PREHOSPITAL CARE

# The experience of Teesside helicopter emergency services: doctors do not prolong prehospital on-scene times

**P D Dissmann, S Le Clerc**

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See end of article for authors' affiliations

Correspondence to: Dr P D Dissmann, Great North Air Ambulance, Northumberland Wing, The Imperial Centre, Grange Road, Darlington DL1 5NQ, UK; doctordissmann@aol.com

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**Background:** The benefits of helicopter emergency medical services (HEMSs) attending the severely injured have been documented in the past. The benefits of doctors attending HEMS casualties have been demonstrated in particular in inner-urban and metropolitan areas. However, for UK regions with potentially less major trauma, concerns have been raised by ambulance services that a willingness of doctors to ''stay and play'' may lead to unnecessary delays on-scene without any additional benefit to the patient.

**Aims** : To identify factors that do prolong on-scene time, establish whether doctors ''stay and play'' on-scene compared with paramedics and document how often advanced medical skills may have to be used by HEMS doctors working outside the London HEMS environment.

**Methods:** Patient report form data were studied with regard to the number of and mean on-scene times of missions flown to (A) road-traffic collisions (RTCs), (B) other trauma calls (OTCs) and (C) medical emergencies. Trauma missions (categories A and B) were further subcategorised with regard to associated patient entrapment. Any advanced medical interventions (AMIs) performed by HEMS doctors were recorded and categorised. Finally, we looked at the difference in on-scene times for physician–paramedic partnerships (PPPs) and conventional paramedic crews (CPCs) for the above categories and subcategories.

**Results:** A total of 203 patient report forms were identified and examined. In all, 44.3% of missions were flown to RTCs with a further 44.3% for OTCs and 11.4% to medical emergencies. AMIs were performed by HEMS doctors in 34.1% of PPP missions, with a prehospital rapid sequence induction rate of 3.8%. Overall mean on-scene time was 25 min, with no difference for PPP and CPC missions. The mean on-scene time was prolonged by 6 min for RTCs ($p = 0.006$) and by 23 min for patient entrapment ($p < 0.001$). No significant differences were found for the comparison between PPPs and CPCs in any of the subgroups A–C. However, there seemed to be a trend towards reduced on-scene times of PPPs for medical emergencies and patient entrapments.

**Discussion:** This study did not show any significant prolongation of mean on-scene times for PPP missions either overall or for any of the subgroups A–C. The fact that AMIs were performed in a large number of missions attended by HEMS doctors seems to further justify their current role in providing improved care at the roadside without leading to any delays in transfer to definitive care.

The Great North Air Ambulance Service (GNAAS) is one of a few helicopter emergency medical service (HEMS) operators in the UK to have pre-hospital care doctors working on board their aircraft as part of the HEMS crew. The benefits of HEMS services attending the severely injured have been documented in the past.[1 2] There is also no doubt that appropriately trained HEMS physicians bring important and advanced life support skills to the roadside[3] and improve the vital functions of patients with trauma at the time of hospital admission.[4] These benefits have been particularly shown in inner-urban and metropolitan areas. However, for other UK regions with less major trauma, concerns have been raised by ambulance services in the past about a willingness of doctors to ''stay and play'' with no additional benefit to the casualty. This may lead to unnecessarily prolonged on-scene times, causing delays in transferring the patient to definitive care.

Some debate has arisen regarding the competencies required of a pre-hospital care doctor,[5] and a lot of emphasis has been placed on advanced medical interventions (AMIs) including pre-hospital rapid sequence induction (PRSI), advanced pain management skills and advanced trauma life support procedures, all of which are currently outside the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) guidelines for paramedic practitioners.[6]

In order to deal with the above issues, we aimed to (1) identify factors that prolong on-scene time, (2) establish whether doctors stay and play on-scene compared with paramedics and (3) document how often AMIs may have to be performed by HEMS physicians working in parts of the UK with mixed rural/urban catchment areas.

