

Development

Developing a new response to non-urgent emergency calls: evaluation of a nurse and paramedic partnership intervention

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Aim: To evaluate a new service development whereby a nurse and a paramedic working in partnership attended non-urgent emergency calls. **Background:** The demand for emergency ambulance services both nationally (in the UK) and internationally has been steadily increasing. A large proportion of calls made to the emergency ambulance service are classified as non-urgent. An alternative response to these calls may release the standard ambulance service to attend more urgent calls. A pilot project was initiated in order to provide an alternative response to non-urgent emergency calls in an Ambulance Trust in England with support from the local Primary Care Trust. This alternative response comprised a district nurse or an emergency nurse practitioner dispatched with a paramedic to visit low-priority emergency calls. The pilot service was trialled during a 15-week period in 2003–2004. **Methods:** This paper evaluates the cost effectiveness of the pilot service by examining both the resource use and the outcomes of the service. **Findings:** It was found that introducing this service to the current provision would increase the overall cost to the ambulance services. However, a reduction in conveyance rate to the hospital was observed as people could be treated on-scene. A reduction in conveyance rate to the hospital would lead to reduced admissions to accident and emergency departments and subsequent hospitalization. This paper provides an indication that further development of this type of service has the potential to be cost effective, if the wider health care economy is considered, as the cost savings made in secondary care could more than balance the costs to the Ambulance Services in providing such a service.

Key words: cost effectiveness; emergency services; low-priority ambulance calls; older people; partnership working

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Introduction

History of the development

In 2003, two short projects were undertaken by Bedfordshire Heartlands PCT (BHPCT) and

Bedfordshire and Hertfordshire Ambulance and Paramedic Service (BHAPS) to trial an alternative response to low-priority ambulance calls. Calls to the ambulance service are allocated a priority A, B or C indicating the urgency of the response required (Woollard, 2006). The alternative response comprised a district nurse and an accident and emergency nurse accompanying a paramedic to Category C emergency calls.

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Following the positive results of these two short projects, a longer pilot project was proposed with a formal evaluation undertaken by the authors. Using the information gained from the two short pilot projects, it was decided that, for the new project, one nurse and a paramedic would form the response team. The intervention vehicle used to convey the nurse and paramedic was a fully equipped emergency response car. The pilot project extended over 15 weeks from 5th December 2003 until 15th March 2004 and the pilot project operated on shifts from Friday to Monday inclusive, between 08.00–16.00 and 16.00–24.00.

Background

Over the course of the last few years, various reports have documented the increased demand for emergency ambulance services both in the UK and internationally (Department of Health, 2001; 2005; National Audit Office, 2004). While part of this increase may be due to the general ageing of the population, there is also a significant proportion of ambulance calls that have been found not to warrant an emergency response. As early as 1980, Morris and Cross (1980) found that out of 1000 consecutive patients brought to A&E by ambulance following an emergency 999 telephone call, 51.7% of these journeys were medically 'unnecessary'. Similarly, Gardner (1990) showed that 38% of people who used an ambulance service following a '999' call in Chester did not have a sufficient medical need (Gardner, 1990). More recently in 1998, Snooks *et al.* (2002) found that 40% of calls to '999' were estimated not to require an emergency response. In a study providing epidemiological information on 999 callers not conveyed to the hospital, most callers were assigned as low-priority at the time of the call and the largest category of non-transported callers were people who had fallen, most of whom were over 70 years.

Dispatching an emergency ambulance to low-priority calls is a cause for concern as patients may be transported to hospital unnecessarily, incurring long waits in A&E departments when an alternative response might have been more appropriate. In addition, the cost component associated with the expenditure of scarce ambulance resources is a serious matter in a health care system already

facing budgetary pressures. In 1998, for example, Snooks *et al.* (2002) determined that 16%, or 75 000 calls per year to the London Ambulance Service, were not necessary. At the same time, the monies that are spent on these unnecessary/low-priority emergency ambulance calls might be applied to other sectors of the health care system that require investment.

