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Richards, D.A., Godfrey, L., Richardson, G. orcid.org/0000-0002-2360-4566 et al. (4 more authors) (2002) Nurse telephone triage for same day appointments in general practice: multiple interrupted time series trial of effect on workload and costs. *British medical journal*. pp. 1214-1217. ISSN 1756-1833

<https://doi.org/10.1136/bmj.325.7374.1214>

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Primary care

Nurse telephone triage for same day appointments in general practice: multiple interrupted time series trial of effect on workload and costs

David A Richards, Joan Meakins, Jane Tawfik, Lesley Godfrey, Evelyn Dutton, Gerald Richardson, Daphne Russell

Abstract

Objective To compare the workloads of general practitioners and nurses and costs of patient care for nurse telephone triage and standard management of requests for same day appointments in routine primary care.

Design Multiple interrupted time series using sequential introduction of experimental triage system in different sites with repeated measures taken one week in every month for 12 months.

Setting Three primary care sites in York.

Participants 4685 patients: 1233 in standard management, 3452 in the triage system. All patients requesting same day appointments during study weeks were included in the trial.

Main outcome measures Type of consultation (telephone, appointment, or visit), time taken for consultation, presenting complaints, use of services during the month after same day contact, and costs of drugs and same day, follow up, and emergency care.

Results The triage system reduced appointments with general practitioner by 29-44%. Compared with standard management, the triage system had a relative risk (95% confidence interval) of 0.85 (0.72 to 1.00) for home visits, 2.41 (2.08 to 2.80) for telephone care, and 3.79 (3.21 to 4.48) for nurse care. Mean overall time in the triage system was 1.70 minutes longer, but mean general practitioner time was reduced by 2.45 minutes. Routine appointments and nursing time increased, as did out of hours and accident and emergency attendance. Costs did not differ significantly between standard management and triage: mean difference £1.48 more per patient for triage (95% confidence interval -0.19 to 3.15).

Conclusions Triage reduced the number of same day appointments with general practitioners but resulted in busier routine surgeries, increased nursing time, and a small but significant increase in out of hours and accident and emergency attendance. Consequently, triage does not reduce overall costs per patient for managing same day appointments.

Introduction

Changes in the delivery of primary care¹ have led to an increase in workload.² Much of this workload is accounted for by requests for same day appointments (urgent appointments),³ home visits,⁴ and out of hours calls.⁵⁻⁶ Attempts to manage this workload include out of hours doctors' cooperatives⁷ and delegation to nurses.⁸⁻¹¹ Nurses can run minor illness clinics effectively,¹² and nurse practitioners provide an alternative to general practitioner care.¹³ Randomised controlled trials have shown that nurse practitioners¹⁴⁻¹⁵ and practice nurses¹⁶ can cater for same day and urgent appointments, and this has led to calls for nurses to coordinate delivery of patient care.¹⁷

Telephone consultation by doctors has increased,¹⁸ as have telephone triage systems in accident and emergency,¹⁹ in paediatrics,²⁰ and through health advice lines such as NHS Direct.²¹ A recent study found that 19% of practices surveyed managed same day requests using telephone triage.²² Evidence for the safety and effectiveness of this approach comes from one randomised controlled trial in which telephone triage of out of hours calls by a nurse did not increase adverse events.²³

Studies of the effect of triage on workload have been small and had a restricted focus (for example, calls in the morning only,³ out of hours,²⁴ and home visit requests received before 10 30 am⁴). Triage has been reported to reduce general practitioners' same day activity by between 25% and 49%,³⁻⁴⁻²⁴ but only one small study examined use of services after triage. This study found an increased rate of return to the practice within the first week after triage.³

We are not aware of any studies of comprehensive nurse telephone triage systems for patients requesting same day appointments during working hours or of any studies examining the costs of such services in routine practice. We investigated the effect on general practitioner and nurse workloads and cost of patient care of nurse telephone triage and standard appointment management systems—both operating routinely in primary care.

