ORIGINAL ARTICLE

Towards primary care for non-serious 999 callers: results of a controlled study of ''Treat and Refer'' protocols for ambulance crews

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Objective: To develop and evaluate ''Treat and Refer'' protocols for ambulance crews, allowing them to leave patients at the scene with onward referral or self-care advice as appropriate.

Methods: Crew members from one ambulance station were trained to use the treatment protocols. Processes and outcomes of care for patients attended by trained crews were compared with similar patients attended by crews from a neighbouring station. Pre-hospital records were collected for all patients. Records of any emergency department and primary care contacts during the 14 days following the call were collected for non-conveyed patients who were also followed up by postal questionnaire.

Results: Twenty three protocols were developed which were expected to cover over 75% of patients left at the scene by the attending crew. There were 251 patients in the intervention arm and 537 in the control arm. The two groups were similar in terms of age, sex and condition category but intervention cases were more likely to have been attended during daytime hours than at night. There was no difference in the proportion of patients left at the scene in the intervention and control arms; the median job cycle time was longer for intervention group patients. Protocols were reported as having been used in 101 patients (40.2%) in the intervention group; 17 of the protocols were recorded as having been used at least once during the study. Clinical documentation was generally higher in the intervention group, although a similar proportion of patients in both groups had no clinical assessments recorded. 288 patients were left at the scene (93 in the intervention group, 195 in the control group). After excluding those who refused to travel, there were three non-conveyed patients in each group who were admitted to hospital within 14 days of the call who were judged to have been left at home inappropriately. A higher proportion of patients in the intervention arm reported satisfaction with the service and advice provided.

Conclusions: ''Treat and Refer'' protocols did not increase the number of patients left at home but were used by crews and were acceptable to patients. The protocols increased job cycle time and some safety issues were identified. Their introduction is complex, and the extent to which the content of the protocols, decision support and training can be refined needs further study.

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The number of emergency (999) calls received by ambulance services in the UK has been rising persistently[1] although not all calls require emergency department (ED) care.[2–6] Up to 30% of patients for whom a 999 call has been made are left at the scene,[1] with onward referral to a primary or other health or social care provider being rare. Emergency medical technicians (EMTs) and paramedics (ambulance crews) have usually had little, if any, formal training and do not generally have protocols to support decisions to leave patients at the scene.[7]

With an increasing emphasis on integrated emergency care systems in the UK,[8] the need to consider alternatives to the standard emergency ambulance response has been highlighted (box 1). Recent national policy changes have allowed exploration of alternative responses to less serious 999 calls—termed ''category C'' calls in the 1996 NHS Executive Steering Group Review of Ambulance Performance Standards[9]—and the option not to convey to the nearest ED has been confirmed.[10] Similar pressures to provide appropriate and safe care exist internationally and have led to several preliminary descriptive studies.[11–17] Issues explored have included the ability of crews to select cases for alternative management as well as optimal crew configuration, with the inclusion of nurses in the field response tested in Sweden.

Implementing alternative responses to transportation to the ED has been advocated many times.[2–6] Avoiding unnecessary journeys to the ED may bring benefits for patients by providing appropriate care with less inconvenience; for the ambulance service by freeing up ambulances more quickly to attend other more serious cases; for crews by improved job satisfaction and reduced stress; and for the wider health service through more efficient and effective use of resources. However, the development of alternatives to transportation to the ED depends on the ability of emergency crews to make decisions to leave patients at the scene. Several studies exploring this issue have highlighted the difficulties of pre-hospital identification of patients' clinical needs.[18–20] These studies have been shown in a recent review to be methodologically weak, with varying methods used to assess appropriateness of care and safety, and no randomised controlled trials have been completed in this field.[21] However, preliminary results have raised concern, consistently showing a substantial risk for a small minority of patients[22 23] and, indeed, one US trial was recently abandoned due to concerns about safety.[24]

Against this background, this study was set up to assess the effectiveness of implementing a new alternative to emergency transportation to the ED for non-serious 999 callers. The aim of the study was to develop and evaluate ''Treat and Refer'' (T&R) protocols for ambulance crews which allowed them to leave patients at the scene with referral to community based services or self-care advice.

Box 1 UK ambulance response to emergency calls

Current performance standards

Emergency ambulance services are required to meet national performance standards, with calls triaged in the ambulance control room as:

- Category A (immediately life threatening): 75% to be attended within 8 minutes.
- Category B (serious) and Category C (neither life threatening nor serious): 90% to be attended in 14 minutes (19 minutes in rural areas).

Current 999 response

Immediate despatch of an emergency ambulance able to convey a patient which travels to the incident with flashing lights and sirens, with two trained personnel, either emergency medical technicians or paramedics, with Advanced Life Support (ALS) qualifications.

If the patient's condition is immediately life threatening an EMT or paramedic in a response unit without ability to convey usually also attends.

