work as part of a team alongside general practitioners, and it is this model we have evaluated.

Nurse practitioners are increasingly used as points of first contact in primary care. The number of trained nurse practitioners is increasing as dedicated training programmes become more accessible. New government initiatives include nurses as front line providers for a national telephone advice service² and for proposed new walk-in primary care clinics.³ Despite this, there have been few rigorous comparisons between doctors and nurses. Observational studies generally suggest that patients give positive reports of nurses in such roles.^{4,5} However, the only two randomised controlled trials comparing the cost effectiveness of nurses and doctors in first contact roles in primary care in the United States and Canada provide conflicting results.^{6,7} These studies were conducted on single sites with a small number of nurses. A recent meta-analysis commented on the limited evidence available to compare the cost effectiveness of doctors and nurses in primary care.⁸

The aim of this study was to compare the process, outcome, and costs of care given by general practitioners and nurse practitioners for patients requesting a same day appointment in 20 general practices. This group of patients was chosen because a high proportion would be likely to agree to randomisation as they would not have a strong preference for one practitioner who was already involved in their ongoing care.

Participants and methods

The study took place in 20 geographically dispersed practices in England and Wales. Table 1 shows the location, list size, and number of general practitioner partners in the practices recruited. Ethical approval was obtained for the 20 practices from local research ethics committees. Each practice employed a nurse who had completed a one or two year nurse practitioner training programme at diploma, BSc, or MSc level. The median length of time the nurses had been qualified as nurse practitioners was 3 (range 1-5) years and the median time as registered nurses was 22 (9-35) years. Each nurse practitioner had been seeing patients as first point of contact for at least two years.

Randomisation

In each practice, experimental sessions were booked when both the nurse practitioner and a general practitioner had appointments available for patients who asked to be seen on the same day. Patients were eligible for entry to the study if they requested an

appointment the same day and were able to come to the experimental session. If these conditions were satisfied, the receptionist then asked patients whether they would agree to be randomised to see either a nurse practitioner or a general practitioner. A method of coded block randomisation was developed which meant that neither the receptionist nor the patient could determine the group to which a patient had been allocated at the time of booking. The coded blocks were generated from random number tables. The randomisation code was broken by one of the researchers at the start of each experimental session, at which point it became apparent which patient would see which practitioner. One of the researchers explained the study further to patients as they arrived for their appointment and informed consent was obtained. For drop-in clinics or where patients telephoned or called in after a session had started, the researchers randomised patients after they arrived in the surgery and had consented to enter the study. Randomisation continued until a minimum of 60 patients in each practice had been allocated to the clinician groups.

Patients were excluded from the study if one or more of the following criteria applied: patients who were temporarily resident or not yet registered with the practice, any patient with language or reading problems, any patient who was too ill, and unaccompanied children under 16 years of age.

Data collection

The general practitioners and nurse practitioners booked appointments at their normal intervals. For each consultation they recorded details of history, diagnosis, examination, tests carried out, prescriptions, and referrals. The time of each consultation, including interruptions, was recorded with an electronic time stamp. This included time taken by the nurse practitioners to get a prescription signed by a general practitioner. We extracted details of consultations in the following two weeks from the medical records.

Patients completed health status measures before the initial consultation and by post two weeks later (SF-36⁹ for adults or the child health questionnaire for parents of children aged 5 to 16¹⁰). For children under 5 years, parents completed a brief health status questionnaire which had been developed for a previous study in general practice.¹¹ After the consultation, patients completed the medical interview satisfaction scale¹² or the paediatric version of this scale¹³ and the patient enablement instrument.¹⁴