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bmj.com 2002;325:1214

Participants and methods

The study took place in a large general practice in York. The practice had five surgery sites in inner city York, a list size of 25 000, 16 general practitioners (nine full time, four part time, two retainers, and one registrar), and a nursing team consisting of one full time nurse team leader and seven practice nurses (whole time equivalents 3.3). The practice population had a slightly poorer standardised mortality ratio, higher unemployment, and more pensionable residents than the regional average. Three of the practice's surgery sites participated in the study, giving a total study population of 20 800.

Design

We chose a multiple interrupted time series design (figure) to detect differences between the two systems in routine practice. We entered all consecutive patients requesting same day appointments into the trial using the broadest possible inclusion criteria. We used three repeated measurement points to establish stable baselines at each site during standard management. Nine measurement points were used after the introduction of triage to allow multiple cross sectional comparisons of data during the sequential inclusion of the sites into the study. We chose this repeated measures design to control for threats to internal validity (such as increasing professional expertise) or continuous and discrete historical events (such as undefined health trends or defined events such as influenza epidemics). Sequential introduction of triage into multiple sites controlled for any interaction between the intervention, time, and different settings. At each site, therefore, for one week in each of three consecutive months, all patients request-

ing same day appointments entered the trial and were managed by the standard management system. The triage system was then continuously introduced, data being collected on patients for one week in each of the next nine months. Surgery sites entered the study sequentially at three monthly intervals. All patients requesting same day contact between 8.30 am and 5 pm during data collection weeks were eligible for the study (figure). The multiple measurement points allowed us to use autocorrelation analyses to assess for any trends caused by confounding effects of associations between data points over time, unrelated to the intervention.

Interventions

In both systems, patients requesting a same day appointment were offered a routine appointment by receptionists, who were instructed not to attempt any triage. If patients continued to request a same day appointment the following procedures applied:

Standard management—Patients requesting same day appointments were fitted into extra general practitioner appointments at the end of each surgery by receptionists. Occasionally, general practitioners took telephone calls and practice nurses saw some patients on an ad hoc basis.

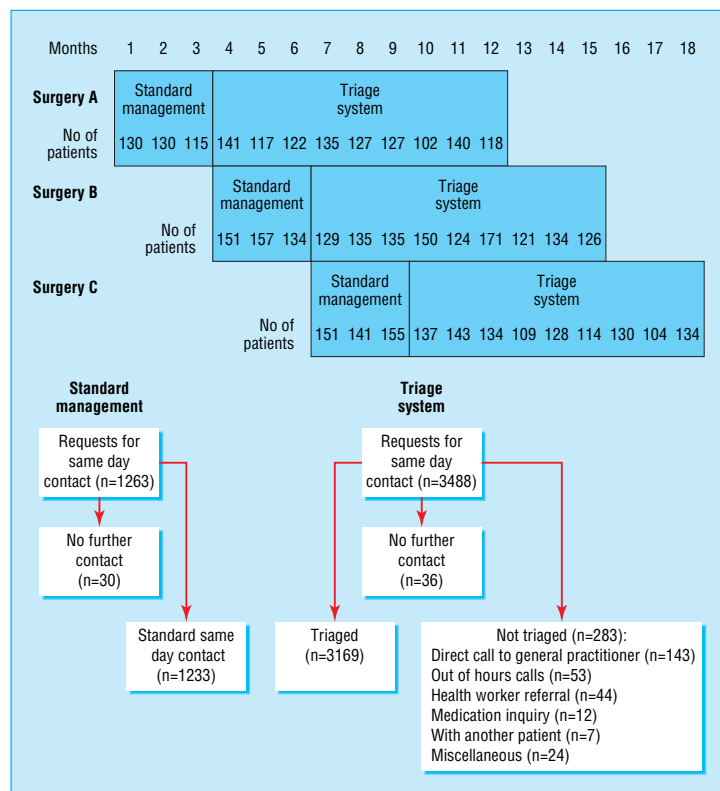
Triage system—Receptionists passed on requests for same day appointments to six experienced practice nurses who had received 30 hours of minor illness management training and were supported by computerised management protocols developed by the practice. Nurses assessed and managed the call through telephone advice only, a same day nurse appointment, a same day general practitioner appointment, a home visit, or a routine nurse or general practitioner appointment. Individual nurses triaged patients across all three sites. The triage nurses could use reserved nurse and general practitioner appointment slots, to which they had sole access. The nurses' triage role was in addition to their usual routine duties, triage time being made available through a skill mix review reported in detail elsewhere.²⁵

