

The Need for a UK Helicopter Emergency Medical Service by Night: A Prospective, Simulation Study

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Abstract

Background: Major trauma commonly occurs at night. Helicopter emergency medical services (HEMS) can provide advanced prehospital care to victims of major trauma but do not routinely operate at night in the United Kingdom. We sought to prospectively examine the need for a night HEMS service in Kent, Surrey, and Sussex in the United Kingdom.

Methods: A 4-month, prospective study was conducted (July 1, 2012–October 31, 2012). HEMS dispatch paramedics were present in the ambulance dispatch center and undertook simulated HEMS activations when a suitable case was identified. All trauma cases from the 4-month study period were collated. Five independent HEMS clinicians reviewed the simulated tasking and trauma cases and gave an opinion on whether the patient met HEMS activation criteria.

Results: A mission rate of 1 case per night was predefined as cost-effective. During the prospective study, 145 calls were identified by the HEMS dispatch paramedic as appropriate for an HEMS response. If HEMS had deployed to all 145 incidents, this would have resulted in an average mission rate of 1.2 activations per night. Two hundred eight incidents were identified as potentially appropriate for HEMS activation. Responding to all 208 incidents would have resulted in a mean activation rate of 1.7 per night.

Conclusion: This study justifies the need for Kent, Surrey and Sussex Air Ambulance Trust to operate a service at night for a trial period, with an estimated average mission load of 1 per night spread over the entire night period. Further research is warranted to determine the potential impact of a night HEMS service on outcome from major trauma.

In the United Kingdom, trauma is the leading cause of death in young adults, and for every fatality, there are at least 2 survivors with serious, permanent disabilities.^{1,2} Helicopter emergency medical services (HEMS) provide highly trained specialist emergency physicians and paramedics to the scene of accidents where patients require advanced clinical care during the prehospital resuscitation period.^{3,4} HEMS provide prehospital interventions not routinely performed by local road ambulance crews. These include prehospital anesthesia, procedural sedation, transfusion of blood products, and life-saving surgical procedures such as thoracotomy. HEMS also enable rapid triage and transfer of injured patients to the most suitable hospital. Local ground ambulance crews cannot administer procedural sedation, cannot administer drugs to facilitate intubation, and do not carry prehospital blood. Ground ambulance crews transferring a patient at night to the nearest major trauma center can take up to 90 minutes from some parts of the study region. In areas where ground transport to a major trauma center (MTC) is < 45 minutes, ground crews are instructed to bypass local hospitals for major trauma patients. If concern exists about the patient's airway or when transport to an MTC is > 45 minutes, the ground ambulance crew can transport to the nearest hospital with a trauma unit, and then secondary transfer is considered. Given these prolonged distances, we decided not to explore a ground-based physician system. HEMS may also have a significant benefit for acute medical patients; however, this study was restricted to trauma patients.

Kent, Surrey and Sussex (KSS) HEMS responds to over 1,500 emergency calls a year, providing a service to a resident population of over 4.5 million people over an area of approximately 9,000 km². KSS HEMS operates 2 helicopters from bases at Marden in Kent and Redhill in Surrey. KSS HEMS operates rapid response cars when poor weather prevents flying. KSS HEMS operates 7 days a week between the hours of 0730 and 1900. The HEMS team consists of a pilot, a prehospital doctor from an emergency medicine or anesthesia background, and a critical care paramedic.

Given the size of the region, the spread of the 4.5 million resident population, the concentration of the 90 million annual transient population, the nature of the road network and the concomitant times of road travel, and the random

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spread of trauma incidents, it was considered that at least 4 ground response teams would be needed to cover the region in cars by night to achieve a reasonable response time.

By air, the team can reach any location in the counties within 20 minutes of dispatch. A specialist paramedic in the dispatch control center screens 999 emergency calls and activates the service when they identify that a patient has clinical needs justifying HEMS deployment. HEMS activation is based on predefined criteria (eg, road traffic collision with a fatality, road traffic collision with ejection from the vehicle, entrapment under a vehicle, struck by train, fall > 5 m, or amputation proximal to the wrist/ankle) or by interrogating the 999 call and using clinical judgment.