In line with policy initiatives (The NHS Plan (Department of Health, 2000), Reforming Emergency Care (Department of Health, 2001), Transforming Emergency Care in England (Department of Health, 2004a)) interventions to provide a more appropriate response by the emergency ambulance services to low-priority calls are being investigated. In 2002, Snooks *et al.* explored a range of options for calls that were neither life threatening nor serious, including the following: (1) prioritizing 999 calls; (2) telephone advice; (3) alternative vehicles and (4) on-scene alternatives. Overall, little data are available on the potential cost effectiveness of providing alternative responses to low-priority ambulance calls, although there have been some attempts at economic modelling to compare costs of implementation of use of Emergency Care Practitioners (ECPs) in urgent care both in urban and in rural areas (Modernisation Agency, 2004).

It is against this backdrop that this study to evaluate the pilot project involving partnership working between paramedics and community nurses attending low-priority ambulance calls took place.

The service development

The alternative response comprised a district nurse or an emergency nurse practitioner teamed with a paramedic to visit low-priority emergency calls. The aim of the intervention was to visit and treat patients at home where appropriate and hence reduce the unnecessary transfer of patients to hospital. The pilot service was trialled during a 15-week period in 2003/2004. A qualitative exploration of the views of patients and staffs was also undertaken and is reported elsewhere (Machen *et al.*, 2005; 2007).

Emergency 999 calls were answered and triaged by emergency call operators who allocated the calls to different categories according to their priority and need. Those calls that were thought

to be non-urgent, non-life threatening cases were given a lower priority and could be assigned to the pilot service.

Method

Aim

To investigate the cost effectiveness of the development project.

Cost-effectiveness analysis

In order to measure the cost effectiveness of the pilot service, both resource and outcome data from the pilot service were analysed and compared with the current standard service data for responding to non-urgent calls. A comparison group, attended by the standard ambulance service, was drawn from non-urgent emergency callers on the same shift and time period and similar geographical area, as the pilot service.

Cost data and outcome data

Although, ideally, costs are measured from the social (whole community) perspective (Drummond *et al.*, 1997), the analysis in this study was limited to the viewpoint of health care providers (i.e. Primary Care, Ambulance and Hospital Trusts). This was thought sufficient to answer whether the pilot project was a cost-effective service with potential to be implemented by the NHS, which operates within stringent budgetary constraints.

Costs were measured as costs in the year 2004 as the pilot service was primarily carried out within the first months of 2004. Data were gathered from various sources, including from the PCT, Ambulance and Paramedic Trust and also other published studies from the UK setting. Unit cost figures were obtained from the Unit Cost of Health and Social Care 2004 compiled by PSSRU University of Kent (Curtis and Netten, 2004) as well as the costs from the Department of Health Reference Cost database (DH, 2004b).

Cost effectiveness of the pilot service was assessed using an incremental cost-effectiveness analysis, where the difference in costs of introducing such a service is compared with the difference in outcomes/effectiveness of the service.

It was thought that the most important impact of the pilot service would be the reduction of

patient conveyance to hospital as the patients could receive on-scene treatment by the nurse. To measure this, hospital conveyance data recorded on the database of the ambulance dispatch system in the ambulance trust were used. Data from the Computer Aided Dispatch (CAD) system from the Bedfordshire and Hertfordshire Ambulance and Paramedic Trust were used to compare the performance and the outcomes of the pilot service relative to the standard ambulance services in attending non-urgent emergency calls. These data were extracted from the database by ambulance trust personnel. No data that could be used to trace individual patients were extracted from the database.

The data covered all of the ambulance dispatch information from the ambulance trust for non-emergency calls (categories B&C) made during the operation times of the pilot project. This included the call-sign codes for the vehicles used by the pilot initiative as well as other vehicles available for the standard dispatch procedure. The data were available in MS Excel format and converted to SPSS to enable statistical calculations.