Before data collection, both systems were pilot tested to ensure capacity was sufficient to meet the demand for same day appointments.

Measures

We collected data on all requests for same day appointments for one week in every month. A computer code was entered into the electronic record of patients receiving same day appointments to alert the general practitioner or nurse to record details of the consultation in standardised diaries. The information recorded included the type of consultation (telephone, appointment, or visit), the time taken for the consultation, up to three presenting complaints per patient (chosen from 10 categories; table 1), and up to three clinical decisions made during the consultation (chosen from 13 categories—for example, prescription, advice, or type of onward referral). We checked and validated diary data against clinical notes in the electronic patient record. We also used the electronic patient record to determine demographic details, final point of same day contact, and use of services during the month after contact.

All costs for same day appointment activity and one month follow up care were calculated at the level



Study design and flow chart of patients through study

of the individual patient. We calculated costs of general practitioner and nurse time using salary and earning scales current at the time of the study multiplied by the length of consultation. Prescription costs were taken from the *British National Formulary*, and the costs of tests and emergency care were obtained from the local provider units. Because follow up consultations were not timed, we used the average time for telephone consultations, appointments, or home visits recorded in the standard management or triage conditions to calculate follow up general practitioner and nurse costs.

Analysis

We analysed the data on an intention to treat basis. The only patients for whom data were not analysed were those who had no further contact with a general practitioner or nurse after their request and so had no data recorded. All other patients requesting a same day service were entered into the analysis.

To determine if triage influenced the time taken to manage same day requests, we did time series analyses of the mean total, general practitioner, and nurse times per patient, checking for autocorrelations or seasonal effects for the complete sample and individual practices. We used these analyses to identify the independent variables to be fitted into an analysis of variance model to predict the time taken to manage requests by general practitioners, nurses, or both. As the time series analysis was based on a short series (18 data points), we retained "month" (both in real time and recoded for each practice from a baseline when triage actually started in that practice) in preliminary versions of the main analysis of variance model. We used general linear modelling procedures to estimate parameters and test goodness of fit. We calculated relative risks and associated confidence intervals for the final point of contact after standard management or triage and for the impact of different types of triage outcome on subsequent use of services.

We summated cost data for each individual patient, calculating sample means and standard deviations for each cost variable. We compared the average (mean) costs between the groups using independent *t* tests. Total cost data were positively skewed, and we therefore checked the validity of using the *t* test (that is, tested its robustness to non-normality) by bootstrapping and calculating 95% confidence intervals around the observed and bootstrapped means. Bootstrapping is a technique used to estimate standard errors and other methods of statistical precision.²⁶ We did sensitivity analyses using lower and higher estimates of staff costs and both local and national estimates of emergency and out of hours costs.

Results

We included 4685 patients, 1233 in standard management and 3452 in the triage system (figure). The triage group had more presenting complaints per patient, a higher proportion of respiratory and dermatological complaints, and fewer mental health complaints (table 1).