If the patient's condition is triaged as less serious, an EMT or paramedic may telephone the patient, in place of an ambulance response, to determine if another form of care is appropriate. Alternative response vehicles and staff educated specifically for these callers are in development (not in place at time of the study).

Indicators of effectiveness were set up to measure the operational effects on the emergency care system, as well as the quality and safety of care delivered to patients, from the perspective of patients as well as using clinical measures.

METHODS

Study design overview

The study included both the development and testing of protocols. During phase 1 the treatment protocols were drafted and agreed by a clinical panel. During phase 2 the crews from one ambulance station were trained to use the protocols and the new service was implemented for a trial period (intervention group). During this period processes and outcomes of care were assessed for patients meeting the study inclusion criteria attended by trained crews with similar patients attended and treated by crews working according to standard practice at a neighbouring station (control group).

Study setting

Both ambulance stations were in West London. The protocols were implemented between May and August 2000. The site was selected after extensive external and internal consultation as its crews were reported by local ambulance service managers as being receptive to participation in the study. It was recognised from the outset that this new service would require partners to work together across the traditional boundaries of primary, secondary and social care, so a project steering group was set up with a wide membership in order to bring the perspectives of different service providers and commissioners, professional and patient groups to the study. This group met regularly throughout the study and provided advice and support at all stages.

Development of protocols

A multidisciplinary clinical panel made up of representatives from the London Ambulance Service (LAS) and local ED and

Figure 1 Training sessions: delivery and content of initial and follow up workshops.

primary care services was formed to oversee the development of the protocols. A subgroup of ED consultants, the LAS Medical Director, a specialist registrar (JR), and a representative from the LAS training department met more frequently to draft and revise the detail of the protocols. The protocols were based on findings from:

- a review of previous research literature;
- a national survey of ambulance services to identify other initiatives concerning alternatives for patients with primary care needs (published separately[25]);
- baseline local data collection at the two participating stations between June and September 1999: individual cases falling within illness codes with a high rate of non-conveyance were reviewed against the protocols developed to check coverage;
- routine LAS management information data concerning conveyance rates across the service.

Crew training

The intervention station crews (five paramedics and five EMTs) participated in a 2 day training course in October 1999 led by LAS trainers. The first day included a brief overview of the T&R protocols and role play exercises based on the clinical conditions. The second day gave an overview of the new organisational arrangements being introduced (primary care trusts) to provide an improved community service. Representatives of several local agencies talked to the crews about their service and referral and assessment criteria. Senior managers from the LAS put the project into the context of service developments taking place and the need for research in this area. Research sessions were delivered by members of the research team and covered fundamentals of

research methods, including the importance of recruiting a control group and the need for accurate documentation of patient care.

At the outset of the study no further training was envisaged but, due to identified needs, two additional half day workshops were put on in March 2000. This training was of a clinical nature and was led by the Medical Director of the LAS and the specialist registrar (JR) who had led the drafting of protocols (fig 1).

Clinical scenarios were used in the workshops to review the crews' assessment and decision making skills about conveyance. Emphasis was put on covering all the assessment criteria outlined in protocols and the taking of a consistent and systematic history including the measurement and documentation of clinical observations.

Each crew member underwent a competency assessment, with all crew members deemed competent to use the protocols for the trial.

Study outcome measures

In order to meet the first study objective—to assess the effects of the intervention on the emergency care system—the primary outcome of the evaluation was set as the difference between the proportion of patients left at the scene by crews from the intervention station and those attended by crews from a neighbouring control station. As a secondary outcome concerned with operational impact, the interval between the 999 call and the ambulance reporting the case finished (job cycle time) was also compared between groups.

Further secondary outcomes aimed to assess the quality and safety of care delivered to patients included (1) frequency and patterns of protocol usage; and (2) completeness of clinical documentation. For the patients of most concern—that is, those who were not taken to hospital—comparisons were made between the groups of (3) the number of patients admitted to hospital within 14 days of their emergency ambulance attendance who were judged to have been inappropriately left at the scene by their attending crew; and (4) patient satisfaction.

Identification of intervention and control group cases

As it would have been inefficient to include all 999 patients in the study, a method was needed for identifying similar patients in each group who would be appropriate to leave at the scene that did not rely on crew selection. Locally collected baseline data concerning patterns of conveyance in the study area were used to identify illness codes (routinely assigned by ambulance crews on their patient report forms, completed for each individual patient they attend) that were most frequently given to patients who were left at the scene. These illness codes were used to identify patients for inclusion in each arm of the study.

Cases for which crews reported that they had used their new protocols but which fell outside of these illness codes are described but not included in the comparative analysis as they were not matched in the control group by any similar cases.