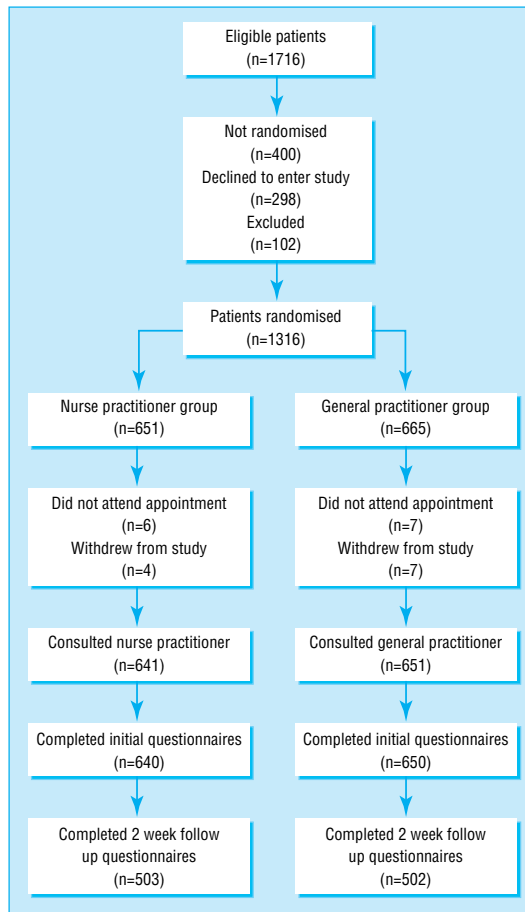
We coded patients' diagnoses and prescriptions using Read codes. Data were double coded, double entered, and verified. For health status and satisfaction scales, scores were reported if 50% or more of items had been completed, and we used the method advised for the SF-36 scale to impute missing values.¹⁵ Costs of general practitioners' and nurse practitioners' time were taken from Netten et al using the actual grades on which the study nurses were employed.¹⁶ Costs of prescriptions were derived from the *British National Formulary*, and costs for investigations and referrals were supplied by the individual provider units associated with the practices.

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Table 1 Location, number of partners, and practice list size of recruited practices

	No of practices (n=20)
Practice location:	
Inner city	4
Council estate	2
New town	1
Urban and rural	3
Urban	10
No of partners:	
1	3
2-3	5
4-5	8
>5	4
Practice list size:	
3000-5000	6
-8000	4
-10 000	4
-12 000	4
>12 000	2



Flow chart tracking patients through study

Analysis

Because of potential correlation between the outcomes of patients treated by the same health professional, estimates of variation between health professionals may be over precise unless intracluster correlation is adjusted for.¹⁷ We adjusted outcome for the age and sex of the patients as these characteristics may also influence outcome. The statistical modelling used generalised estimating equations¹⁸ in which the intracluster correlation is modelled by an exchangeable correlation structure. A logistic regression model was used for binary outcomes. Analyses were carried out with STATA statistical

Table 2 Demographic information and the five most common diagnoses. Values are numbers (percentages) of patients

	Total (n=1292)	Nurse practitioners (n=641)	General practitioners (n=651)
Age (years):			
>16	866 (67.0)	414 (64.6)	452 (69.4)
5-15	200 (15.5)	114 (17.8)	86 (13.2)
<5	224 (17.3)	112 (17.5)	112 (17.2)
Sex:			
Male	547 (42)	269 (42)	278 (43)
Female	743 (58)	371 (58)	372 (57)
Diagnosis*:			
Upper respiratory tract infection	475 (36.8)	236 (36.8)	239 (36.7)
Viral illness	147 (11.4)	81 (12.6)	66 (10.1)
No specific diagnosis	142 (11.0)	76 (11.9)	66 (10.1)
Minor injuries	119 (9.2)	70 (11.0)	49 (7.5)
Eye and ear conditions	98 (7.6)	45 (7.0)	53 (8.1)

*362 (28%) of patients had more than one diagnosis.

software.¹⁹ As some of the cost data were highly skewed, estimates for costs were compared with estimates based on non-parametric clustered bootstrap to check the robustness of the analysis.²⁰ Both estimates gave similar results and so only the direct estimates are presented.

Results

A total of 1716 patients were able to come to the experimental sessions and were informed about the study; 102 patients met one or more exclusion criteria and 298 declined to be randomised, leaving 1316 (76.7%) eligible patients who were randomised. Fifteen patients subsequently did not attend the appointment which they had booked. The figure gives further details of recruitment and response rates.

Table 2 shows the demographic characteristics of the patients and the main diagnoses. Two hundred (15.5%) patients were aged between 5 and 15, and 224 (17.3%) were children under 5. The commonest presenting problem was upper respiratory illness (36.8% of all consultations).

