Air Medical Journal 40 (2021) 28–35

Contents lists available at ScienceDirect

Air Medical Journal

journal homepage: http://www.airmedicaljournal.com/

Original Research

Scoping the Demand for Night Operation of Essex & Herts Air Ambulance: A Prospective Observational Study

Sarah McLachlan, MSc, PhD [1,2,*], Hilary Bungay, HDCR, MA, PhD, PGCLT [1], Scott Wallman, DipIMC, RCSEd [2], Michael D Christian, MD, MSc, FRCPC [3], Erica Ley, MSc, DipIMC [2], Ronan Fenton, MBBCh, BAO, FFA (RCSI), Dip Med Ed [2]

[1] *Anglia Ruskin University, Chelmsford and Cambridge, United Kingdom*
[2] *Essex & Herts Air Ambulance, Colchester, United Kingdom*
[3] *London's Air Ambulance, Royal London Hospital, Bart's NHS Trust, London, United Kingdom*

A B S T R A C T

Objective: Helicopter emergency medical services play an important role in the prehospital care of critically ill and injured patients, providing enhanced interventions and direct transfer to specialist centers. Essex & Herts Air Ambulance (EHAAT) delivers prehospital critical care to patients in Essex, Hertfordshire, and the surrounding areas. Historically, EHAAT's resources have not operated during the night. This study aimed to ascertain demand for prehospital critical care in Essex and Hertfordshire during night hours.

Methods: A prospective observational design was used. Data were collected by 11 critical care paramedics during night shifts on a critical care desk using an online survey. Details were recorded for incidents in Essex and Hertfordshire between 21:00 and 07:00 deemed appropriate for a prehospital critical care response.

Results: A total of 108 incidents were recorded across 52 nights, equating to an average of 2.08 incidents per night. For 52 incidents, there was no critical care resource available to attend. The majority of incidents fell in closer proximity to EHAAT's North Weald base than its Earls Colne base.

Conclusion: The findings suggest a potential need for prehospital critical care during night hours in Essex and Hertfordshire and support the operation of a resource from EHAAT's North Weald base.

© 2020 The Authors. Published by Elsevier Inc. on behalf of Air Medical Journal Associates. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

The long-established concept of the "golden hour" refers to the crucial nature of the first hour after injury in determining patients' likelihood of survival.[1] In the United Kingdom, the majority of the first hour after injury is spent in the prehospital environment[2]; therefore, prehospital critical care plays a vital role in the pathway for trauma patients. Prehospital critical care in the United Kingdom comprises targeted dispatch of critical care paramedics and/or prehospital care doctors to critically ill or injured patients. Helicopter emergency medical services (HEMS) form part of UK prehospital critical care, providing air medical retrieval and transfer of patients, in addition to enhanced care interventions not provided by ground ambulance crews. These enhanced interventions include prehospital anesthesia, sedation, blood transfusion, and surgical procedures such as thoracotomy.

Studies have supported the importance of enhanced prehospital critical care in the management of trauma patients.[3,4] A prospective observational study concluded that standard ambulance service provision is not sufficient for all trauma patients, and critical care teams with rapid sequence induction capability are required to manage significant airway compromise.[3] Furthermore, findings of the Head Injury Retrieval Trial indicated that prehospital critical care has the potential to reduce mortality in patients with a Glasgow Coma Scale score < 9 after severe blunt head injury, relative to management by paramedics alone.[4] Systematic review findings have also shown increased survival of trauma patients after physician-provided prehospital care relative to provision by paramedics only.[5] Therefore, trauma guidelines make evidence-based recommendations for the delivery of advanced prehospital interventions by critical care teams.[6,7]

*Address for correspondence: Sarah McLachlan, PhD, Anglia Ruskin University, Bishop Hall Lane, Chelmsford, Essex, UK CM1 1SQ.
E-mail address: sarah.mclachlan@anglia.ac.uk (S. McLachlan).

