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9 Brazier JE, Harper R, Jones N, O'Cathain A, Thomas K, Usherwood T, et al. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. *BMJ* 1992;305:160-4.
10 Landgraf J, Maunsell E, Speechley KN, Bullinger M, Campbell S, Ware J. Canadian, French, German and UK versions of the child health questionnaire: methodology and preliminary item scaling results. *Qual Life Res* 1998;7:433-45.
11 McKinley RK, Cragg DK, Hastings AM, French DP, Manku-Scott TK, Campbell S, et al. Comparison of out of hours care provided by patients' own general practitioners and commercial deputising services: a randomised controlled trial. 2. Outcome of care. *BMJ* 1997;314:190-3.
12 Wolf MH, Putnam SM, James SA, Stiles WB. The medical interview satisfaction scale: development of a scale to measure patient perceptions of physician behaviour. *J Behav Med* 1978;1:391-401.
13 Lewis C, Scott D, Pantell R, Wolf M. Patient satisfaction with children's medical care: development, field test and validation of a questionnaire. *Med Care* 1986;24:209-15.
14 Howie JGR, Heaney D, Maxwell M, Walker JJ. A comparison of the patient enablement instrument (PEI) against two established satisfaction scales as an outcome measure of primary care consultations. *Fam Pract* 1998;15:165-71.
15 Ware J. *SF-36 health survey: manual and interpretation guide*. Boston: Health Institute, New England Medical Center, 1993.
16 Netten A, Knight J, Dennett J, Cooley R, Slight A. *A ready reckoner for staff costs in the NHS. Volume 1. Estimated unit costs*. Canterbury: Personal Social Services Research Unit, University of Kent, 1998.
17 Roberts C. The implication of variation in outcome between health professionals for the design and analysis of randomised controlled trials. *Stat Med* (in press).
18 Zeger SL, Liang KY, Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 1986;42:121-30.
19 Stata Corporation. *Stata statistical software, release 5.0*. College Station, TX: Stata Corporation, 1997.
20 Barber JA, Thompson SG. Analysis and interpretation of cost data in randomised controlled trials: review of published studies. *BMJ* 1998;317:1195-200.
21 Richardson G, Maynard A. *Fewer doctors? More nurses? A review of the knowledge base of doctor-nurse substitution*. York: Centre for Health Economics, University of York, 1995.
22 NHS Executive. *Nurse practitioner evaluation project: final report*. Uxbridge. Coopers and Lybrand, 1996.
23 Mayes M. A study of prescribing patterns in the community. *Nursing Standard* 1996;10(29):34-7.
24 Reveley S. The role of the triage nurse practitioner in general medical practice: an analysis of the role. *J Advan Nurs* 1998;28:584-91.
25 Office of Technology Assessment. *Nurse practitioners, physician assistants and certified midwives: a policy analysis*. Washington DC: US Government Printing Office, 1986. (Health technology case study 37, OTA-HCS-37.)

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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

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Subjects and methods

We undertook a cost analysis of the establishment and running of a nurse telephone consultation intervention for a year. The trial was designed to detect equivalence in the incidence of a rare event (death within seven days of a call), and total numbers of calls exceeded 14 000. The size of the trial was therefore considered sufficient for a cost analysis. A full cost effectiveness analysis was not possible because it was not an objective of the trial to measure long term patient outcomes and because of the difficulties involved in measuring other benefits arising from the intervention and combining these with patient outcomes.

We adopted the perspective of the NHS for the study. General practitioner costs and savings not resulting in changes in NHS funding of practices were considered separately. Patient and carer costs (for example, travel) were not measured as they were difficult to estimate and their impact in the overall cost analysis would be small. Cost data were collected prospectively, enabling a bottom up approach to the valuation of resources. The trial ran from January 1997 to January 1998, and therefore calculations are based on 1997-8 prices.

Nurse telephone consultation was added to an existing general practice cooperative comprising 55 general practitioners in a shared call centre in Wiltshire, England, serving a population of 97 000 registered patients. In the total cost estimate we have included only categories of resource use for which costs were significantly different—that is, those additional inputs directly linked with the two options.[5] We excluded common, fixed costs, such as overhead costs, costs for non-nurse staff, and routine operating costs. The service was run from a room within the cooperative call centre, which was used for administration during the day and therefore incurred no extra cost. Generalisation of this aspect of costing, therefore, should take account of the likely availability of such space.