Ethics and research governance approval were obtained prior to the pilot project evaluation.

Analysis

The cost effectiveness of the pilot project was assessed using incremental cost effectiveness analysis, where the incremental cost of introducing such a programme is compared with the incremental effectiveness of the project.

Sensitivity analyses were directly performed to factor uncertainty in the analyses. These were done by manipulating some related variables to reflect differences that might occur and also to provide a safe margin of error to support policy decisions.

All analyses were conducted with SPSS (Version No. 12) and MS Excel (2003).

Results

Although the pilot project was conducted over a 15-week period, the data analysed here were limited to a 13-week period. Data from the first two weeks of the trial were not used as during this time the emergency dispatchers and the pilot

Table 1 Patient conveyance

Patient outcome	Standard		Pilot		Total	
	N	%	N	%	N	%
Conveyed to hospital	2130	82.5	91	46.0	2221	79.9
On-scene treatment	453	17.5	107	54.0	560	20.1
Total	2583	100	198	100	2781	100

service team were still familiarizing themselves with the project and their tasks.

During the 13-week period (morning–evening shifts, Friday–Monday inclusive), 3523 non-urgent, non-life-threatening calls were logged into the computer-aided dispatch system. After cleaning the data for erroneous entries, cancelled calls, hoax calls, etc, 2781 non-urgent emergency calls with a total of 4310 vehicle journeys were analysed. The pilot service team attended 198 of these calls either alone or in conjunction with other emergency vehicles.

It was found that the group of patients attended by the pilot service had a significantly lower conveyance rate than those attended by the standard service alone. This was an encouraging result as the pilot team appears to be successful in treating patients at home (on-scene) and hence reduced the need to convey patients to hospital (Table 1). Similar results in relation to a reduction in conveyance rates have been found by Mason *et al.* (2007) in a randomized controlled trial focusing on paramedic practitioners (paramedics who have had extended training and education) when managing older patients with non-life-threatening conditions.

Costs

Table 2 shows the breakdown of unit cost of both the standard and pilot service. Unit cost is the financial cost required to produce a unit of output. Data for the standard ambulance service were compiled from Curtis and Netten (2004) and supplemented with the data from the Ambulance and Primary Care Trusts, in particular, the data for the pilot service. Overheads consisted of general office costs, electricity, petrol and other items related to the operations of the Ambulance Trusts.

Overall, the pilot service was slightly more expensive than the standard ambulance service in

Table 2 Unit cost for pilot and standard ambulance service (in £)

	Standard	Pilot
Categories		
Crew salaries	113.7	124.1
Vehicle	12.3	5.5
Overheads	118.4	118.4
Unit cost		
Per patient attended	244.4	247.9
Per patient conveyance to hospital	276.0	Not calculated ^a

^a The unit cost for the pilot service was not calculated as the service was not intended to convey patients to hospital.

attending a call. This was mainly due to the higher salaries of the members of the pilot service team compared to the salaries of those on the standard ambulance service. The salary component of the pilot service was higher as the pilot vehicle was crewed by an experienced senior community nurse (Agenda for Change, Band 6 equivalent (NHS Employers, 2007)) and a paramedic. A standard ambulance vehicle is usually operated by a paramedic and a technician although some variances to this practice are also observed (Downing and Wilson, 2005). For clinical reasons, it would have been inappropriate for a nurse and a technician to attend: what we were seeking to explore was how the additional skills the nurse brought would enhance the skills of the paramedic. These additional skills included knowledge of local community services and referral systems, as well as clinical skills such as suturing and wound dressing. The vehicle unit cost for the pilot service was less than the standard service due to the cheaper cost of the leased pilot vehicle (a car) and the high utilization rate of the vehicle.

The cost for responding to non-urgent patient calls during the pilot project was calculated by multiplying the number of emergency journeys/visits by the pilot service and the standard service with their respective unit cost, both for on-scene treatment and hospital conveyance data, and is presented in Table 3.