The nurse practitioners spent a mean of 11.57 minutes face to face with patients compared with 7.28 minutes by general practitioners (table 3). In addition, the nurses spent a mean of 1.33 minutes per patient in getting prescriptions signed. Table 4 shows that there was no significant difference in the percentage of patients who had a physical examination (nurse practitioners 88.1% v general practitioners 85.7%). Nurse practitioners issued fewer prescriptions than general practitioners, but the difference was not significant (391 (61.0%) v 421 (64.6%); odds ratio 0.88, 95% confidence interval 0.66 to 1.17). Nurses ordered more tests and investigations than general practitioners (56 (8.7%) v 37 (5.6%); 1.66, 1.04 to 2.66). In particular, the nurse practitioners carried out more tests associated with opportunistic screening such as urine testing and cervical screening. Nurse practitioners were also significantly more likely to ask patients to return (37.2% v 24.8%; 1.93, 1.36 to 2.73). In 81 (12.6%) consultations the nurse discussed the patient with a doctor, and in 26 (4.1%) consultations the patient was seen by the doctor.

The satisfaction questionnaires (table 5) showed patients were more satisfied after consultations with nurses. Scores were significantly higher for the adult medical interview satisfaction scale scores and all its subscales and for the paediatric medical interview satisfaction scale scores in children and two of its subscales. There were no significant differences in enablement scores between the groups. The differences in satisfaction scores were still significant when the scores were additionally controlled for the length of face to face contact (mean difference 0.16, 95% confidence interval 0.08 to 0.24).

In the two weeks after the initial consultation, patients who had seen a nurse practitioner were more likely to make a return visit to the clinic (mean number of returns 0.49 v 0.36). These return visits were mainly to general practitioners because there were more general practitioners than nurses in the practices and many of the nurses worked part time. There were no differences in health status at the end of two weeks.

Table 3 Differences in care given at initial consultation (values adjusted for age, sex, and intracluster correlation)

	Nurse practitioners		General practitioners		Adjusted mean difference (95% CI)	P value	Intracluster correlation
	No of patients	Mean (SD)	No of patients	Mean (SD)			
Total consultation time (min)	639	12.90 (6.28)	639	7.49 (4.75)	5.46 (4.16 to 6.78)	<0.001	0.19
Face to face consultation time* (min)	639	11.57 (5.79)	651	7.28 (4.80)	4.20 (2.98 to 5.41)	<0.001	0.17
Mean number of physical examinations per patient	612	2.28 (1.55)	635	1.95 (1.57)	0.19 (-0.03 to 0.71)	0.072	0.19
Mean number of return visits	638	0.49 (0.79)	651	0.36 (0.66)	0.14 (0.05 to 0.22)	0.002	0.0†

*Face to face consultation time = total consultation time minus time to have prescription signed or time to sign a prescription.

†Negative estimate of intracluster correlation coefficients.

Table 4 Differences in actions taken during consultation with nurse and general practitioners (values adjusted for age, sex, and intracluster correlation)

Action	Nurse practitioner		General practitioner		Odds ratio (95% CI)	P value	Intracluster correlation
	No of patients	%	No of patients	%			
Physical examination	590/640	88.1	572/649	92.2	1.76 (0.90 to 3.42)	0.097	0.10
Prescription given	391/641	61.0	421/651	64.7	0.88 (0.66 to 1.17)	0.375	0.03
Antibiotic prescribed	195/641	30.4	207/651	31.7	0.94 (0.76 to 1.17)	0.576	0.0*
Investigation carried out	56/641	8.7	37/651	5.6	1.66 (1.04 to 2.66)	0.033	0.01
Hospital referral	11/641	1.7	25/651	3.8	0.50 (0.16 to 1.63)	0.250	0.08
Asked to return	236/634	37.2	161/648	24.8	1.93 (1.36 to 2.73)	<0.001	0.05
Actually returned	224/634	35.3	184/647	28.4	1.42 (1.18 to 1.71)	<0.001	0.0*

*Negative estimate of intracluster correlation coefficient.

Table 6 shows health service costs. These include the basic salary costs of each health professional plus the costs of prescriptions, tests, referrals, and the cost of return consultations in the following two weeks. Since return consultations were not timed, we estimated that they lasted an average of 7 minutes for general practitioner consultations and 11.5 minutes for nurse practitioner consultations. There was no significant difference in the cost of care given by the nurse practitioners and the general practitioners. Further details of costings are available from us on request.

Discussion

We have evaluated care given by nurse practitioners working as part of primary care teams alongside general practitioners. Our results do not therefore relate to nurse practitioners who are working independently. It is often assumed that when nurses substitute for doctors, the same service is provided.²¹ However, the British literature suggests that the combi-

nation of nursing and medical skills provides a more comprehensive and flexible service for patients than that provided by doctors.²² Our study provides limited support for this theory.