Sample size calculation

Based on activity levels before the trial, it was estimated that each week there would be approximately 50 cases meeting the study inclusion criteria. A sample size of 530 patients was aimed for in each arm of the study to give an 85% chance of detecting an increase in non-conveyance rate of 9% (from 35% to 44%) at the 5% level.

Data collection

Patient report forms completed by ambulance crews were collected for all cases included in the study. Cases were
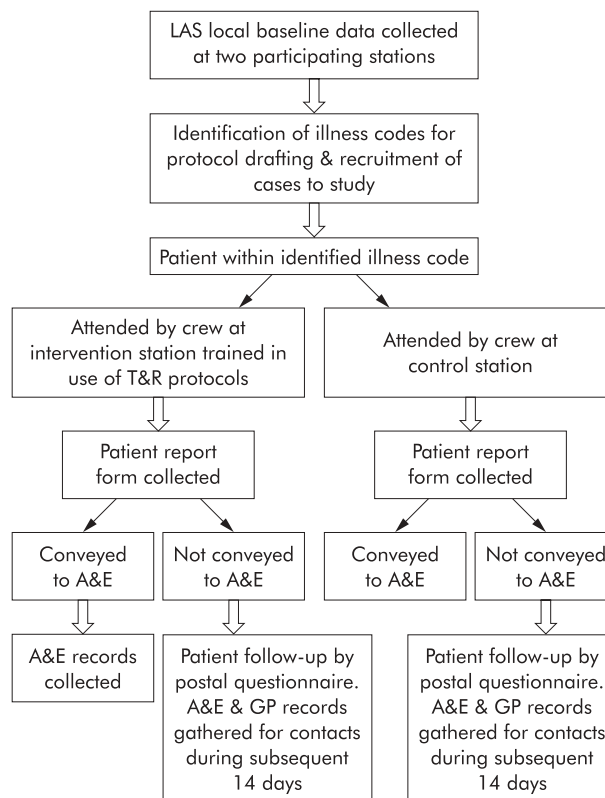

Figure 2 Data collection processes: flow chart.

reviewed by JR to assess whether protocols were used appropriately. A second clinician (ED consultant/Medical Director of LAS) independently assessed protocol usage for 15% of the intervention patients to assess inter-rater reliability. ED records were collected for all patients taken there, and these were reviewed by JR for all patients discharged home with only basic or no care.

Follow up data were collected on patients who were left at the scene from ED and GP records and by postal questionnaire. The patient questionnaire (modified version of the "Quality of Care Monitor"[26]) measured patient satisfaction and health service usage in the 14 days following the incident.

All non-conveyed cases identified as having been admitted to hospital in the 14 days after the 999 call were reviewed by two local ED consultants who were asked to judge whether non-conveyance was appropriate at the time of the 999 call and which (if any) protocols should have been used for intervention group patients.

Figure 2 illustrates the data collection processes.

Use of routine management information

In order to help us interpret our findings, once the illness codes had been identified for the trial, routinely collected management information was used to compare the proportions of patients not conveyed to hospital and job cycle times for cases meeting the identified codes for the two study stations and service wide for the same periods in the 2 years before the trial.

Data analysis and research ethics approval

The study illness codes were grouped into condition categories for the purposes of analysis. Binomial data were analysed by Fisher's exact test, other categorical data by a χ^2 test with correction for continuity. Numerical data were

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                ┌─────────────────────────┐
                │   (21) SOCIAL PROBLEMS  │
                │        (Draft 5)        │
                └─────────────────────────┘



   ┌──────────┐        ┌──────────────────────┐
   │ HOSPITAL │◄───────│  Breathing compromise?│
   └──────────┘        │   Signs of shock?     │
                       │   GCS <15 acutely?    │
                       │ Difficult to assess   │
                       │     the patient?      │
                       └──────────────────────┘
                                 │
                                 ▼
   ┌──────────┐        ┌──────────────────────┐
   │ HOSPITAL │◄───────│ Signs of systemic upset?│
   └──────────┘        │     Severe pain?      │
                       │   Worrying history?   │
                       │    Signs of injury?   │
                       └──────────────────────┘
                                 │
                                 ▼
   ┌──────────┐        ┌──────────────────────┐
   │ CONTACT  │◄───────│ Social problem appears│
   │ PRIMARY  │        │ to be applicable to   │
   │ CARE TEAM│        │ primary care team and │
   └──────────┘        │       urgent.         │
                       └──────────────────────┘
                                 │
                                 ▼
   ┌──────────┐        ┌──────────────────────┐
   │NHS Direct│◄───────│  Patient requesting   │
   └──────────┘        │   further advice      │
                       └──────────────────────┘
                                 │
                                 ▼
   ┌──────────┐        ┌──────────────────────┐
   │GP REVIEW │◄───────│  Patient happy and    │
   │NEXT DAY  │        │  able to comply with  │
   └──────────┘        │        advice         │
                       └──────────────────────┘
                                 │
                                 ▼
                       ┌──────────────────────┐
                       │ Advice                │
                       │ Offer advice as       │
                       │ applicable            │
                       └──────────────────────┘

                       ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─┐
                         Protocol only to be
                       │ used by personnel who │
                         have received training
                       │    in their use       │
                       └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─┘
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Social problem
The patient describes a problem which is not related to a medical condition, eg housing problem etc.