During the 13 weeks of the pilot service, non-urgent emergency calls cost the Ambulance Service more than £772 000. However, what is important is how much the pilot service increased the costs in comparison to the currently available

Table 3 Cost of responding to patient calls (in £)

Outcome	Standard	Pilot	Total cost
On scene	110 700	26 529	137 229
Hospital	587 880	47 678 ^a	635 558
Total cost	698 580	74 207	772 787

^aThis includes the conveyance cost by standard ambulance in addition to the cost of on-scene treatment by pilot team.

Table 4 Incremental cost of introducing the pilot service (in £)

Outcome	Base service (no pilot service)	Pilot + standard service
Conveyed to hospital	632 944	635 558
On-scene treatment	119 186	137 229
Total cost	752 130	772 787
Incremental cost		20 657
Patient conveyance prevented		72
Incremental cost per hospital conveyance prevented		286.9

service (incremental cost). This was analysed by comparing the total cost of the pilot service with the cost of standard ambulance service (without the pilot service).

The following analysis shows the incremental cost of introducing the pilot service (Table 4). This assumes that prior to the introduction of the pilot service, patients' conveyance rate was identical to that of the standard service (operational during the timescale of the pilot phase). The incremental cost of conducting the pilot service was about £20 000 for the duration of the project. This incremental cost consisted of the additional cost of the pilot service attendance as well as the cost of the standard ambulance services on the occasions when the pilot service was unable to deal with the case on-scene and the patient needed to be transported to hospital.

If we assume that there had been no pilot service, and assume that patients were conveyed to hospital at the same rate as in the standard ambulance service (running concurrently), then there would have been an additional 72 hospital

Table 5 Incremental cost analysis (in £)

Treatment	Base service (no pilot service)	Pilot + standard service
Hospital	632 944	635 558
On scene	119 186	137 229
Ambulance cost	752 130	772 787
A&E cost	190 342	184 343
One day hospitalization cost	232 328	188 410
Hospital cost	422 670	372 753
Total cost	1 174 800	1 145 540
Incremental cost		-29 260

conveyances over the 13-week time period. Hence, the incremental cost per patient prevented from being conveyed to hospital by the pilot service was £286.90 (ie, £20 657 divided by 72). This means that the pilot service costs an additional £286.90 to prevent a single hospital conveyance from a non-urgent caller.

Economic modelling

In order to explore potential costs and savings to the wider health economy, the following economic modelling was undertaken.

The pilot project showed that more people could be treated in their own homes (or on-scene), thereby reducing the need to convey patients to hospital unnecessarily. Consequently, this would lead to a reduction in the use of the A&E department and subsequent hospitalization. The following analysis assumes that each conveyed patients cost £83 to the A&E department (Curtis and Netten, 2004). This cost does not include any treatments given in the A&E department. The rate of hospitalization following a transfer to A&E visit by ambulance has been found to be 33.4% for people under 65 years and 58.8% for those over 65 years (Downing and Wilson, 2005). In the modelling carried out here, we assumed a conservative length of stay of one day for those who could have been admitted, at a cost of £166 (Curtis and Netten, 2004).

Therefore, adding all the above estimations and conservative costs into the model, the updated incremental cost across the wider health economy is shown in Table 5.

Therefore, the total cost to respond to non-emergency patient calls was lower than the

standard service following the introduction of the pilot service. Even with the very conservative estimate of the costs incurred in the A&E department and the subsequent hospitalization rate, the modelling demonstrated that the project saved £29260 during its 15 weeks. The cost of providing the pilot service was compensated by the savings made from the reduced use of the A&E department and subsequent hospitalization.

The negative incremental cost and a positive outcome (positive number of prevented patient conveyances to hospital) imply that the pilot service was very cost effective for NHS when the wider system was considered. Although it actually costs more to the Ambulance Trust to provide such a service, the pilot service saved money when considered in terms of overall NHS expenditure.