With reference to recent recommendations on the reporting of economic evaluations, we report interval estimates alongside point estimates for all the outcomes of interest and for the alternative scenarios of extreme values for savings, plus and minus 10% for costs.[6 7] Event rates and rate differences are reported with 95% confidence intervals.

Data on capital costs were obtained from university records, data on operating costs were collected from the cooperative, and data on length of hospital stay were taken from the trial database. National data on average costs per inpatient day[8] were used to calculate the costs of emergency admission on the assumption that resources freed up by the programme would be employed for other patients at a cost effectiveness ratio similar to those of other widely accepted hospital based treatments, or alternatively, that these would be redeployed in the long run to other forms of care.

Savings were calculated for differences in outcome during the trial year (emergency hospital admission, home visits by general practitioner, and surgery attendances within three days). Savings for general practitioners are calculated using Netten's unit cost of £14 per consultation.[8] We cannot assume, however, that a reduction in follow up visits would lead to a reduction in per capita fees, even in the long run. The savings we report are more likely to be a reflection of the opportunity cost of the general practitioner's time. Data on surgery attendances within three days were extrapolated from a randomly selected four week period of night duty during the trial year (two blocks of two weeks) and show wide confidence intervals.

The use of a time block randomised design for our trial meant that the intervention ran for exactly half the evenings and weekends in a year. So that the cost analysis is meaningful outside the context of the trial, we have multiplied data gathered by two, to show the costs and savings over a year.

Table 1 Cost analysis of nurse telephone consultation in out of hours primary care (1997-8 prices); savings within general practice are excluded

Expenditure	Item	Actual costs (£)	Extrapolated full year cost (£)
Human resources			
Recruitment	Advertising	997	997
Nurse salaries	G grade mid point (1.4 whole time equivalent)	29 737	59 474
Indemnity insurance	Annual policy (up to £1 million per claim)	1 538	1 538
Cooperative management	Services rendered in set up period	433	433
Education programme	100 hours contact time G grade midpoint	1 010	756*
	1 H grade × 0.25 whole time equivalent	5 121	3 832*
	10 days lecturer B at £150 per day	1 500	561*
Technical support for information technology	Linking new software to the database	4 510	4 510
Subtotal		**44 846**	**72 101**
Equipment			
Computers	Two desktop personal computers	3 121	1 168*
Decision support software	Networked version plus online support	16 014	5 991*
Furniture	Two desks and chairs	580	138†
Telephones	Two telephones and headsets	240	57
Digital tape recorder	One recorder, tapes, and on-site technical support	7 508	1 782
Subtotal		**27 463**	**9 136**
Total per annum			**81 237**
Savings			
Adult emergency admissions			72 850
Child emergency admissions			21 572
Total savings per annum			**94 422**

*Annuity factor, 3 years at 6%.
†Annuity factor, 5 years at 6%.

Results

The additional costs associated with the intervention were £81 237 per annum. This, however, determined a £94 422 reduction of other costs within the secondary sector arising from reduced emergency admissions, suggesting that were the costs of the intervention to be borne by the NHS, overall net savings would still be achieved (table 1). In addition, reduced general practice costs of £16 928 per annum were observed through reduced travel costs and reduced appointments at surgery within three days of a call.

Emergency admissions within three days of a call

Calculation of age specific length of stay required data on date of birth and date of discharge. One or other of these data was missing in 27 (3%) of 935 cases known to have been admitted to hospital (12 in the control arm and 15 in the intervention arm) leaving 908 valid cases for analysis (table 2). The potential for missing data, and therefore for bias, was equal in both arms of the trial as a function of randomisation.