1067-991X/$36.00
© 2020 The Authors. Published by Elsevier Inc. on behalf of Air Medical Journal Associates. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

Out-of-hospital cardiac arrest is also associated with high mortality; data suggest that patient survival to hospital discharge ranges from 2% to 12% across UK ambulance services.[8] A number of HEMS services respond to out-of-hospital medical cardiac arrests, and there is some evidence that physician-delivered prehospital critical care has a positive impact on patient outcomes.[5] The suggested mechanisms underlying this beneficial impact include more efficient performance of advanced life support interventions; enhanced experience and clinician judgment; and advanced postarrest treatment, including conveying patients to the most suitable specialist hospitals.[9]

Essex & Herts Air Ambulance (EHAAT) is a HEMS charity that provides enhanced prehospital critical trauma and medical care to patients in the counties of Essex and Hertfordshire, covering a population of approximately 3 million people, and the surrounding areas. EHAAT works closely with the East of England Ambulance Service National Health Service Trust (EEAST), supporting ground ambulance crews in treating critically ill and injured patients. The charity has 2 air bases from which 2 aircraft and a fleet of rapid response vehicles operate. The rapid response vehicles are used when the aircraft are offline, and 1 vehicle was historically operational between 18:00 and 02:00 on Fridays and Saturdays. These hours were extended in January 2019 to provide full coverage on Friday and Saturday nights from 19:00 to 07:00. Including incidents in which the clinical team subsequently stood down, EHAAT responded to 1,342 missions in Essex, 406 in Hertfordshire, and 384 in surrounding areas during the year 2018 to 2019. Of these missions, 478 were road traffic collisions, 830 were other trauma incidents such as falls and assaults, and 824 were medical emergencies. Treatment was provided to 1,440 patients.

Aside from the service provided by a rapid response vehicle on 2 nights per week, EHAAT's critical care resources have not historically operated during night hours, finishing at 21:00 and beginning again at 07:00. This left a gap in critical care coverage for the region during night hours whereby patients may not have access to the same enhanced care as those who were ill or injured during the day. In order to scope the demand for night operation and ensure the appropriate use of resources, data were required on the incidence and nature of critical incidents occurring in Essex and Hertfordshire between 21:00 and 07:00.

Using prospective and retrospective methods, Lyon et al[10] and Curtis et al[11] assessed the demand for and impact of night operation of Kent Surrey and Sussex Air Ambulance Trust (KSSAAT). Lyon et al[10] used simulated HEMS tasking for emergency calls judged by dispatch paramedics as appropriate for an HEMS response to prospectively examine demand for a night HEMS service. Across the 4-month study period, dispatch paramedics reported 145 calls as potentially appropriate for an HEMS response, equating to an average of 1.2 simulated activations per night. The authors also retrospectively assessed call data for the same 4-month period and identified 208 incidents potentially appropriate for an HEMS response. After removing duplicates, the combined analyses identified 307 unique incidents, equating to an average of 2.5 activations per night. On this basis, the authors concluded that there was sufficient justification for a trial period of night operation. Curtis et al[11] subsequently conducted a retrospective case review of all night HEMS missions attended by KSSAAT between October 2015 and October 2017. This identified 5,004 night missions and 3,728 patients attended by the HEMS crew, equating to averages of 1.9 missions and 1.3 patients attended per night. The analysis also showed that a significantly higher proportion of patients were transported to a major trauma center at night relative to during the day. These findings were broadly consistent with the predicted activation rate reported in the prospective study.[10]

The current study used similar methods to Lyon et al[10] to scope the demand for night operation of EHAAT's critical care resources. The aim of this study was to determine the number and nature of incidents received by the critical care desk at EEAST's Emergency Operations Centre for the counties of Essex and Hertfordshire between 21:00 and 07:00 judged by critical care paramedics as appropriate for HEMS activation. A secondary aim was to map the geospatial distribution of critically ill and injured patients potentially requiring critical care in Essex and Hertfordshire between 21:00 and 07:00.

Methods

Study Design

This prospective, observational study used data from emergency calls received by the critical care desk at EEAST's Emergency Operations Centre. The critical care desk is staffed by a critical care paramedic and a dispatcher who are responsible for the tasking of critical care resources to incidents received by EEAST. The critical care paramedic and dispatcher screen all calls received and identify those that are likely to require critical care resources.