Breathing compromise
Inability to maintain adequate oxygenation manifest by increased work of breathing, increased respiratory rate or exhaustion.

Signs of shock
These would include sweating; pallor; tachycardia or hypotension.

Difficult to assess patient
Any problem which prevents a proper assessment of your patient.

Signs of systemic upset
Anything during the assessment of the patient which would suggest another co-exisiting acute pathology such as infection.
    Check:
        Temperature
        Dehydration
        Vomiting

Severe pain
The patient is complaining of or exhibiting signs of pain which would be unlikely to respond to oral analgesia or settle with simple treatment.

Worrying history
A history which does not fit with the condition of the patient OR the patient has a past medical history or drug history which you feel may have a bearing on the management of the condition.
    Check:
        Warfarin
        Social isolation
        Immunosuppression

Signs of injury
The patient has any bruising or lacerations around the head or the history suggests a possible head injury. Any other indications that the patient has sustained an injury which requires further attention.

Contact primary care team
Contact with the General Practitioner or District Nurse is appropriate for further advice. If a visit is appropriate but you feel or the patient feels unable to wait for the estimated time of arrival then transfer to the Accident and Emergency is appropriate.

NHS Direct
Provide the patient with the telephone number of NHS Direct.

GP review the next day
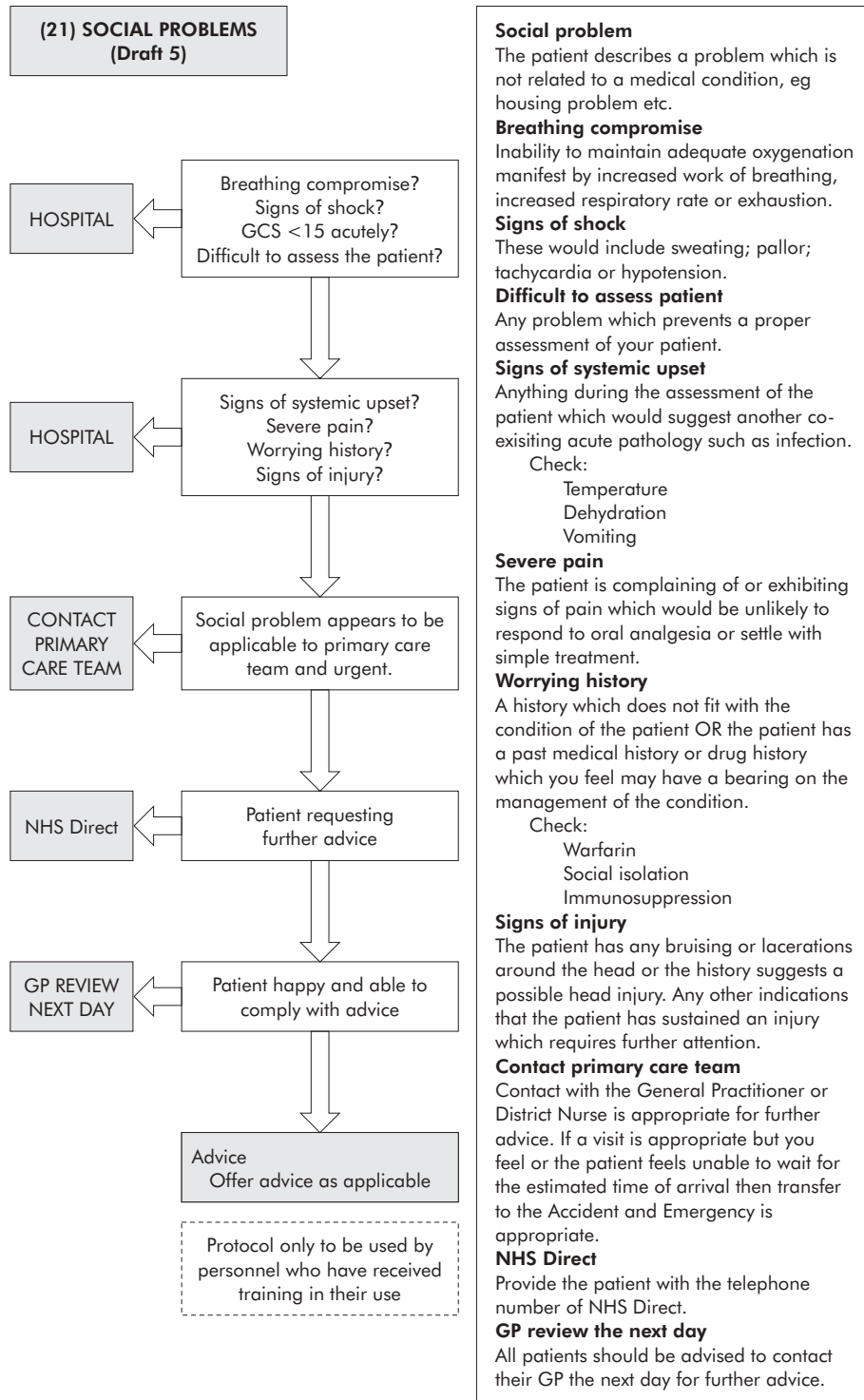All patients should be advised to contact their GP the next day for further advice.