Table 2 Number of emergency hospital admissions within three days of a call

Variable	Control group (n=7308)	Intervention group (n=7184)
Children aged <16 years	99	71
Adult admissions	396	342
Missing date of discharge	5	4
Missing date of birth	7	11
Total admissions within 3 days	507	428

Patients managed by nurse telephone consultation were less likely to be admitted to hospital and if admitted were less likely to be admitted for short stays of 1-3 days. The frequency distributions of length of stay for adults and children are shown in figures 1 and 2. Discharge on the same day as admission was categorised as a one day stay and an overnight stay as two days. Length of stay ranged from 1-64 days for children and 1-185 days for adults and has a skewed distribution, with most patients admitted for less than five days. This suggests that most of the difference observed between the two arms of the trial relates to lengths of stay of between one and five days. The modal value for length of stay was two days for all ages. Savings from reduced admissions are calculated on the basis of observed differences in the number of admissions (adjusted for differences in denominator) and length of stay per admission. These cost differences are shown in table 3.

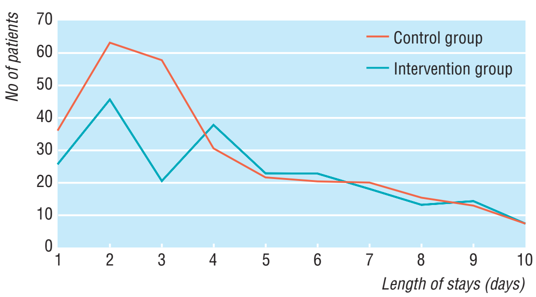

Fig 1 Emergency hospital admissions for adults and length of stay

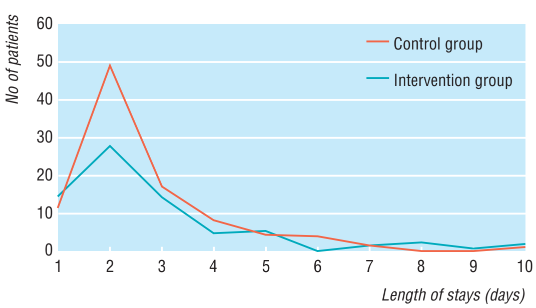

Fig 2 Emergency hospital admissions for children and length of stay

The intervention resulted in 25 fewer child emergency admissions (9.2 per 1000; $\chi^2=3.86$, $P=0.049$) and 54 fewer adult emergency admissions (11.4 per 1000; $\chi^2=3.87$, $P=0.049$) within three days of a call. Extrapolation from these values gives savings derived from reduced adult admissions over a year of £72 850 (£3642 to £165 369). Savings from reduced child admissions of £29 268 per annum were reduced to £21 572 (£86 to £36 692) by the costs of additional admission through accident and emergency (13 cases at £296 in the trial year totalling £7696 per annum).

Attendance at a practice within three days of a call

Assuming that rates of attendance within three days observed in night calls were observed throughout, 1069 (613 to 1527) attendances could have been expected in the control arm and 575 (253 to 1092) in the intervention arm. On the basis of an estimated cost of £14 per 8.4 minute consultation, the cost saving for a full year would be £13 568 (£3212 to −£30 636). The wide confidence intervals around this value is because it is extrapolated from a much smaller dataset than that used for the rest of our study.

Reduced travel costs associated with home visits

General practitioners made 428 fewer home visits during intervention periods, generating savings of £3360 (£2578 to £4198) in a year. This value is based only on reduced fuel costs, available in the short term, but in the long term savings could also be made through the modification of the annual mileage terms in the lease contract.

Sensitivity analysis

A sensitivity analysis was carried out to test the impact of alternative scenarios for costs and savings, based on the premise that costs are borne by the NHS and that only savings from reduced admissions count as savings for the NHS (table 4). Costs and savings are per annum.

Alternative scenarios for net costs per annum are shown in table 5. In a scenario where point estimates for savings apply, the net savings observed across both sectors were £13 185. The break even point for the fixed costs of the intervention with savings from reduced hospital admissions is shown in figure 3. Taking the cost of a two day stay in hospital for an adult as a proxy for average cost per admission, the intervention would have needed to save 138 admissions per year to break even.