Participants

Information about the study was sent via e-mail to all 17 critical care paramedics employed at EEAST to work shifts on the critical care desk. These critical care paramedics also worked for EHAAT and/or the East Anglian Air Ambulance. Study information included a letter of invitation, a participant information sheet, a copy of the consent form, and a letter of endorsement for the study from a member of EHAAT's Executive Team. Eleven critical care paramedics (64.7%) consented to participate.

Procedure

Data were collected by the critical care paramedics from emergency calls received by the critical care desk between the hours of 21:00 and 07:00. The survey was developed with reference to the *Trauma East Manual of Procedures and Operations* (edition 2) and through expert involvement. Details of the survey items and response options are provided in Table 1. An electronic survey was created using the tool Online Surveys (Jisc, Bristol, UK), which is compliant with UK data protection law. The survey was accessed via the critical care desk computer, and a pilot survey was completed with 1 paramedic to ensure that this process ran smoothly.

The data collection period spanned from October 21, 2018, to August 28, 2019, and it was intended that data would be collected across 90 nights. Because the critical care desk is not staffed by a clinician every night and some clinicians did not consent to participate, a longer period was required to try to meet this aim. The survey was completed for calls within the county boundaries of Essex and Hertfordshire for which the paramedic in their clinical judgment believed an HEMS activation would be appropriate. Paramedics received brief training on data collection from the lead researcher and were encouraged to contact the researcher with any questions. Data were downloaded from Online Surveys once weekly to Excel 2016 (Microsoft, Redmond, WA). All processes for data collection and storage were compliant with the General Data Protection Regulation.

Data Analysis

Data were analyzed in Excel 2016. Frequency counts were produced for all categoric variables, and the mean number of incidents deemed appropriate for a critical care response per night were calculated. The mean and standard deviation response time of the critical care teams from dispatch to arrival on scene were calculated. Location data were mapped to indicate the geospatial distribution of incidents during night hours using QGIS Geographic Information System software (Version 3.4.9; Open Source Geospatial Foundation, Chicago, IL). QGIS was also used to calculate the number of incidents deemed appropriate for a critical care response within the particular radii of

Table 1
Clinician Survey Items and Response Options

Survey Item	Response Format/Options
Participant ID	Free text
Date of call	dd/mm/yy
Time of call	hh:mm (limited to times between 21:00 and 06:59)
How was the call identified?	Silent interrogation; Active interrogation; Crew request; Call handler/call handler team leader; External agency; Other (please give details)
Location of incident—postal code	Free text
Location of incident—grid reference	Free text
Type of incident	Medical; Trauma
Mechanism of injury (if applicable)	Blunt trauma: *Ejection from vehicle/thrown from motorbike; Motor vehicle fatality in the same passenger compartment; Motorbike/bicycle/ pedestrian hit by car at ≥ 20 miles per hour; Prolonged extrication time > 20 minutes; Crush injury to thorax/abdomen; Fall > 3 meters/10 feet; Other (please give details)* Penetrating trauma: *Blast injury/explosion; Gunshot wound; Stabbing; Other (please give details)*
Type of medical incident (if applicable)	Cardiac arrest; Other (please give details)
Was a critical care team activated?	Yes; No
Was it the case that a critical care team was available but not activated? (if applicable)	Yes; No
What was the reason for not activating the critical care team? (if applicable)	Free text
Critical care teams activated (if applicable)	Basics Essex Accident and Rescue Service; East Anglian Air Ambulance; Essex & Herts Air Ambulance; Magpas Helimedix; Suffolk Accident Rescue Service; EEAST Critical Care Paramedic; Mutual Aid; Other (please give details)
Where were the critical care team(s) activated from? (if applicable)	Free text
Outcome of activation of critical care team(s) (if applicable)	Stood down en route; Stood down on scene/no clinical input required; Ground assist; Ground escort; Patient carried; Patient died on scene
Response time(s) of critical care team(s), defined as time from passing of the call to the responding critical care team to arrival at the incident scene (if applicable) *If multiple teams are activated, please base this on the time that the first team arrive on scene*	hh:mm
In your clinical judgment, has the critical care team had an impact on patient care (eg, triage, interventions, destination)? Please explain your answer (if applicable)	Yes; No Free text
In your clinical judgment, has the lack of availability of critical care resources adversely affected patient care (eg, triage, interventions, destination)? Please explain your answer (if applicable)	Yes; No Free text
Trigger for decision that a critical care team activation would be appropriate	Free text
At which stage did you decide that a HEMS response would be appropriate?	Free text

HEMS = helicopter emergency medical services.