## METHODS

GNAAS operates two helicopters, one serving Cumbria out of Penrith and the other serving the northeast out of Teesside. The Teesside HEMS crew consists of a senior pilot (Pilot), a senior paramedic with a minimum of 5 years' experience of front-line emergency work for a recognised ambulance service NHS trust (Medic 2), and a senior pre-hospital care doctor (Medic 1). When a doctor is not available, a second senior paramedic takes up the position of Medic 1. At the beginning of each shift, the three ambulance control rooms serving the north of England are made aware of the exact staffing of the HEMS crew.

**Abbreviations:** AMI, advanced medical intervention; CPC, conventional paramedic crew; GNAAS, Great North Air Ambulance Service; HEMS, helicopter emergency medical service; JRCALC, Joint Royal Colleges Ambulance Liaison Committee; PPP, physician–paramedic partnership; PRSI, pre-hospital rapid sequence induction; RTCs, road traffic collisions

**Table 1** Helicopter emergency medical services (HEMS) mission breakdown for overall, physician–paramedic partnership and conventional paramedic crew missions into the various subcategories

| HEMS mission breakdown | Total missions n (%) | PPP missions n (%) | CPC missions n (%) |
|---|---|---|---|
| RTC | 90 (44.3) | 60 (45.5) | 30 (42.3) |
| OTC | 90 (44.3) | 58 (43.9) | 32 (45.1) |
| Medical | 23 (11.4) | 14 (10.6) | 9 (12.6) |
| Entrapment | 29 (16.1) | 26 (22) | 3 (4.8) |
| Non-entrapment | 151 (83.9) | 92 (78) | 59 (95.2) |
| Overall missions | 203 (100) | 132 (100) | 71 (100) |

CPC, conventional paramedic crew; HEMS, helicopter emergency medical service; OTC, Other trauma calls; PPP, physician–paramedic partnership; RTC, road travel collisions.

**Table 2** Advanced medical interventions breakdown as total number (n) and rate (percentage) of all PPP missions for the various categories

| AMI breakdown | Drug treatment | PRSI | Analgesia | Chest drain | MUA | Total |
|---|---|---|---|---|---|---|
| Number (n) | 24 | 5 | 5 | 1 | 1 | 45 |
| Rate (%) | 18.2 | 3.8 | 3.8 | 0.8 | 0.8 | 34.1 |

AMI, advanced medical intervention; MUA, manipulation under sedation or regional anaesthesia; PRSI, pre-hospital rapid sequence induction.

The report forms for all patients attended by the Teesside HEMS team during the period between 1 June and 30 November 2005 were examined. Patient report form data were studied with regard to the number and mean on-scene times of missions flown to (A) road traffic collisions (RTCs), (B) other trauma calls (OTCs) and (C) medical emergencies. Trauma missions (categories A and B) were further subcategorised with regard to patient entrapment. AMIs were classified as any procedure or skill performed by a HEMS doctor that exceeded current JRCALC guidelines. These included PRSI with maintenance of anaesthesia and muscle relaxation, advanced analgesia (ketamine and fentanyl) and pre-hospital sedation (midazolam), advanced pharmacotherapy (cardiac, antibiotic, antiemetic, etc), insertion of chest drains, and fracture manipulation under sedation or regional anaesthesia (MUA). The retrospective calculation of injury severity scores or trauma revised injury severity scores was found to be unreliable owing to lack of detailed information on the patient report forms and was therefore not part of this study.

The study looked at the difference in on-scene times for physician-paramedic partnerships (PPPs) and conventional paramedic crews (CPCs) for the above categories and subcategories. Results were shown as the absolute number (n), percentage of total (%) and mean on-scene time with 95% confidence interval width rounded to the nearest half minute. Where a HEMS mission included multiple casualties, the overall on-scene time was divided by the number of patients attended to by either the PPP or CPC. AMIs were recorded for all PPP missions as absolute number (n) and percentage of total (%).

Statistical analysis was performed using the two-sided Student's t test for unpaired samples. Results were considered significant at the level of $p<0.05$. As no previous data on this subject were available, a retrospective power calculation was performed with $\alpha$ set at 5% and $1-\beta$ set at 80% to check for internal validity of the study results.