At all surgery sites, triage resulted in fewer patients receiving a general practitioner appointment than standard management (table 2). More patients in the

Table 1 Demographic information and presenting complaints of patients requesting same day appointments according to system of management. Values are numbers (percentages) of patients unless stated otherwise

	Standard management (n=1233)	Triage system (n=3452)	95% CI for difference (%)
Age (years)†:			
0-4	181 (14.7)	618 (17.9)	-5.6 to -0.9
5-16	133 (10.8)	400 (11.6)	-2.8 to 1.2
17-24	98 (7.9)	274 (7.9)	-1.8 to 1.8
25-44	335 (27.2)	868 (25.1)	-0.9 to 4.9
45-64	189 (15.3)	488 (14.1)	-1.1 to 3.5
65-74	113 (9.2)	318 (9.2)	-1.9 to 1.8
≥75	184 (14.9)	486 (14.1)	-1.5 to 3.2
Sex‡:			
Male	480 (38.9)	1361 (39.4)	-3.7 to 2.7
Female	753 (61.1)	2091 (60.6)	-2.7 to 3.7
Presenting complaint:			
Respiratory system	414 (33.6)	1355 (39.3)	-8.8 to -2.6***
Dermatological	162 (13.1)	536 (15.5)	-4.6 to -0.2*
Musculoskeletal	176 (14.3)	459 (13.3)	-1.3 to 3.2
Digestive system	151 (12.2)	435 (12.6)	-2.5 to 1.8
Genitourinary system	143 (11.6)	405 (11.7)	-2.2 to 2.0
Nervous system	61 (4.9)	203 (5.9)	-2.4 to 0.5
Mental health	84 (6.8)	166 (4.8)	0.4 to 3.6**
Cardiovascular system	61 (4.9)	158 (4.6)	-1.0 to 1.8
Eyes	39 (3.2)	148 (4.3)	-2.3 to 0.1
Other infectious disease	43 (3.5)	143 (4.1)	-1.9 to 0.6
Other	51 (4.1)	143 (4.1)	-1.3 to 1.3
Mean (SD) No of complaints	1.13 (0.36)	1.20 (0.45)§	—

*P<0.05; **P<0.01; ***P<0.001.
 †χ²=8.84, df 6; P=0.18.
 ‡χ²=0.09, df 1; P=0.76.
 §Mann-Whitney U test: Z=-5.58, P<0.001.

triage group received telephone consultations (relative risk 2.41, 95% confidence interval 2.08 to 2.80) or nurse care (3.79, 3.21 to 4.48), and there was a small reduction in home visits (0.85, 0.72 to 1.00).

Time taken to manage same day requests

Apart from the effect of changing from a standard management to a triage system, time series analysis showed no significant autocorrelation or seasonal effect and no consistent pattern either for the complete sample or for individual practices (P > 0.05 in all cases).

Table 2 Final point of contact for patients requesting same day appointment handled through standard management or triage according to surgery site

Type of contact	No (%) of patients			
	Surgery A	Surgery B	Surgery C	Total
Nurse phone:				
Standard management	4 (1.1)	1 (0.2)	17 (3.9)	22 (1.8)
Triage	233 (20.8)	335 (27.8)	322 (28.6)	890 (25.8)
Nurse appointment:				
Standard management	34 (9.3)	34 (7.9)	39 (8.9)	107 (8.7)
Triage	242 (21.5)	171 (14.2)	101 (9.0)	514 (14.9)
General practitioner phone:				
Standard management	54 (14.8)	27 (6.3)	58 (13.2)	139 (11.3)
Triage	79 (7.1)	58 (4.8)	86 (7.6)	223 (6.5)
Home visit:				
Standard management	27 (7.4)	61 (14.2)	88 (20.0)	176 (14.3)
Triage	72 (6.4)	160 (13.3)	186 (16.5)	418 (12.1)
General practitioner appointment:				
Standard management	246 (67.4)	306 (71.3)	237 (54.0)	789 (64.0)
Triage	495 (44.2)	482 (39.9)	430 (38.2)	1407 (40.8)
Total:				
Standard management	365 (100)	429 (100)	439 (100)	1233 (100)
Triage	1121 (100)	1206 (100)	1125 (100)	3452 (100)

Once triage was allowed for in the model, there was neither a general time trend nor individual monthly effects. Management time in the triage system was higher, but both the total amount of general practitioner time and the proportion per patient was reduced (table 3). The extra time required for triage and some of the existing general practitioner management time was taken up by nurses.