EHAAT's 2 air bases. Free-text responses regarding justification for a critical care response and the stage of decision making were analyzed thematically. During data analysis, substantial intervals were identified between nights of data collection. Although some gaps in data collection were anticipated, these were cross-checked against staffing records for the critical care desk on EHAAT's clinical database. This indicated that there were a number of nights when a participating clinician had been on the critical care desk but data had not been collected. To determine whether this reflected a lack of incidents appropriate for a critical care response, critical care desk shift reports were examined for each night in question. Clinicians' notes were analyzed to identify any incidents deemed appropriate for a critical care response within Essex and Hertfordshire between 21:00 and 07:00. Incidents were excluded if a resource was initially dispatched but subsequently stood down because the mission was not as originally given or a patient was reported to have been pronounced life extinct by the attending ambulance crew. Incidents were included if a resource was initially dispatched but stood down because the ambulance crew subsequently left the scene (ie, "scoop and run") because this is likely a reflection of the time required for a resource to reach the scene rather than the need for critical care input. Incidents were excluded if the ambulance crew were judged to be adequately dealing with the patient(s).

Ethics and Governance

Ethical approval was obtained from the Faculty Research Ethics Panel at Anglia Ruskin University (ref: FMSFREP/17/18 250). The study does not constitute research according to National Health Service criteria and is classified as a service evaluation; therefore, Health Research Authority approval was not required. A research passport and letter of access were obtained from EEAST to facilitate the collection of data at a National Health Service site. Permission to conduct the study was also obtained from the air operations manager at EEAST.

Patient and Public Involvement

Paramedics employed on the critical care desk were consulted on the study methodology. In particular, paramedics were asked about the feasibility of collecting these data during night shifts and whether they felt that paper or electronic data collection forms would be preferable. Based on their responses, we were confident that it would be feasible to collect the study data, and an electronic survey was used. A critical care paramedic from another HEMS service was asked to review drafts of the participant information sheet, consent form, and draft survey. Consistent with the paramedic's feedback, several items were added to the survey. These included items on how the call was identified; whether a critical care team was available but not activated and, if so, the rationale for not activating the resource; and, in the case of an activation, where the critical care team(s) were activated from. Two items were added to explore clinicians' views on whether the availability of critical care resources adversely affected the patient's destination. Additional response options were suggested for 2 existing items; "EEAST critical care paramedic" and "mutual aid" were added to the list of critical care teams activated, while "no clinical input required" and "patient died on scene" were added to the list of outcomes of critical care team activation.

Table 2
The Frequency of Activation of Critical Care Resources for Incidents Recorded in the Survey

Critical Care Resource	Frequency of Activations
East Anglian Air Ambulance	11
EEAST Critical Care Paramedic[a]	1
Essex & Herts Air Ambulance	9
Magpas Helimedix	1
Mutual Aid	1
Other	4
Suffolk Accident Rescue Service	2

[a] Please note that the scope of practice of an EEAST critical care paramedic is quite narrow in relation to helicopter emergency medical services, and these are not interchangeable resources.

Results

Survey Analysis

During the study period, a total of 108 incidents across 52 nights were recorded as appropriate for a critical care response in Essex and Hertfordshire. This equates to approximately 2 incidents per night of data collection (mean number of incidents per night = 2.08). The number of trauma and medical incidents were 61 and 47, respectively. The percentage of incidents that were medical in nature (43%) is consistent with the percentage of medical events in EHAAT's overall workload.

The total number of incidents deemed appropriate for a critical care response within a single night ranged from 1 to 5. Key triggers for the decision that a critical care response would be appropriate were cardiac arrest, particularly when witnessed, and there was a likelihood of achieving return of spontaneous circulation (33 incidents); a central stab wound or other penetrating trauma (15 incidents); a fall down stairs or from height (8 incidents); a head injury (8 incidents); the patient was unresponsive/not breathing (8 incidents); a crew request for critical care support (8 incidents); and agitation or difficulty managing the patient (7 incidents). For many incidents, clinicians described a combination of factors as underlying their decision.