In many respects the behaviour of the nurses was similar to that of general practitioners, but some important differences existed. Nurse practitioners spent more time with patients and were more likely to ask patients to return. There were no differences in health outcome, although the study did not have sufficient power to detect a difference in rare serious events.

The differences in working styles between nurse practitioners and general practitioners are shown by the number and types of tests ordered and the numbers of patients who were asked to return to surgery. Nurse practitioners carried out more opportunistic screening. This was also found in a comparative study in the United States.⁷

In Britain only two groups of nurses (district nurses and health visitors) are able to prescribe drugs, and then from a limited list of items. During training nurse practitioners do an extensive pharmacology module

Table 5 Differences in satisfaction after consultation (adjusted for age, sex, time, and intracluster correlation)

	Nurse practitioner		General practitioner		Adjusted mean difference (95% CI)	P value	Intracluster correlation
	Mean (SD) score	No of patients	Mean (SD) score	No of patients			
Adults							
Medical interview satisfaction scale	4.40 (0.46)	388	4.24 (0.52)	390	0.18 (0.09 to 0.26)	<0.001	0.04
Communication	4.35 (0.54)	370	4.21 (0.60)	384	0.13 (0.06 to 0.21)	0.001	0.0*
Distress relief	4.43 (0.47)	390	4.26 (0.57)	400	0.19 (0.08 to 0.29)	0.001	0.01
Clinician behaviour	4.44 (0.49)	375	4.22 (0.57)	369	0.23 (0.15 to 0.32)	<0.001	0.2
Enablement score	4.92 (3.62)	335	4.43 (3.65)	361	0.65 (-1.50 to 0.19)	0.13	0.14
Children							
Medical interview satisfaction scale†	4.39 (0.46)	220	4.17 (0.57)	181	0.23 (0.12 to 0.34)	<0.001	0.3
Communication with parent	4.58 (0.51)	223	4.48 (0.65)	190	0.07 (-0.26 to 0.16)	0.159	0.00
Communication with child	4.16 (0.63)	176	3.67 (0.77)	147	0.47 (0.29 to 0.67)	<0.001	0.11
Distress relief	4.41 (0.53)	222	4.21 (0.64)	186	0.21 (0.08 to 0.34)	0.002	0.04
Adherence intent	4.47 (0.53)	218	4.44 (0.53)	185	-0.01 (-0.10 to 0.08)	0.817	0.0*

*Negative estimate of intracluster correlation coefficient.

†Paediatric version.

Table 6 Difference in cost of consultation with nurse and general practitioners based on salary costs. Data are adjusted for age, sex, and intracluster correlation

	Nurse practitioner		General practitioner		Adjusted mean difference (95% CI)	P value	Intracluster correlation
	Mean (SD) cost (£)	Range	Mean (SD) cost (£)	Range			
Initial consultation:							
Total time	11.71 (25.23)	0.66-297.1	14.14 (29.62)	0.78-246.5	2.17 (-1.18 to 5.51)	0.204	0.009
Face to face time*	11.29 (25.18)	0.66-297.1	14.11 (29.63)	0.79-246.5	2.58 (-0.73 to 5.89)	0.127	0.009
Return consultation	6.40 (21.20)	0.0-219.3	6.56 (22.85)	0.0-217.3	-0.03 (-2.25 to 2.20)	0.98	0.008
Total costs:							
Total time	18.11 (33.43)	0.66-297.1	20.70 (33.43)	0.78-300.6	2.33 (-1.62 to 6.28)	0.247	0.0†
Face to face time*	17.69 (33.41)	0.66-297.1	20.68 (33.41)	0.78-300.6	2.73 (-1.20 to 6.66)	0.173	0.0†

*Face to face time = total consultation time minus time to get a prescription signed or time to sign a prescription.

†Negative estimate of intracluster correlation coefficient.

with supporting modules in pathophysiology and disease management, and they argue that they are able to use the same range of drugs as doctors.²³ We found that the nurse practitioners had similar prescribing behaviour to the general practitioners. As they had been qualified for some time, unlike nurse practitioners in other British studies,^{4 22 24} and were experienced nurses, this finding is not unexpected. These nurses were working in teams alongside general practitioners and consistent prescribing behaviour should, in theory, be adopted by all practice staff. Indeed, some practices had developed specific prescribing protocols for both general practitioners and nurse practitioners.