Discussion

The results of the economic modelling indicate that the development of an alternative response for non-urgent emergency calls can be cost effective. However, caution should be exercised in using these results, as there are several possible biases within the project methodology. Firstly, the vehicles in this project were not assigned randomly to patients' calls. Second, the reduction in the conveyance rate might have been an indirect result from a selection bias from the emergency dispatchers. If the pilot service was deployed to attend less-serious calls, then patients receiving the pilot service may have had less need to be conveyed to hospital.

The economic modelling has used very conservative assumptions about costs in the calculations; therefore, it is possible that the actual cost effectiveness of the pilot service is higher than the calculated figures presented in this paper. That is, if extra diagnostic tests were carried out and periods of hospitalization were longer than one day, the pilot service would have saved further resources, and hence be more cost effective.

This development indicates that there is very real potential for similar developments to address the increasing demand on emergency services and improve the cost effectiveness of services. This pilot intervention was only able to attend a small proportion of the non-urgent emergency calls being made. Not all of the non-urgent

patient calls could be treated on-scene by the pilot service, thus necessitating a response from the standard ambulance service.

The accuracy of triage classifying emergency calls is important for the effective implementation of alternative responses to non-urgent calls. Urgent calls might be wrongly classified as low-priority patient calls (Deakin *et al.*, 2006) and inaccuracies in allocating those calls to the pilot service might require further assistance from additional vehicle units, which would in turn increase the costs. Furthermore, assigning an alternative response (the pilot service) to those callers could potentially affect the patient outcome. However, during the current study, no evidence was found to indicate any adverse effects on patient outcome caused by the introduction of the pilot service.

Recently in the UK Emergency Care Practitioners (ECPs) have been employed by some ambulance trusts to attend low-priority ambulance calls. The ECP role combines some of the extended skills of the nurse and paramedic and is currently being evaluated. Results from an initial survey found that ECPs were able to assess, treat and discharge over 40% of patients who were classified as low-priority callers (Mason *et al.*, 2006) and similarly Cooper *et al.* (2007a) had an overall non-conveyance rate of 62% in their study, with 48% (285/595) of patients being seen, treated and discharged by the ECP. Further evaluations of this and other interventions that provide alternative responses to low-priority emergency needs are required. Further evaluations of these developments should include a thorough economic evaluation, which enables exploration of the real costs of the intervention and its economic impact on the wider health economy. For the economic analysis to be more precise and not be reliant on estimates and modelling, detailed data on patient destination, hospital length of stay, treatment and investigation cost will also need to be collected.

This paper only discusses the financial implications and outcomes of the pilot project, and does not discuss other benefits of the pilot service such as patient and staff satisfaction (for discussion of these see Machen *et al.*, 2007), patient convenience, releasing emergency ambulances for more life-saving calls and the reduction in waiting times for available beds at the hospital.

Several of the original, qualitative findings have been supported more recently in Cooper *et al.*'s (2007b) study.

As far as the authors are aware, to date, few studies have reported the cost and the effectiveness of similar developments (Snooks *et al.*, 2004; Newton *et al.*, 2006).

Conclusion

These findings demonstrate the potential for the development of similar interventions to deal with non-urgent calls to the ambulance service in other ambulance trusts. Policy makers and those responsible for the provision of emergency services seeking to reduce unplanned hospital conveyance and admission should consider similar schemes as a potentially cost-effective response to non-urgent emergency calls, particularly within the context of the wider health care economy.

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References

- Cooper, S., O'Carroll, J., Jenkin, A. and Badger, B. 2007a: Collaborative practices in unscheduled emergency care: role and impact of the emergency care practitioner – quantitative findings. *Emergency Medicine Journal* 24, 630–33.
- Cooper, S., O'Carroll, J., Jenkin, A. and Badger, B. 2007b: Collaborative practices in unscheduled emergency care:

role and impact of the emergency care practitioner – qualitative and summative findings. *Emergency Medicine Journal* 24, 625–29.