The model best fitted to predict general practitioner, nurse, and total time consisted of three independent variables—management system, final point of contact, and surgery site. The model also included at least one interaction between these three variables. Time trends or differences between individual months did not significantly improve the model. In particular, there was no evidence of an introductory learning curve after triage was introduced. Because of the large effect of home visits on total and general practitioner times, we reran these models with home visits omitted, which confirmed the results.

Triage took a mean 1.7 minutes longer per patient than standard management ($P < 0.001$), with nursing time 4.15 minutes longer ($P < 0.001$). However, management system and final point of contact interacted, in that fewer general practitioner appointments, general practitioner telephone consultations, and home visits in the triage system resulted in general practitioners spending a mean 2.45 minutes less per patient ($P < 0.05$). Final point of contact had the greatest influence on general practitioner ($P < 0.001$), nurse ($P < 0.001$), and total time ($P < 0.001$), with home visits and general practitioner appointments requiring the most time in both systems. Total and nursing time for all final points of contact except nurse telephone was greater in the triage system ($P < 0.001$). Total, general practitioner, and nursing time varied between surgery sites ($P < 0.001$ in all cases). Surgery site also modified the effect of final point of contact on total ($P < 0.001$), general practitioner ($P < 0.001$), and nurse time ($P < 0.05$). Therefore, whereas nurse time was influenced most by management system, general practitioner time was influenced by the numbers of patients

at each final contact point, although the effect varied by surgery site.

Follow up care

More patients in the triage system returned for further practice based care within one month of the initial appointment request than in standard care (relative risk 1.11, 95% confidence interval 1.01 to 1.22). The mean number of return consultations was greater in triaged patients, and more patients used out of hours and accident and emergency services (table 4). Patients were more likely to have contact with the practice after same day telephone care than after appointments (1.32, 1.23 to 1.41) and after nurse care than general practitioner care (1.15, 1.08 to 1.23).

Costs of providing a triage service

General practitioner same day costs and drug costs were significantly less for the triage patients, but these savings were offset by significant increases in costs for nurses (both for same day appointments and at follow up) and for out of hours and accident and emergency care (table 5). General practitioner follow up costs increased, although not significantly. Overall, therefore, triage costs were higher than those for standard management, but the difference did not reach significance. The 95% confidence interval around the bootstrapped mean difference in total costs was $-\text{£}0.23$ to $\text{£}3.02$ (using the bias corrected bootstrap), which confirms the appropriateness of using the *t* test.

We did sensitivity analyses by varying unit costs of general practitioner and nurse salaries using both lower and higher estimates based on training costs plus salary costs and using national²⁷ rather than local estimates to calculate the costs of out of hours and accident and emergency services. The lower sensitivity analysis indicated that cost differences were not significant (mean difference $\text{£}0.71$, -0.69 to 2.11 , $P=0.32$), whereas the highest cost estimates showed triage to be significantly more expensive (mean difference $\text{£}2.32$, $\text{£}0.42$ to $\text{£}4.22$, $P=0.017$). A further sensitivity analysis in which we removed accident and emergency costs found that cost differences were not significant ($\text{£}0.45$,

Table 3 Mean (SD) general practitioner, nurse, and total time per patient by final point of contact for patients managed by standard management or triage

Final point of contact	No of patients		Nursing time (min)		General practitioner time (min)		General practitioner and nurse time (min)	
	Standard	Triage	Standard	Triage	Standard	Triage	Standard	Triage
Nurse telephone	22	890	6.55 (3.25)	5.00 (2.29)	0.00	0.00	6.55 (3.25)	5.00 (2.29)
Nurse appointment	107	514	8.69 (3.59)	10.47 (3.85)	0.00	0.00	8.69 (3.59)	10.47 (3.85)
General practitioner telephone	139	223	0.00	2.23 (3.14)	3.92 (2.21)	4.69 (2.73)	3.92 (2.21)	6.92 (4.67)
General practitioner home visit	176	418	0.05 (0.43)	3.44 (2.15)	21.09 (7.92)	20.05 (7.76)	21.14 (7.92)	23.49 (7.96)
General practitioner appointment	789	1407	0.22 (1.73)	4.33 (3.33)	8.12 (4.31)	8.51 (4.49)	8.34 (4.68)	12.84 (5.40)
Total	1233	3452	1.02 (3.09)	5.17 (3.83)	8.65 (7.35)	6.20 (7.56)	9.67 (6.98)	11.37 (7.42)