## RESULTS

A total of 203 patient report forms were identified and examined. Data acquisition was complete, with inclusion of all report forms for the above study period. In all, 132 (65%) HEMS missions were attended by PPPs, compared with 71 (35%) missions by CPCs. Also, 90 (44.3%) missions were flown to RTCs, with a further 90 (44.3%) for OTCs and 23 (11.4%) to medical emergencies. Of 180 trauma missions, 28 (16.1%) were flown to incidents with patient entrapment, whereas 152 (83.9%) missions attended non-entrapped casualties. The proportion of category A–C missions was similar for PPPs and CPCs. However, PPPs attended four times more trauma incidents with patient entrapment as compared with CPCs (22% *v* 4.8%; table 1).

GNAAS HEMS physicians performed advanced medical interventions outside JRCALC guidelines in 45 of 132 missions (34.1%), with a PRSI rate of 3.8% (5 of 132 missions). Table 2 gives the further breakdown of AMIs.

The mean (95% confidence interval (CI)) overall on-scene time was 25 (23 to 27) min, with 25 (22 to 28) min and 25 (21.5 to 28.5) min for PPP and CPC missions, respectively. For trauma missions, a mean (CI) on-scene time for RTCs of 28.5 (25 to 32) min was significantly higher than the mean (CI) time of 22 (19.5 to 24.5) min for other calls, with $p = 0.006$. Patient entrapment led to a significantly higher mean (CI) on-scene time of 44.5 (36.5 to 52.5) min compared with a mean

**Table 3** Overall breakdown of trauma missions, mean on-scene times with 95% confidence interval and associated p values for the comparison of entrapment versus non-entrapment and road-traffic collision versus other trauma call incidents

| Trauma on-scene times | Missions (n) | Missions (%) | Mean (min) | 95% CI (min) | Student's t test |
|---|---|---|---|---|---|
| Entrapment | 29 | 16.1 | 44.5 | 8 | $p<0.001$ |
| Non-entrapment | 151 | 83.9 | 21.5 | 2 | |
| RTC | 90 | 50 | 28.5 | 3.5 | $p=0.006$ |
| OTC | 90 | 50 | 22 | 2.5 | |

OTC, other trauma calls; RTC, road traffic collision.

**Table 4** Comparison of mean on-scene times with mean difference and p value for physician–paramedic partnership and conventional paramedic crew missions to road-traffic collisions, other trauma calls, medical emergencies, patient entrapments and non-entrapped patients with trauma

| | Mean on-scene times | | | |
|---|---|---|---|---|
| | PPP missions (min) | CPC missions (min) | Difference (min) | p Value |
| RTC | 29 | 28 | 1 | 0.862 |
| OTC | 22 | 22 | 0 | 0.923 |
| Medical | 20.5 | 24 | 3.5 | 0.326 |
| Entrapment | 43 | 56 | 13 | 0.412 |
| Non-entrapment | 20.5 | 23.5 | 3 | 0.186 |
| Overall | 25 | 25 | 0 | 0.796 |

CPC, conventional paramedic crew; OTC, other trauma calls; PPP, physician–paramedic partnership; RTC, road traffic collision.

**Table 5** Retrospective optimal ratio and sample size calculation for the overall comparison of on-scene times for road traffic collisions compared with other trauma calls, entrapment compared with non-entrapment and prehospital rapid sequence induction (PRSI) compared with non-PRSI

| Comparison overall of missions | Actual ratio | Optimal ratio | Actual sample | Optimal sample |
|---|---|---|---|---|
| RTCs *v* OTCs | 1 | 0.59 | 180 | 45 |
| Entrapment *v* non-entrapment | 0.19 | 0.5 | 180 | 31 |

RTC, road traffic collision; OTC, other trauma calls.

(CI) on-scene time for non-entrapped casualties of 21.5 (19.5 to 23.5) min, with $p<0.001$ (table 3).