A critical care team was activated for 29 of the 108 incidents (26.9%). For the remaining 79 incidents, there was no critical care resource available for 52 incidents (65.8%). Outcomes for the 29 critical care team activations were as follows: 4 "ground assist" (HEMS team was involved in the patient's care but did not accompany the patient to the hospital), 6 "ground escort" (HEMS team was involved in the patient's care and accompanied the patient to the hospital in the ground ambulance), 4 "patient carried," 4 "patient died on scene," 10 "stood down en route," and 1 "stood down on scene" because

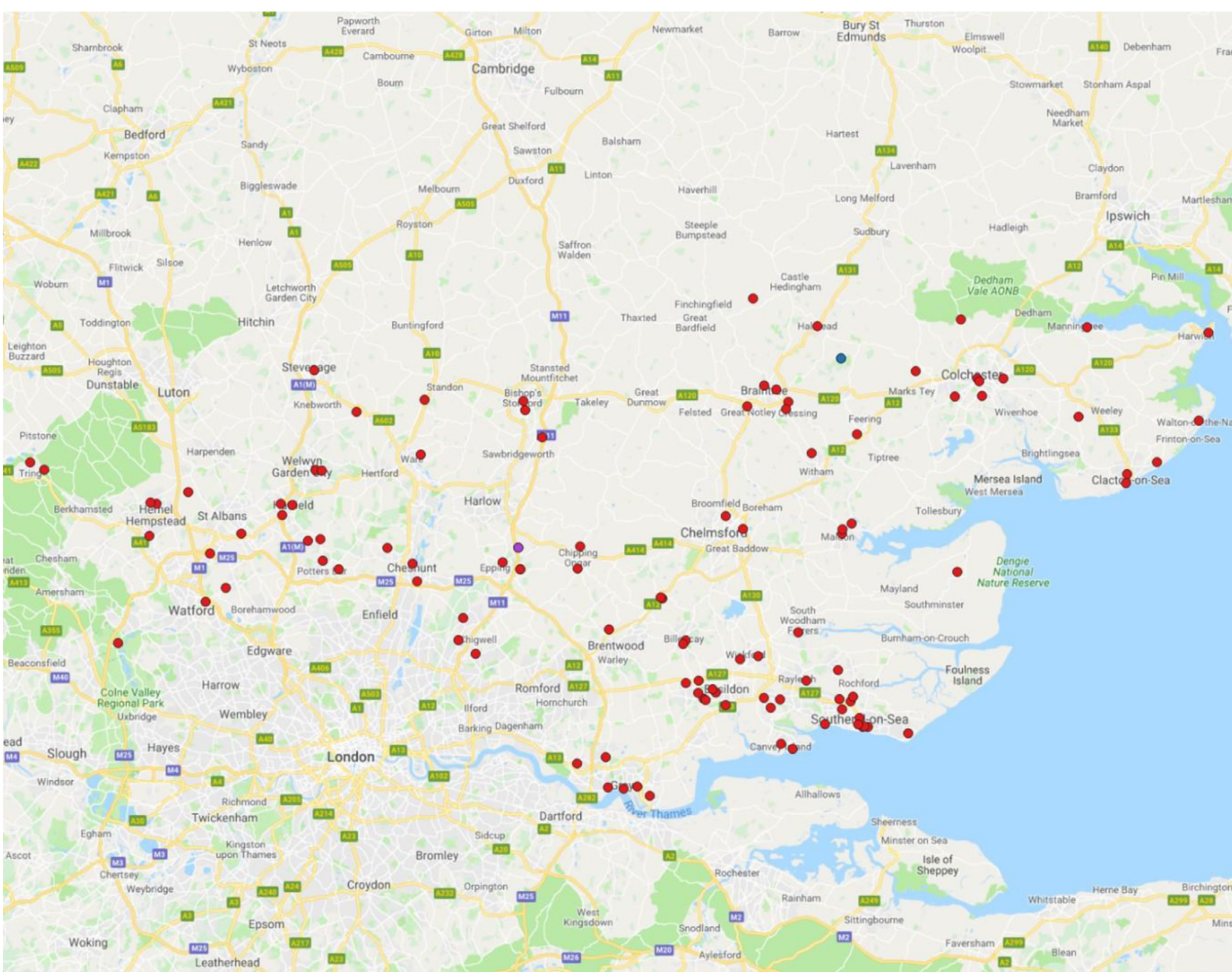

Figure 1. A map showing geospatial distribution of incidents in Essex and Hertfordshire 21:00-07:00, recorded in the prospective study as appropriate for critical care resource activation.

clinical input was not required. A critical care team from EHAAT was activated for 9 of the incidents. A full breakdown of the activated resources is provided in Table 2.