Table 4 Differences in length of same day appointment and care within one month according to type of initial management

	Mean (SD) for standard management	Mean (SD) for triage	Mean difference (95% CI)	P value
Duration of same day appointment (min)	9.67 (6.98)	11.37 (7.42)	1.70 (1.24 to 2.16)	<0.001
No of out of hours consultations	0.08 (0.38)	0.11 (0.49)	0.04 (0.01 to 0.07)	0.005
No of accident and emergency visits	0.010 (0.10)	0.033 (0.19)	0.023 (0.015 to 0.032)	<0.001
No of return consultations	0.93 (1.30)	1.24 (1.78)	0.32 (0.22 to 0.41)	<0.001

Table 5 Difference in costs of care for standard management and triage—base case scenario for costs on day plus total costs incurred one month after request for same day appointment based on local service costs plus lowest estimates of general practitioner and nurse salary costs

Costs	Mean (SD) cost (£)		Mean difference (95% CI)	P value
	Standard management	Triage		
General practitioner same day appointment	7.37 (6.44)	5.36 (6.59)	-2.01 (-2.43 to -1.59)	<0.001
General practitioner follow up	6.19 (10.36)	6.85 (11.96)	0.66 (-0.04 to 1.36)	0.063
Nurse same day appointment	0.26 (0.79)	1.33 (1.00)	1.07 (1.01 to 1.12)	<0.001
Nurse follow up	0.35 (1.28)	0.81 (1.96)	0.46 (0.36 to 0.55)	<0.001
Drugs	4.46 (11.47)	3.67 (10.78)	-0.79 (-1.52 to -0.06)	0.033
Tests and radiography	0.45 (3.22)	0.30 (2.53)	-0.16 (-0.35 to 0.04)	0.122
Out of hours and accident and emergency	2.81 (12.48)	5.06 (18.51)	2.25 (1.33 to 3.17)	<0.001
Total	21.89 (23.89)	23.37 (30.65)	1.48 (-0.19 to 3.15)	0.081

– £1.35 to £2.19, $P=0.64$). This shows the robustness of our results.

Discussion

Our triage system resulted in general practitioners having 29-44% fewer same day appointments than standard management, with 40% of requests being managed by nurses alone. However, although general practitioner time was 2.45 minutes less per patient in the triage system, the total time to manage same day requests was 1.70 minutes more per patient. Triage was no cheaper than standard management as savings in general practitioner time and drugs costs were offset by increases in nursing, follow up, out of hours, and accident and emergency costs.

Robustness of results

The type of presenting problems differed between the standard and triage groups. This cannot be because receptionists selected certain patients for triage because we included data from every patient requesting a same day appointment during data collection periods. These differences do not account for cost differences between standard management and triage. In both groups, respiratory and dermatological disorders were cheaper to treat than other conditions. The increased numbers of respiratory and dermatological disorders in the triage group, therefore, do not account for the increase in costs. The larger number of patients with multiple diagnoses in the triage group is not explained by nurses eliciting more complaints or categorising problems under multiple headings—general practitioners made more diagnoses in triage than in standard management. Furthermore, although the difference between costs of one and multiple diagnoses was highly significant ($P<0.001$), the larger number of multiple diagnoses in the triage group accounted for only £0.69 of the cost difference between the groups.

Effect of triage

During triage, patients were more than twice as likely to receive telephone advice only and almost four times as likely to be managed by a nurse. The triage system affected general practitioner time by reducing the proportion of patients managed by general practitioners not by reducing individual consultation times during general practitioner appointments or home visits. Although the extra complexity of the triage system required more time, both this and the replacement

general practitioner time was found through additional nursing time.