Patient satisfaction is an important component of nearly all studies looking at the role of nurse practitioners, and patients generally report high levels of satisfaction with nurse practitioner care.^{4 5 22 24 25} Increased satisfaction has been linked with longer consultations, and nurse practitioners have been shown to spend longer with patients than general practitioners. However, the differences in satisfaction remained in our study after we had controlled for differences in consultation time.

The health service costs of consultation with nurse practitioners were 12.5% lower than those for general practitioners, but this difference was not significant. However, a larger study with greater power to detect cost differences is needed. We were unable to do power calculations for cost before the study because none of the British studies of nurse practitioners have compared cost of consultations for general practitioners and nurse practitioners.^{4 5 22 24} In the United States studies have shown conflicting results.²⁵ Nurses were paid less than the general practitioners, but they took longer to see patients and more of their patients returned for further consultations. This reduced the overall difference in consultation costs. If lifetime training costs were included the general practitioner costs would be higher.

Conclusion

Our results relate to patients requesting a same day appointment in general practice and cannot necessarily be generalised to other situations. Overall, the clinical care and outcome were similar for nurse practitioners and general practitioners. Patients who requested a same day appointment were satisfied with nurse practitioner consultations. If nurse practitioners were able to work in different ways—for example, to shorten their consultation times (which our results suggest will not alter higher patient satisfaction with

What is already known on this topic

Nurse practitioners are increasingly used as point of first contact in primary care

Observational studies suggest patients react positively to use of nurse practitioners

What this study adds

Patients were more satisfied with nurse practitioner consultations even after their longer consultation times were allowed for

There were few differences in clinical care and no difference in clinical outcome between nurse practitioners and general practitioners

Health service costs were not significantly different between nurses and general practitioners

nurse practitioners) or reduce their return consultation rate—they could be more cost effective than general practitioners for this group of patients.

We thank all the patients who participated in the study and the administrative, nursing, and medical staff in the 20 practices recruited for the study.

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Cost analysis of nurse telephone consultation in out of hours primary care: evidence from a randomised controlled trial

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Abstract

Objective To undertake an economic evaluation of nurse telephone consultation using decision support software in comparison with usual general practice care provided by a general practice cooperative.

Design Cost analysis from an NHS perspective using stochastic data from a randomised controlled trial.

Setting General practice cooperative with 55 general practitioners serving 97 000 registered patients in Wiltshire, England.

Subjects All patients contacting the service, or about whom the service was contacted during the trial year (January 1997 to January 1998).

Main outcome measures Costs and savings to the NHS during the trial year.

Results The cost of providing nurse telephone consultation was £81 237 per annum. This, however, determined a £94 422 reduction of other costs for the NHS arising from reduced emergency admissions to hospital. Using point estimates for savings, the cost analysis, combined with the analysis of outcomes, showed a dominance situation for the intervention over general practice cooperative care alone. If a larger improvement in outcomes is assumed (upper 95% confidence limit) NHS savings increase to £123 824 per annum. Savings of only £3728 would, however, arise in a scenario where lower 95% confidence limits for outcome differences were observed. To break even, the intervention would have needed to save 138 emergency hospital admissions per year, around 90% of the effect achieved in the trial. Additional savings of £16 928 for general practice arose from reduced travel to visit patients at home and fewer surgery appointments within three days of a call.

Conclusions Nurse telephone consultation in out of hours primary care may reduce NHS costs in the long term by reducing demand for emergency admission to hospital. General practitioners currently bear most of the cost of nurse telephone consultation and benefit least from the savings associated with it. This indicates that the service produces benefits in terms of service quality, which are beyond the reach of this cost analysis.

Introduction

Nurse telephone consultation refers to an intervention in which experienced and specially trained nurses use decision support software to receive, assess, and manage calls from patients or their carers.¹ The concept was tested in a UK primary care setting in 1996,² and over 30% of general practice cooperatives now employ nurse advisers.³ The safety and effectiveness of out of hours general practice care augmented by nurse telephone consultation has been shown in a randomised controlled trial.⁴ This trial found a substantial reduction in general practitioner workload during intervention periods, nurses managing 50% of calls without referral to a general practitioner, without any increase in the number of deaths observed within seven days of a call. Although our original hypothesis was that calls handled by the nurse alone would primarily replace calls for which the general practitioner would have delivered advice by telephone, the intervention was also associated with a reduction in the number of home visits by general practitioners, patients attending an out of hours surgery, and emergency hospital admissions. We examine the economic implications of these findings.

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Full details of the methodology can be found on the BMJ's website