In the best case situation (upper 95% confidence limit for outcomes applies together with 10% lower costs), net savings of £131 948 would occur. In the worst case situation (lower 95% confidence limit for

Table 3 Average cost per inpatient stay and cost differences during trial year. Values (£) are based on observed differences in number of admissions and length of stay per admission in intervention group

	Adults			Children		
Length of stay (days)	Cost per stay*	Observed difference	Cost difference	Cost per stay†	Observed difference	Cost difference
1	377	−10	−3 770	271	+2	+542
2	588	−18	−10 584	542	−21	−11 382
3	799	−38	−30 362	813	−2	−1 626
4	1010	+7	+7 070	1084	−2	−2 168
5	1221	+1	+1 221	1355	0	0
Total cost difference			**−36 425**			**−14 634**

*Assuming generic care at £211 per day plus £166 costs per admission to accident and emergency. In total, 220 of 402 adults in control arm (55%) and 203 of 346 adults in intervention arm (59%) were admitted to hospital through accident and emergency, the remainder being admitted directly to wards. Cost per admission includes assumed cost for accident and emergency of 56% of the full cost per accident and emergency inpatient day. Child admissions through accident and emergency differed between two arms of trial; related costs discussed in text. †Assuming paediatric care at £271 per day.

Table 4 Sensitivity analysis testing impact of alternative scenarios for costs and savings based on point estimates (95% confidence intervals) for numbers of emergency admissions and length of stay for all admissions of up to and including five days' duration. Table includes additional costs for accident and emergency for children admitted in intervention arm, and includes savings within general practice: unit costs for travel are assumed to be £4.18 per home visit; attendance at surgery costed at £14.00 per consultation

	Event rate/1000 calls					
Analysis	Control (n=7308)*	Intervention (n=7184)†	Rate differences	Significance	Cost difference	Extrapolated cost difference
Child admissions	35.6 (29 to 43)	26.4 (20 to 33)	−9.2 (−0.004 to −1.84)	χ^2=3.86, P=0.0495	−10 786 (−43 to −19 846)	−21 572 (−86 to −39 692)
Adult admissions	87.5 (79 to 96)	76.1 (68 to 85)	−11.4 (−5 to −23)	χ^2=3.87, P=0.049	−36 425 (−1821 to −82 685)	−72 850 (−3642 to −165 369)
Home visits	238.8 (228 to 249)	183.3 (174 to192)	−55.5 (−42 to −69)	χ^2=66.85, P<0.001	−1663 (−1289 to −2099)	−3360 (−2578 to −4198)
Attendances at surgery within 3 days of call	146.3 (83 to 209)	80.0 (35 to 152)	−66.3 (16 to −148)	χ^2=2.36, P=0.13	−6784 (1606 to −15 143)	−13 568 (3212 to −30 636)

*4528 adults, 2780 children.
†4494 adults, 2690 children.

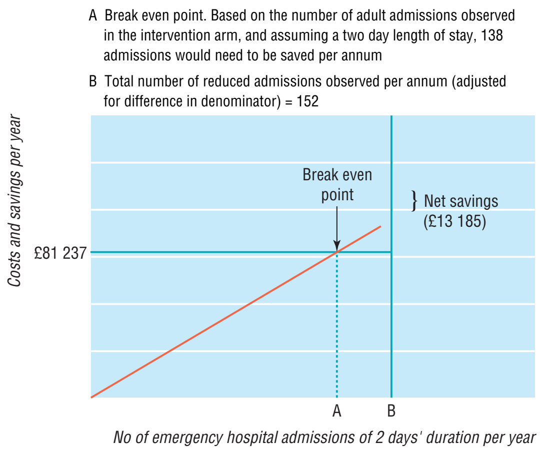

Fig 3 Break even point of fixed costs of intervention with savings from reduced hospital admissions

outcomes applies and costs are inflated by 10%) a net cost of £85 635 would arise.

Discussion

The greatest impact on the results of the cost analysis was generated by costs for emergency hospital admissions, a secondary analysis of admission data for this trial having shown that the intervention saved short stays (1-3 days) in hospital. The reasons for this reduction are not clear. It is possible that the nurse intervention prevented unnecessary admissions, in particular those of short duration, by improved management of patient care at home or by improved assessment of urgency as a consequence of using decision support software. We postulate that the admissions avoided will be shown to have non-specific diagnoses, and we are currently gathering data on diagnosis at discharge from hospital to try and illuminate this point. Unnecessary admission places patients at risk of iatrogenic harm,[9] and recent research has suggested that sociodemographic patient factors may account for some 45% of variation in a twofold difference in emergency admission rates between general practices.[10] Further assessment of the process of care in systems employing nurse telephone consultation may enable the factors associated with reduced admission to be better understood. In the worst case scenario, the intervention incurred net costs, but there are uncertainties in all economic evaluations and decision makers typically have to weigh up the results of sensitivity analyses based on known and unknown parameters.