The response time of the critical care resource was recorded for 19 of the 29 activations, defined as the time from passing the call to the responding resource to arrival at the scene. The response time ranged from 7 to 49 minutes (mean = 24.3 minutes). Of the 29 critical care resource activations, clinicians felt that the activation had an impact on patient care (eg, triage, interventions, and destination) in 13 cases, no impact in 6 cases, and there was no response to this item for 10 cases. The positive impacts described by clinicians included the enhanced interventions provided by the critical care team, such as prehospital anesthesia and management of hypovolemia, triage to a major trauma center or other appropriate destination, assistance with difficult airways, assistance with decision to cease resuscitation, and scene management. The reasons for a perceived lack of impact included minor nature of the injury or issue, no interventions being performed by the team, and assistance only with decision making to cease resuscitation.

For the 52 incidents for which a critical care team was not available, respondents felt that this lack of availability adversely affected patient care in 35 cases but did not adversely affect patient care in 17 cases. Adverse effects of the lack of availability of critical care included unmet need for pain management, sedation, blood products, advanced interventions (particularly in the case of deterioration in the patient's condition), assistance with triage, assessment and management of the patient, clinical leadership and scene management. When there was no perceived adverse effect of a lack of critical care resources, this was because of a need to minimize scene time, adequate management of the patient by the EEAST crew, the minor nature of the injury or issue, appropriate and timely conveyance of the patient to the destination hospital, or recognition of life extinct on arrival at scene.

When a team was available but not activated (27 incidents), the predominant reason for nonactivation was the distance to the mission or "run time" (26 incidents [96.3%]). The only other reason cited for nonactivation of an available team was that a volunteer responder could not be contacted by phone (1 incident).

QGIS geographic information systems software was used to map location data for all 108 incidents recorded. A heat map was created to identify areas with the greatest concentration of incidents during night hours. Postal codes recorded by the paramedics were converted to latitude and longitude coordinates for mapping. The software was also used to calculate the number of incidents falling within varying radii of EHAAT's Earls Colne and North Weald bases. The findings are presented in Figures 1 through 4 and Table 3. Heat mapping indicated that the areas of Basildon and Southend-on-Sea saw the highest concentration of incidents over the data collection period. Analysis of the number of missions within varying radii of the bases showed that the majority of missions fell within closer proximity to the North Weald than the Earls Colne base. For instance, 68 incidents fell within a 60-km radius of the North Weald base, whereas only 39 fell within 60 km of Earls Colne.