Figure 3 Example of ''Treat and Refer'' protocol.

analysed using the Mann-Whitney U test. Inter-rater reliability was assessed with Cohen's kappa.

Approval for the study was granted by the local research ethics committees for the area.

RESULTS
Baseline operational indicators
Pre-study routine management information from the same months in 1998 and 1999 showed that non-conveyance rates for cases meeting the study inclusion criteria were significantly higher at the study stations than service wide (1998: intervention station 34%, control station 37%, service wide 23%, p<0.001; 1999: intervention station 32%, control station 32%, service wide 24%, p<0.001). However, there was no significant difference between the intervention and control stations (1998: 34% *v* 37%, p = 0.34; 1999: 32% *v* 32%, p = 1.0). Both stations had relatively short mean job cycle times for non-conveyed cases (1998: intervention station 44 minutes, control station 46 minutes, service wide 51 minutes; 1999: intervention station 46 minutes, control

Table 1 Cases matching the ''Treat and Refer'' (T&R) protocols by illness code from the locally collected 3 month pre-trial dataset

LAS illness code	No (%) of cases that matched T&R protocols
No injury or illness	232 (78)
Minor cuts and bruises	76 (100)
Alcohol related	38 (100)
Minor injuries (other)	35 (100)
Diabetic	32 (100)
Fainted, dizziness, loss of coordination	23 (100)
Epileptic fit	20 (100)
Hyperventilation/panic	20 (100)
Pain(s) back	15 (100)
Generally unwell	12 (35)
Confused, distressed, upset	10 (91)
Unable to cope	8 (100)
Other medical condition	8 (29)
Pain, other	5 (28)
Psychiatric problem diagnosed	5 (63)
Psychiatric problem undiagnosed	5 (83)
Abdominal pains	4 (25)
Diarrhoea	3 (100)
(Vomiting)	2 (100)
Sprains/strains	2 (100)
Collapse	1 (100)
Other	8 (13)
Total	564 (75)

station 46 minutes, service wide 55 minutes), again with no difference between the sites.

Protocol development

Twenty three protocols were developed (box 2), intended for active use during the patient care process and including decision points for transportation to the ED, referral to other agencies, or self-care (fig 3). For any individual patient, all protocols appropriate to the presented problem were required to be used, in conjunction with one another if necessary. Together, the protocols covered the problems documented as presented for 75% of the cases that had not been conveyed to hospital in the locally collected baseline data (table 1).

Main trial: sample details

From the baseline data collected at the study sites, 24 illness codes were selected to be used to identify patients to be included in the study. The primary and secondary outcomes depended on data collected from within the ambulance service and, to our knowledge, complete retrieval was achieved. In all, 797 patients were included in the study: 251 in the intervention group (attended by a crew member trained to use the new protocols with a condition that fell within the study illness codes); 537 in the control group (attended by a crew from the control station, with a designated study illness code and treated according to standard practice); and nine attended by trained crews but with a condition outside the designated illness codes and therefore excluded from the comparative analysis.

There were no statistically significant differences between the intervention and control groups in age (54 *v* 47 years, p = 0.08, 95% CI of difference 0 to 7), sex (52% *v* 51% male, p = 0.69, 95% CI of difference −5 to 8), or condition category of patients ($\chi^2 = 15.23$, p = 0.06), with the most common problems in each group being falls (29.6% *v* 22.9%), generally unwell/medical problems (17.3% *v* 18.2%), and minor injuries (14.6% *v* 12.1%). There were differences in the temporal distribution of calls, with intervention group patients somewhat more likely to have been attended during daytime hours

Box 2 ''Treat and Refer'' protocols (n = 23)

- Minor allergic reactions
- Insect bites and stings
- Boils/abscesses
- Splinter removal
- Postoperative wound problem
- Dressing problem
- Wounds (minor)
- Soft tissue injuries (minor)
- Epistaxis
- Sore throat
- Cold or flu symptoms
- Toothache
- Fit (= seizure) in known epileptic
- Resolved hypoglycaemia in known diabetic (insulin dependent)
- Back pain
- Diarrhoea
- Constipation
- Blocked urinary catheter
- Emotional or hysterical reaction
- Alcohol intoxication
- Social problems
- Faints
- Falls

than at night (61% *v* 52%, p = 0.02, 95% CI of difference 2 to 15).