Table 5 Alternative scenarios for net cost (£) per annum assuming both costs and savings are attributable to NHS (excludes savings within general practice)

Assumption	Cost per annum	Savings per annum	Net savings per annum
Point estimates for savings apply	81 237	94 422	13 185
Upper 95% confidence limit for savings applies	81 237	205 061	123 824
Lower 95% confidence limit for savings applies	81 237	3 728	−77 509
Costs inflated by 10% with point estimates for savings	89 361	94 422	5 061
Costs reduced by 10% with point estimates for savings	73 113	94 422	21 309
Post trial staffing ratio	57 232	94 422	37 190

Generalisability of findings

Analyses of data at patient level from randomised controlled trials are sometimes considered to be more valid than analyses based on decision models.[11] Furthermore, to provide meaningful information for the allocation of scarce healthcare resources, trials should use usual practice as the comparator.[12 13] Although the cost analysis presented here fulfils these criteria, we have previously argued that our findings relate to the system we tested, including the selection and training of nurses and the software used.[4] In some cooperatives and elsewhere in Europe, general practitioners provide a telephone service[14] and the impact of these on other health services should also be tested.

To make the results of this study more easily generalisable to other settings, an "ingredients' approach" has been adopted—that is, physical units of resources consumed and saved have been reported separately from their unit costs.[15]

Allocation of costs and savings

The costs and savings associated with this intervention occur in different NHS budgets. After the trial, collaborating general practitioners showed their willingness to pay for the service by voting to retain it, although a slight reduction was made to staffing levels to reflect perceived overstaffing during weekday evenings. As in Wiltshire, general practitioners elsewhere incur the continuing costs, with some receiving partial funding through development monies for out of hours' services administered by health authorities. Although the intervention reduced general practitioner travel costs, and although fewer patients may be seen in follow up, the major saving associated with reduced admissions to hospital benefits secondary care, and only in the long term.

Why then do general practitioners continue to pay for nurse telephone consultation? Perhaps they value the reduction in personal stress when being on-call with a nurse colleague or the faster access to medical advice available to patients and their carers. In the pilot study for this trial, 87% of respondents to a satisfaction survey were satisfied or highly satisfied with the advice they received from a nurse,[2] and during the trial fewer complaints were made concerning care given when the nurse service operated than when it did not. Pilot sites for "NHS Direct" report similar levels of satisfaction with nurse advice,[16] although further work on the process and quality of care from the patient's perspective is needed.

Implications of the analysis

From the perspective of an equivalence trial, that there were fewer emergency admissions to hospital in the intervention arm was only of consequence because they were within the limits defined for equivalence. The observation is intriguing from an economic perspective because of its potential to reduce emergency demand for admission in the long run. Decision makers should appraise the net costs of this service based on point estimates, bearing in mind that values toward the centre of a confidence interval are known to be more likely, and that lower limits of confidence rarely play a practical part in decision making.[17]

The impact of introducing nurse telephone consultation in a setting where primary care is financed primarily on a fee for service basis may be different. In our study, general practitioners were willing to pay for the service out of their own budgets, with practice revenues remaining unchanged. In principle, the reduction in general practitioner visits may result in a cut in practice revenues in a fee for service setting, making the financial burden of nurse telephone consultation exceed general practitioners' willingness to pay for the service. However, whether practice revenues would be affected by a reduction in the number of visits for the patients who used the service depends on the fee charged for telephone consultation, on the demand for the new service, and on the rate of substitution between telephone consultation and office visits. If the demand for telephone consultation and office visits are sufficiently sensitive to price changes, relative fees can be set at a level that makes the service attractive to general practitioners, allowing the system to benefit from a reduction in expenditure associated with secondary care. Moreover, a reduction in practice visits for patients who used the nurse telephone consultation service may not even result in a decrease in overall revenues related to visits if practices faced excess demand.