Major trauma commonly occurs at night.¹ Darkness and colder weather can increase the likelihood of road traffic collisions, and serious assaults often occur at night, as do alcohol-related injuries. Despite this significant burden of nocturnal major trauma, few air ambulances in the United Kingdom fly during the hours of darkness.⁵

Night HEMS missions carry logistical complexity with increased risk and cost,⁶ and safety is absolutely paramount. Specific regulations governing night HEMS operations have been laid down by the Civil Aviation Authority.⁷ In order to legally undertake night HEMS operations, the aircraft must be certified to fly at night, have an instrument flight rating, and be equipped with suitable lighting systems. Night HEMS aircrew must be specifically trained and equipped with Night Vision Imaging Systems. All of these elements require considerable capital expenditure, ongoing costs, and training. Flying at night poses the risk of striking terrain or obstacles, particularly from pilot disorientation and Night Vision Imaging Systems-related fatigue.⁸ KSS HEMS undertook this study in order to establish the need for a night HEMS service in the region. If required, KSS HEMS would launch a night HEMS service, with safety as the first priority. This would involve a new aircraft with full night instrument flight capability, antiwire technology, and a traffic collision avoidance system. The aircraft would be flown by 2 pilots 24/7 in order to maximize dual pilot capability. The pilots, doctor, and paramedic would undergo extensive night HEMS training, and all would use night vision on missions. New computer hardware and software would be purchased for advanced night HEMS mission planning, navigation, and landing. In addition, night landing sites across the region were presurveyed and indexed to allow further landing options should an ad hoc landing at the scene not be feasible.

Accurate tasking is required for night HEMS. The ability to identify the incidents in which HEMS are likely to be of clinical benefit to the patient is important.⁹ A low activation rate may deprive critically injured patients of a potentially lifesaving service, whereas a high level of HEMS stand-downs could expose the aircrew and medical team to unnecessary risk.

A night HEMS service requires additional funding. Currently, a daytime HEMS mission costs approximately £2,900 per mission. The estimated additional cost of a night HEMS service was £1 million per year. Therefore, we set an

arbitrary mission rate of 1 per night, or a cost of £2,700 per night mission, as a level where the night HEMS service would be worthwhile.

For HEMS to operate at night, the clinical need for the service must be established and justified. This study aimed to prospectively determine if there was a need for HEMS during night hours in KSS and categorize the type of calls that a night service would be likely to receive.

Methods

The study took place in KSS and used data from 999 calls to the ambulance control centers in these counties. We evaluated 2 case series over the same time period: a prospective simulation and a retrospective case analysis over a 4-month period of 123 nights (July 1, 2012–October 31, 2012).

In the prospective simulation, KSS HEMS paramedics at the ambulance control dispatch center were present 24 hours per day. During night hours (1900–0730), the tasking HEMS paramedic was asked to identify potentially suitable HEMS cases, as they would during a day shift. If the HEMS dispatch paramedic felt HEMS activation would be justified, a simulated dispatch was performed. The call information, ambulance response, and patient condition were recorded on the ambulance dispatch computer for future analysis. Simulated HEMS activation was restricted to trauma cases.

No individual patient records, either prehospital or hospital, were accessed for this study. Only information held on the regional ambulance service dispatch system was used for the study. It was agreed that this study met UK National Institute for Health Research criteria for a service evaluation.

Retrospectively, all emergency calls to the ambulance dispatch in the 4 months between the hours of 1900 and 0730 involving trauma were identified by an automated search of the dispatch computer system. Cases of major trauma in which a patient may have benefited from HEMS input were identified during an initial screen by excluding patients not requiring transport to a major trauma center.

To assess whether an HEMS response would have been appropriate for each case, 5 senior HEMS clinicians independently evaluated all incidents from both case series. Each clinician was provided with an incident description, location, initial patient physiology, and Glasgow Coma Score. Appropriateness for a HEMS dispatch was based on those missions felt to benefit from on-scene HEMS intervention (eg, procedural sedation, prehospital anesthesia, chest decompression with chest drain or thoracostomy, and prehospital blood). The clinician was also requested to take into account the geographic location of the incident, in particular if the transfer time to an MTC was > 45 minutes. Each clinician was asked whether HEMS activation would have been justified.

The feedback was recorded on a 4-point score as follows: “YES—immediately dispatch HEMS,” “LIKELY—for a HEMS dispatch,” “POSSIBLE—indicating more information is required before dispatch,” or “NO—not HEMS appropriate.” Ordinal data were analyzed and presented as proportions. The

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