There were no significant differences in mean on-scene times between PPP and CPC missions for any of the categories A–C. However, there seemed to be a trend towards reduced mean (CI) on-scene times for PPP missions in category C (medical emergencies), with 20.5 (17.5 to 23.5) *v* 24 (17.5 to 30.5) min ($p = 0.326$), and for patient entrapments, with 43 (34.5 to 51.5 *v* 56 (31.5 to 80.5) min ($p = 0.412$), and non-entrapped patients with trauma with 20.5 (18.5 to 22.5) *v* 23.5 (20 to 27) min ($p = 0.186$), when compared with PPC details (table 4).

The retrospective power calculation showed that a sufficient sample size had only been achieved for detecting overall differences in on-scene time of RTC versus OTC and casualty entrapment versus non-entrapment (table 5). In addition, the study seemed powered to show statistical differences in the comparison of mean on-scene times for PPPs and CPCs in call-outs to entrapped patients with trauma, but in none of the other category subcomparisons (table 6).

## DISCUSSION

This study did not show any statistically significant prolongation of mean on-scene times for physician–paramedic partnership missions either overall or for any of the subgroups A–C. The fact that PPPs relatively attended four times more trauma calls with patient entrapment may be due to ambulance control rooms being more willing to mobilise the HEMS team to serious incidents when there is a doctor on board. This has led to substantial selection bias in disfavour of on-scene times for PPP missions. Hence, we might argue that PPPs may have been faster on-scene on an incident-by-incident basis, but had to deal with a greater proportion of more complicated incidents. This is supported by a noticeable trend for reduced on-scene times when PPPs attended trauma calls (categories A and B) with patient entrapment and medical emergencies in remote areas (cardiovascular, asthma, COPD, etc).

GNAAS HEMS physicians exceeded JRCALC guidelines in 34.1% of missions while providing acute medical interventions at the roadside. This not only justifies the presence of

**Table 6** Retrospective optimal ratio and sample size calculation for the comparison of on-scene times for physician–paramedic partnerships and conventional paramedic crews with regard to missions flown to road-traffic collisions, other trauma calls, medical emergencies, entrapment incidents and non-entrapped patients with trauma

| Comparison of PPP and CPC | Actual ratio | Optimal ratio | Actual sample | Optimal sample |
|---|---|---|---|---|
| RTCs | 2 | 0.84 | 90 | 3620 |
| OTCs | 1.81 | 1.08 | 90 | 2230 |
| Medical emergencies | 1.56 | 2 | 23 | 46 |
| Entrapment incidents | 8.67 | 1 | 29 | 26 |
| Non-entrapped patients | 1.56 | 1.3 | 151 | 428 |

CPC, conventional paramedic crew; OTC, other trauma call; PPP, physician–paramedic partnerships; RTC, road traffic collision.

appropriately trained pre-hospital care doctors on HEMS aircraft in UK regions with mainly mixed rural/urban catchment areas but also shows that improved patient management may not necessarily lead to delays in transfer to definitive care. However, this study did not establish in how many of the CPC missions AMIs would have been indicated, leading to a degree of recording bias.

The above findings seem valid in that apart from a different crew make-up all other factors (number of crew, equipment carried, proportions of category A–C missions) are comparable, and therefore any variations in on-scene times should be largely due to the presence or absence of HEMS doctors and their willingness to perform more complex and potentially time-consuming procedures at the roadside. However, this study was not adequately powered to detect differences between the PPP and CPC groups. Another limitation is the fact that no two incidents are the same, and that there may be other confounding factors—that is, technical difficulty of extrication as well as experience of the attending fire and police crews.

The findings of this study are important and applicable to other HEMS operators who may consider deploying pre-hospital care doctors, as the population served and the missions flown by GNAAS reflect the situation in other parts of the UK better than the highly unique operations of London HEMS.

Finally, this study was not aimed at investigating improved patient outcome or survival rates, and further prospective studies will have to be designed to look specifically at patient injury severity scores as well as 1-week and 30-day mortality.

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## Authors' affiliations

**P D Dissmann, S Le Clerc,** Great North Air Ambulance, Northumberland Wing, The Imperial Centre, Darlington, UK

Competing interests: PDD and SLC are both registered doctors with the British Association for Immediate Care and work for the Great North Air Ambulance Service.

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