If this level of saving (£94 422 for a population of 97 000) was achieved across England it would be comparable with the estimated costs of providing NHS Direct sites, at £1 per head of population per year.[18] In our study, however, automatic routing of calls meant that all out of hours calls went first to a nurse who provided active management for 50% of callers who did not need contact with a general practitioner. To date, this happens in only a few NHS Direct sites, the majority having been set up as parallel services, not embedded within primary care. Under these circumstances, with callers able to choose between NHS Direct and their own general practitioner or cooperative, we cannot assume that emergency hospital admissions would be reduced. The overall effect is likely to be a dilution of the savings shown.

What is already known on this topic

The safety and effectiveness of out of hours general practice care augmented by nurse telephone consultation have been shown in a randomised controlled trial

An economic evaluation of the trial was needed to inform decision making in the allocation of scarce healthcare resources

What this study adds

The nurse service was associated with reduced admission to hospital for both adults and children

This factor had the greatest impact on the analysis, which showed that nurse telephone consultation in out of hours primary care may reduce overall NHS costs

We thank the South Wiltshire Out of Hours Project Group, whose work provided the baseline data for this study.

Contributors: VL and MM conceived the study. VL designed the study, conducted the cost analysis, and wrote the paper. FS provided advice on health economics throughout and contributed to the paper. SG advised on the use of trial data and contributed to the interpretation of data. JT analysed data on emergency hospital admission and length of stay, and MM provided statistical advice. HS revised the paper and contributed to its final form, and all the authors participated in the discussion and interpretation of the results. VL and SG will act as guarantors for the paper.

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1 Lattimer V, George S. Nurse telephone triage in out-of-hours primary care. *Primary Care Manage* 1996;6:3-6.
2 South Wiltshire Out-of-hours project Group (SWOOP). Nurse telephone triage in out of hours primary care: a pilot study. *BMJ* 1997;314:198-9.
3 National Association of GP Co-operatives. *The role of nursing in GP co-operatives.* Maidstone: National Association of GP Co-operatives, 1998.
4 Lattimer V, George S, Thompson F, Thomas E, Mullee M, Turnbull J, et al. Safety and effectiveness of nurse telephone consultation in out of hours primary care: randomised controlled trial. *BMJ* 1998;317:1054-9.
5 Drummond MF, O'Brien B, Stoddart G, Torrance GW. *Methods for the economic evaluation of health care programmes,* 2nd ed. Oxford: Oxford University Press, 1997.
6 Barber JA, Thompson SG. Analysis and interpretation of cost data in randomised controlled trials: review of published studies. *BMJ* 1998;317:1195-9.
7 Drummond MF, Jefferson TO. Guidelines for authors and peer reviewers of economic submissions to the BMJ. *BMJ* 1996;313:275-83.
8 Netten A, Dennett J, Knight J. *Unit costs of health and social care.* University of Kent at Canterbury: Personal Social Services Research Unit, 1998.
9 Janowski R. What do hospital admission rates say about primary care? *BMJ* 1999;319:67-8.
10 Reid FDA, Cook DG, Majeed A. Explaining variation in admission rates between general practices: cross sectional study. *BMJ* 1999;319:98-103.
11 Briggs A, Sculpher M, Buxton B. Uncertainty in the economic evaluation of health care technologies: the role of sensitivity analysis. *Health Econ* 1994;3:95-104.
12 Pocock SJ. *Clinical trials: a practical approach.* Chichester: Wiley, 1983.
13 Jones B, Jarvis P, Lewis JA, Ebbutt AF. Trials to assess equivalence: the importance of rigorous methods *BMJ* 1996;313:36-9.
14 Christiansen MB, Olesen F. Out-of-hours service in Denmark: evaluation five years after reform. *BMJ* 1998;316:1502-5.
15 Levin HM. *Cost-effectiveness: a primer.* Beverley Hills, CA: Sage, 1983.
16 Nichol J, Munroe J, O'Cathain A, Knowles E. *Evaluation of NHS direct first wave sites. First interim report to the Department of Health.* School of Health and Related Research, University of Sheffield: Medical Care Research Unit, 1998.
17 Briggs A, Fenn P. Confidence intervals or surfaces? Uncertainty on the cost effectiveness plane. *Health Econ*1998;7:723-40.
18 College of Health. *Developing NHS direct* London: College of Health, 1998.

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