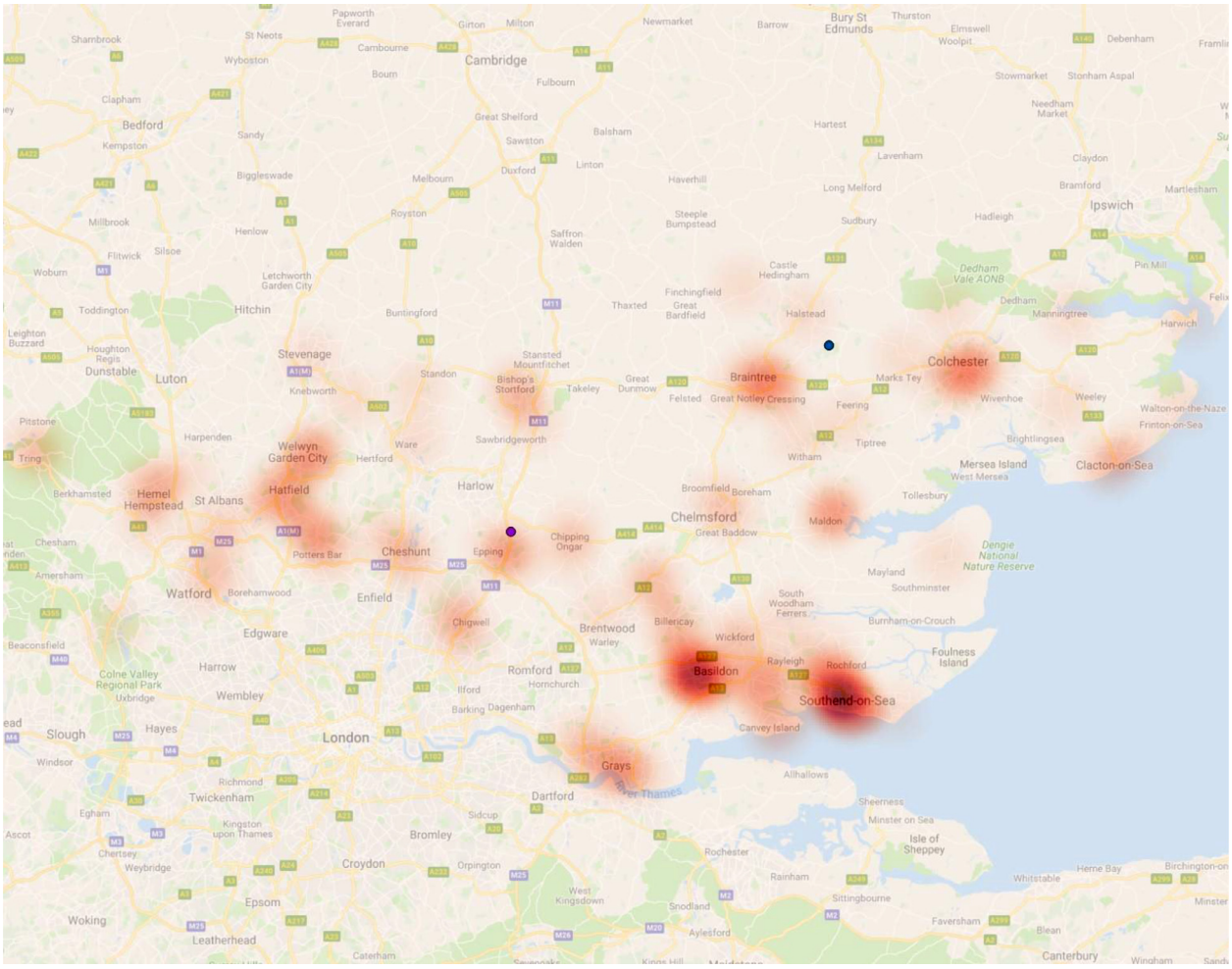

Figure 2. A heat map of incidents in Essex and Hertfordshire from 21:00 to 07:00 recorded in the prospective study as appropriate for critical care resource activation.