Main trial: primary outcome

There was no significant difference in the proportion of patients left at the scene in the intervention and control groups (93/251 (37.1%) *v* 195/537 (36.3%), p = 0.90, 95% CI of difference −6 to 7).

Main trial: secondary outcomes

Protocol usage

Protocols were recorded as having been used for 101 of the 251 patients in the intervention group (40.2%) and for nine other patients who fell outside the study inclusion illness codes. All eight crew members who were trained to use the protocols recorded having used them, although the proportion of patients seen during the study period for whom they did this varied widely (mean 42%, range 11–100). Seventeen of the 23 protocols were reported as having been used during the study, with the falls protocol used far more than any other (57 times). The next most frequently used was soft tissue injury (9 times).

Table 2 Median job cycle times

	Conveyed (minutes)	Non-conveyed (minutes)	p value (95% CI of difference)
Intervention	59	35	<0.0001 (18 to 26)
Control	54	27	<0.0001 (24 to 29)

Table 3 Documentation of assessments in all patients (n = 795)

Assessment	Intervention cases (%)	Control cases (%)	95% CI of difference	p value
O$_2$ saturation	34	6	39 to 57	<0.0001
Pulse rate	56	26	22 to 36	<0.0001
Blood pressure	56	13	41 to 55	<0.0001
Respiratory rate	19	15	−3 to 15	0.21
Glasgow Coma Scale	61	56	−2 to 11	0.20
Pupil check	30	20	4 to 20	<0.005
Blood glucose	15	5	17 to 41	<0.0001
No vital signs recorded	35	38	−10 to 4	0.46

On retrospective review of crew patient report forms, JR judged a further 74 cases (29.5%) to have been appropriate for protocol usage, and three (1.2%) for which a protocol was documented as having been used to have been inappropriate for protocol usage. Hence, of the 181 patients treated by trained crews and deemed suitable for assessment with a protocol, crews recorded having done so for 107 (59.1%) of them. Independent assessment of a sample of cases by a second clinician showed moderate but significant agreement with the first assessment (seven discordant pairs and 30 concordant pairs, kappa = 0.55, p = 0.001).

In 93/156 (59.6%) conveyed patients in the intervention group, A&E department records could be located who did not wait, self-discharged, or were discharged home; 36 (38.7%) of these patients received no investigations *and* no or only minor treatment (Steristrips, written/verbal guidance, oral analgesia, other oral drugs). Crews had used their protocols for 17 of the 36 cases and a review by JR indicated that six more patients may have been appropriate for protocol use.

Job cycle times
The median job cycle time was 4 minutes longer for intervention than control group patients (51 v 47 minutes;

p<0.001, 95% CI of difference 2 to 9). As shown in table 2, in both groups the median job cycle time was considerably longer for patients who were conveyed than for those not conveyed. However, the median job cycle time was 8 minutes longer for non-conveyed patients in the intervention group than in the control group (35 minutes v 27 minutes, p<0.0001, 95% CI of differences 5 to 11).

Clinical documentation
Overall, as shown in table 3, clinical observations were more comprehensively documented in the intervention group. However, a similar proportion of patients in both groups had no clinical assessments recorded at all.

Patients who were not conveyed to ED: further analysis
Response rates and missing data
As summarised in table 4, after excluding repeat callers, patients who lived outside the study area and those without sufficient detail for contact, 117/215 (54.4%) of those invited to participate completed a follow up questionnaire. Data on subsequent care were retrieved from GPs and local ED clinical records for a further 36 patients (16.7%), but there remained

Table 4 Summary of follow up of non-conveyed patients and responses achieved

Follow up: route and outcome	Intervention group (n = 93)	Control group (n = 195)	Overall (n = 288)
Patient postal follow up			
Excluded	23	50	73
Repeat calls	8	16	24
Address outside area	0	1	1
Insufficient details	15	33	48
Sent invitation	70	145	215
Refused	13	25	38
Sent questionnaire	57	120	177
Completed	38	79	117
Refused	1	5	6
No reply	18	36	54
% response rate (completed/sent invitation)	54.3	54.5	54.4
GP follow up			
Excluded	35	86	122
No GP details	10	34	45
Outside study area	3	5	8
Patient in armed forces	1	0	1
Patient refused to participate	15	30	45
Other (including repeat calls)	6	17	23
Sent questionnaire	56	109	166
Returned completed	49	69	118
No reply	7	40	48
% response rate (completed/sent questionnaire)	87.5	63.3	71.1
Hospital follow up for non-responders			
Total followed up at A&E	20	53	73
No follow up information gained	18	44	62
% overall response rate (some information retrieved/total non-conveyed)	80.7	77.4	78.5

Box 3 Non-conveyed cases for which protocols were reported to have been used and judged by the A&E reviewers to have warranted conveyance at the time of the call out

Case 1 (78 year old woman living at home with son)
Presenting problem (time of call: 02:55): fall ?injury. Slipped, twisting and falling backwards against wall. Son had already contacted NHS Direct for advice.