- Curtis, L. and Netten, A. 2004: *Unit costs of health and social care 2004*. Canterbury: Personal Social Services Research Unit, The University of Kent.
- Deakin, C.D., Sherwood, D.M., Smith, A. and Cassidy, M. 2006: Does telephone triage of emergency (999) calls using Advanced Medical Priority Dispatch (AMPDS) with Department of Health (DH) call prioritisation effectively identify patients with an acute coronary syndrome? An audit of 42,657 emergency calls to Hampshire Ambulance Service NHS Trust. *Emergency Medicine Journal* 23, 232–35.
- Department of Health. 2000: *NHS plan. A plan for investment. A plan for reform*. London: The Stationery Office.
- Department of Health. 2001: *Reforming emergency care. First steps to a new approach*. London: The Stationery Office.
- Department of Health. 2004a: *Transforming emergency care in England*. London: The Stationery Office.
- Department of Health. 2004b: *Reference cost 2004*. London: Department of Health. Retrieved April 2007 from http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4105545
- Department of Health. 2005: *Taking healthcare to the patient: transforming NHS ambulance services*. London: The Stationery Office.
- Downing, A. and Wilson, R. 2005: Older people's use of Accident and Emergency services. *Age and Ageing* 34, 24–30.
- Drummond, M.F., O'Brien, B. and Stoddart, G.L. 1997: *Methods for the economic evaluation of health care programs*, 2nd edition. Oxford: Oxford University Press.
- Gardner, G.J. 1990: The use and abuse of the emergency ambulance service: some of the factors affecting the decision whether to call an emergency ambulance. *Archives of Emergency Medicine* 7, 81–89.
- Machen, I., Dickinson, A., Kendall, S., Widiatmoko, D. and Williams, J. 2005: *Nurses and paramedics in partnership: an evaluation*. Centre for Research in Primary and Community Care, University of Hertfordshire.
- Machen, I., Dickinson, A., Williams, J., Widiatmoko, D. and Kendall, S. 2007: Nurses and paramedics in partnership: Perceptions of a new response to low priority ambulance calls. *Accident and Emergency Nursing* 15, 185–92.
- Mason, S., Coleman, P., O'Keefe, C., Ratcliffe, J. and Nicholl, J. 2006: The evolution of the emergency care practitioner role in England: experiences and impact. *Emergency Medical Journal* 23, 435–39.
- Mason, S., Knowles, E., Colwell, B., Dixon, S., Wardrope, J., Gorringer, R., Snooks, H., Perrin, J. and Nicholl, J. 2007: Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial. *BMJ* 335, 919–25.

- Modernisation Agency/Department of Health.** 2004: *The emergency care practitioner report: right skill, right time, right place*. London: Department of Health.
- Morris, D.L.** and **Cross, A.B.** 1980: Is the emergency ambulance service abused? *BMJ* 281, 121–23.
- NHS Employers.** 2007: Agenda for change. Retrieved 22 May 2008 from www.nhsemployers.org/pay-conditions/agenda-for-change.cfm
- Newton, J.L., Kyle, P., Liversidge, P., Robinson, G., Wilton, K.** and **Reeve, P.** 2006: The costs of falls in the community to the North East Ambulance Service. *Emergency Medicine Journal* 23, 479–81.
- Snooks, H., Williams, S., Crouch, R., Foster, T., Hartley-Sharpe, C.** and **Dale, J.** 2002: NHS emergency response to 999 calls: alternatives for cases that are neither life threatening nor serious. *BMJ* 325, 330–33.
- Snooks, H.A., Dale, J., Hartley-Sharpe, C.** and **Halter, M.** 2004: On-scene alternatives for emergency ambulance crews attending patients who do not need to travel to the accident and emergency department: a review of the literature. *Emergency Medicine Journal* 21, 212–15.
- Woollard, M.** 2006: The role of the paramedic practitioner in the UK. *Journal of Emergency Primary Health Care* 4, 1, e-journal. Retrieved 22 May 2008 from www.jephc.com