The effect of the triage system was greater than the modifying effect of surgery site. This suggests that a nurse telephone triage system can reduce general practitioner workload in sites with a varied range of patient profiles and working practices. For example, in surgery C, which had the highest levels of home visits, triage had the greatest effect on home visits and there was a 16% difference in favour of triage.

In line with previous findings,³ more patients returned to surgery within one month after triage than after standard management. However, more patients required accident and emergency or out of hours care. This observation is at odds with the findings of the South Wiltshire Out of Hours Project (SWOOP) trial,²³ which reported no difference in the number of accident and emergency attendances between triage and standard care. However, that trial measured attendance only three days after triage whereas we measured it after 28 days. Furthermore, accident and emergency attendance was not a predetermined primary outcome, so the number attending accident and emergency is relatively small. The effect on emergency care needs further investigation since additional use of out of hours and accident and emergency services may be a consequence of patients not having their needs met in the triage system. Other measures of patient outcomes are also required in future studies to investigate the clinical effectiveness and quality of triage for individual patients.

Costs

The costs of increased emergency care, together with the nursing costs required to carry out triage, offset the savings in general practitioner and drug costs for same day appointments. Our estimates of the costs of routine appointments are limited to estimates from same day appointment times. However, sensitivity analyses equalising the extra costs of accident and emergency and multiple diagnoses still returned no cost savings in favour of introducing triage.

Some of the cost differences between the two systems are predictable. In terms of practice based care, many returns to surgery are planned, routine appointments. One of the benefits of triage is the diversion of patients from inappropriate same day appointment to routine appointments, when general practitioners and nurses can plan their workload. Thus, the cost of the appointment is transferred from same day appointment to routine care. However, in a triage system the

What is already known on this topic

Nurse telephone triage is used to manage the increasing demand for same day appointments in general practice

Evidence that nurse telephone triage is effective is limited

What this study adds

Triage resulted in 29-44% fewer same day appointments with general practitioners than standard management

Nursing and overall time increased in the triage group as 40% of patients were managed by nurses

Triage was not less costly than standard management because of increased costs for nursing, follow up, out of hours, and accident and emergency care

total cost of such routine patient care also includes the extra costs of the triage process.

Advantages and disadvantages

The chief benefits of triage seem to be to smooth out the peaks and troughs of unplanned general practitioner workload. In addition, patients are able to discuss their problems with a primary healthcare professional within minutes rather than days. The disadvantages may be busier routine surgeries, increased nursing time, and a small but significant increase in out of hours and accident and emergency attendance. Triage does not reduce the costs of managing patients who request same day appointments.

We thank the patients, nurses, doctors, and receptionists who took part in this study and Phil Heywood, who provided advice at the later design stage and during data collection and made helpful comments on an earlier draft of this paper.

Contributors: JM, JT, and LG initiated the study. DAR developed the methods and DAR, JM, JT, LG, GR, and ED further developed the methods and data collection instruments. ED undertook data collection and management. DAR and DR analysed the data. GR conducted the economic analysis. All authors helped write the research report. DAR will act as guarantor.

Funding: The research was supported by a grant from the NHS Executive Northern and Yorkshire Regional Office Responsive Funding Programme.

Competing interests: None declared.