Assessment: chief complaint pain (on movement), central lumbar top of right hip bone. Past medical history, arthritis. Patient in bed, no apparent injuries. Contacted NHS Direct to triage and refer to GP.

T&R protocol 23 (falls): the crew's assessment "did not indicate conveyance" to A&E

Referral: NHS Direct, triage (time 03:22). Muscular skeletal backache, onset <3 hours, location lower back, pain moderate, radiation left buttock, mechanism fall, treatment analgesia, bowel movement normal, micturition normal. Triaged as moderate urgency care, GP visit within 24 hours.

Follow up: On-call GP attended (time 04:15). O/E tender over lower sacrum, no T/L spinal tenderness, no neurology, hips NAD, reassurance, analgesia for the time being, will ring GP for follow up. Seen by own GP in the morning and admitted to hospital.

Admission: Same day A&E via emergency ambulance. Complaining of severe neck and lower back pain, now unable to get out of bed, tender C3.

Outcome: orthopaedic admission, fracture; length of stay 35 days.

Consultant review: T&R protocols to be used: (1) 23 "falls" and (2) 15 "lower back pain". Assessment criteria of protocol should have led to admission "worrying injury, patient unable to mobilise". (No indication of inquiring or advising analgesia.)

Case 2 (63 year old woman living in warden controlled sheltered accommodation)
Presenting problem (time of call 09:01): fall ?injuries.

Assessment: no injuries. Past medical history, known alcoholic.

T&R protocol 20 (alcohol intoxication): the crew's assessment "did not indicate conveyance" to A&E.

Referral: crew referred to GP.

Follow up: GP attended within 24 hours, home visit, and referred to DN/social services, prescribed medications.

Admission: next day found on floor by warden, not able to mobilise. Taken to A&E via emergency ambulance.

Diagnosis: (1) Acopia, frequent falls; (2) jaundiced and abnormal liver function tests (secondary to alcohol abuse).

Outcome: medical admission; length of stay 11 days.

Consultant review: T&R protocols 23 ("falls") to be used. Admission does not appear to be related to fall; however assessment criteria should have led to conveyance to A&E, criteria met "worrying history, worrying frequency".

62 (28.9%) for whom no follow up information could be retrieved.

Patient safety
Five of the 93 patients (5.4%) in the intervention group and 12 of the 195 (6.2%) in the control group were identified who had been left at home and were admitted to hospital in the 14 days after the 999 call. After excluding patients who refused to travel, the clinical reviewers judged that three patients in each group should have been taken to the ED at

the time of the 999 call. Crews had reported using protocols for two of those in the intervention group, but the ED reviewers judged from the details of the condition of the patient on scene and the ED records that additional protocols should have been used and that use of these protocols would have led to a decision to convey to an ED (see case reviews 1 and 2, box 3).

Only two of the nine patients assessed with protocols who were outside the study inclusion illness codes were left at home and neither of these was identified as having been subsequently admitted to hospital.

Patient satisfaction
A higher percentage of non-conveyed patients in the intervention group strongly agreed that their ambulance crew gave them the right amount of advice (69% v 46%, p<0.05); that they were reassured by the advice (72% v 45%, p<0.05); that they were given clear advice about when to get more help (71% v 47%, p<0.05); and that they were generally satisfied with the ambulance crew (81% v 58%, p<0.05; table 5).

DISCUSSION
Summary of key findings
Operational impact
This study failed to demonstrate a change in the primary outcome measure (the proportion of patients not conveyed to hospital) associated with the introduction of "Treat and Refer" protocols. However, the intervention was found to have an operational impact through increased job cycle times.

Quality and safety of care
Although the protocols were used to some extent by all the crew members trained in their use, retrospective review of cases suggested that there was potential both for further use of existing protocols and for development of new protocols. Overall, documentation of clinical assessments was higher in the intervention group than in the control group.

Concerns were identified with the safety of current usual practice and of practice using the protocols. High rates of satisfaction were reported in both groups, although satisfaction with some aspects of care—particularly those related to communication of advice—showed higher levels in the intervention group than those attended by crews from the control station acting according to their usual practice.

Study limitations
Study design
There were a number of constraints on the design and implementation of the study. Because of the nature of the intervention which necessitated training of crews to use new protocols and the operational requirements of an ambulance service, it was impractical to set up a study in which patients could be randomly allocated to study groups. Hence, the study design was to track two cohorts of patients that were attended by crews over the same period. Adjacent stations were selected for pragmatic reasons to increase the comparability of the two groups, with the two stations serving similar populations in terms of socioeconomics and geography. However, overlap of station patient catchment areas and receiving hospitals meant possible contamination caused by crew interaction.

Site selection
As the study site was selected due to the anticipated compliance of crews, lower levels of compliance might be seen if protocols were introduced elsewhere. On the other hand, historical data showed that the study sites had relatively high non-conveyance rates and short job cycle

Table 5 Patient satisfaction scores by study group

Satisfaction items	Intervention group % (n/N) strongly agree	Control group % (n/N) strongly agree	p value (95% CI of difference)
Ambulance crew listened very carefully to my problem	63% (22/35)	51% (37/72)	0.30 (−7 to 27)
Crew were very polite	70% (26/37)	62% (47/76)	0.41 (−10 to 26)
Right amount of advice	69% (24/35)	46% (33/71)	0.04 (2 to 37)
Reassured by the advice	72% (23/32)	45% (31/69)	0.02 (6 to 41)
Satisfied with explanation	69% (22/32)	49% (33/67)	0.09 (0 to 35)
Clear advice about when to get more help	71% (22/31)	47% (33/70)	0.03 (3 to 38)
Generally satisfied with the ambulance crew	81% (30/37)	58% (44/76)	0.02 (6 to 39)
	% (n/N) strongly disagree	% (n/N) strongly disagree	
Made to feel wasting the crew's time	52% (17/33)	38% (25/66)	0.28 (−6 to 31)

times compared with the ambulance service as a whole. The study might therefore have been less likely to find an impact on these measures than at other sites.

Reliability of patient satisfaction follow up

Patient satisfaction measures tend to overestimate satisfaction.[27] In this study this effect should have been found in both groups and therefore it is unlikely to have led to any bias in the comparisons presented.

Case recruitment

The power of the study was reduced because of lower recruitment to study groups than anticipated. This occurred due to unexpectedly high rates of absence of trained crews during the study period and non-participation in the study when trained crew members were ''driving'' rather than ''attending'' appropriate patients. We had aimed to recruit

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Key messages

- The introduction of ''Treat and Refer'' protocols did not lead to an increase in the number of patients left at the scene.
- Increased job cycle times associated with the use of ''Treat and Refer'' protocols may lead to less ambulance availability for response to other more serious calls.
- Protocols were used by all the crew members trained in their use, although not for all appropriate cases.
- Overall, documentation of clinical assessments was higher in the intervention group than in the control group.
- Concerns were identified with the safety of current usual practice and of practice using the protocols.
- Patients attended by crews trained in the use of the ''Treat and Refer'' protocols expressed higher levels of satisfaction with some aspects of care—particularly those related to communication of advice—than those attended by crews acting according to their usual practice.
- The need to develop the 999 service to improve the quality and appropriateness of service provided to patients is widely recognised, but this study confirms that changing practice is complex and effects sometimes unanticipated.

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530 patients to each arm of the study but, in the event, this was only reached in the control group with half that number recruited to the intervention arm. With this number we would have been 75% certain of detecting a difference of 9% in non-conveyance at the 5% level. The observed difference was only 1%, which was not statistically significant and was not considered by the research team to be of any clinical or operational significance.

Impact of introduction of protocols

No impact on conveyance rates was identified. However, there was some evidence to suggest changes in practice that may have been masked by the overall result—most noticeably, the increased time on scene spent with patients in the intervention group. The increased time may indicate improved quality of care, supported by more thorough documentation of observations for patients in the intervention group and increased levels of satisfaction of intervention group patients.

If the increased time spent on scene noted in this study proved to be a persistent effect, a considerable impact would be made on operational performance of an ambulance service. With no journeys saved and an increased job cycle time, ambulances would be tied up for longer and availability for primary response to new emergency calls might be affected. In addition, in this study protocols were not used to their full potential, with usage variable between crew members. Crews' views and attitudes towards the new intervention have been explored in a qualitative study that was undertaken alongside the quantitative study reported here.[28] If protocols were used to their full potential, the operational impact of increased job cycle times would be increased. Although care may be more appropriate, the operational implications of this need to be considered by ambulance services.

Conclusions

The necessity to develop the 999 service to improve the quality and appropriateness of service provided is widely recognised, but this study confirms the complexities involved in doing this. Although the trial showed that protocols for this purpose were used by crews and were acceptable to patients, the anticipated operational benefits were not demonstrated and safety concerns were identified. The lessons learned about the design and implementation of ''Treat and Refer'' protocols are valuable for taking the work forward, but to fully realise the potential benefits of this innovative change in service delivery these issues will need to be addressed in further research and/or service development work.

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