1 Department of Health. *General practice in the National Health Service: a new contract*. London: HMSO, 1989.

- 2 British Medical Association. *General medical services committee medical workforce task group report*. London: BMA, 1996.
- 3 Gallagher M, Huddart T, Henderson B. Telephone triage of acute illness by a practice nurse in general practice: outcomes of care. *Br J Gen Pract* 1998;48:1141-5.
- 4 Jones K, Gilbert P, Little J, Wilkinson K. Nurse triage for house call requests in a Tyneside general practice: patients' views and effect on doctor workload. *Br J Gen Pract* 1998;48:1303-6.
- 5 Hallam L. Primary medical care outside normal working hours: review of published work. *BMJ* 1994;308:249-53.
- 6 South Wiltshire Out of Hours Project (SWOOP) Group. Nurse telephone triage in out of hours primary care: a pilot study. *BMJ* 1997;314:198-9.
- 7 Jessopp L, Beck I, Hollins L, Shipman C, Reynolds M, Dale J. Changing the pattern out of hours: a survey of general practice co-operatives. *BMJ* 1997;314:199-200.
- 8 Jeffreys LA, Clark AL, Koperski M. Practice nurses' workload and consultation patterns. *Br J Gen Pract* 1995;45:415-8.
- 9 Hibble A. Practice nurse workload before and after the introduction of the 1990 contract for GPs. *Br J Gen Pract* 1995;45:35-7.
- 10 Jenkins-Clarke S, Carr-Hill R, Dixon P, Pringle M. *Skill-mix in primary care: a study of the interface between the general practitioner and other members of the primary health care team—final report*. York: Centre for Health Economics, University of York, 1997.
- 11 Richards A, Carley J, Jenkins-Clarke S, Richards DA. Skill mix between nurses and doctors working in primary care—delegation or allocation: a review of the literature. *Int J Nurs Stud* 2000;37:185-97.
- 12 Marsh GN, Dawes ML. Establishing a minor illness nurse in a busy general practice. *BMJ* 1995;310:778-80.
- 13 Chambers N. *Nurse practitioners in primary care*. Oxford: Radcliffe Medical Press, 1998.
- 14 Kinnerley P, Anderson E, Parry K, Clement J, Archard L, Turton P, et al. Randomised controlled trial of nurse practitioner versus general practitioner care for patients requesting "same day" consultations in primary care. *BMJ* 2000;320:1043-8.
- 15 Venning P, Durie A, Roland M, Roberts C, Leese B. Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care. *BMJ* 2000;320:1048-53.
- 16 Shum C, Humphreys A, Wheeler D, Cochrane M, Skoda S, Clement S. Nurse management of patients with minor illnesses in general practice: multicentre, randomised controlled trial. *BMJ* 2000;320:1038-43.
- 17 British Medical Association. *The future healthcare workforce*. London: BMA, 2002. (Health policy and economic research unit discussion paper 9.)
- 18 Crouch R, Dale J, Patel A, Williams S, Woodley H. *Ringling the changes: developing, piloting and evaluating a telephone advice system in accident and emergency and general practice settings*. London: Department of General Practice and Primary Care, King's College School of Medicine and Dentistry, 1996.
- 19 Leprohon J, Patel VL. Decision making strategies for telephone triage in emergency medical services. *Med Decis Making* 1995;15:240-53.
- 20 Baker RC, Schubert CJ, Kirwan KA, Lenkauskas SM, Spaeth JT. After hours telephone triage and advice in private and nonprivate pediatric populations. *Arch Pediatr Adolesc Med* 1999;153:292-6.
- 21 College of Health. *Developing NHS Direct*. London: College of Health, 1998.
- 22 Luthra M, Marshall MN. How do general practices manage requests from patients for "same day" appointments? A questionnaire survey. *Br J Gen Pract* 2001;51:39-41.
- 23 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: a randomised controlled trial. *BMJ* 1998;317:1054-9.
- 24 Thompson F, George S, Lattimer V, Smith H, Moore M, Turnbull J, et al. Overnight calls in primary care: randomised controlled trial of management using nurse telephone consultation. *BMJ* 1999;319:1408.
- 25 Richards DA, Tawfik J. Introducing nurse telephone triage into primary care. *Nursing Standard* 2000;15(10):42-5.
- 26 Efron B, Tibishirani RB. *An introduction to the bootstrap*. New York: Chapman & Hall, 1993.
- 27 Netten A, Curtlis L. *Unit costs of health and social care*. Canterbury: University of Kent at Canterbury, Personal Social Services Research Unit, 2000.

(Accepted 15 August 2002)