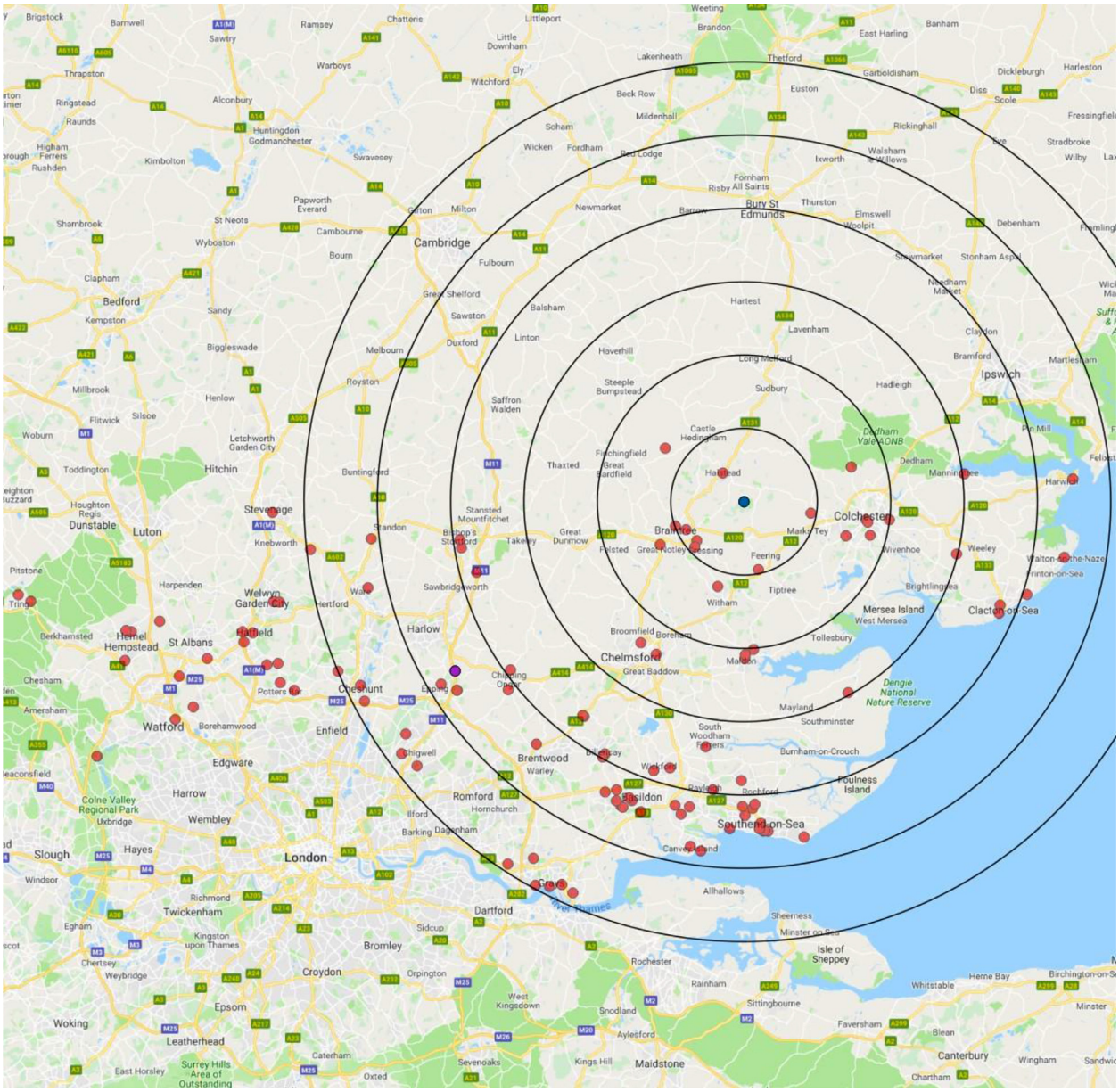

Figure 3. A map showing geospatial distribution of incidents from 21:00 to 07:00 in Essex and Hertfordshire recorded in the prospective study, relative to EHAAT's Earls Colne air base (central to the inner circle). The inner circle represents a radius of 15 km, and each subsequent circle represents an increment of 15 km.

Shift Report Analysis

Records of critical care desk staffing during the data collection period indicated that there were 68 nights on which a participating clinician was working on the desk, but no survey data were collected. Clinicians' shift reports were available for 59 of these nights. Analysis of the shift reports indicated a total of 137 incidents deemed appropriate for critical care across the 59 nights (mean incidents per night = 2.32). There were 6 nights on which there were no incidents deemed appropriate for a critical care response within Essex and Hertfordshire. The number of incidents per night within Essex and Hertfordshire that were considered appropriate for a critical care response ranged from 0 to 10, with the modal number of incidents per night being 1 (18 nights). A critical care resource was dispatched for 55 of these incidents (40.1%), whereas there were no local critical care resources available for 69 incidents (50.4%). For the remaining incidents, the availability of a resource was unclear from the clinicians' notes, or a resource was available but not dispatched because of a long anticipated run time to scene.

Discussion

EHAAT committed to 24 hours a day, 7 days a week operation in October 2019. The results of this study were used to inform decision making regarding the change in operational hours. Survey findings indicated an average of 2.08 incidents in Essex and Hertfordshire per night outside EHAAT's historic operational hours that would have been appropriate for a critical care response. For a substantial percentage of the incidents recorded (48.1%), there was no critical care resource available to respond. Even when a resource was available, it was not activated for 27 incidents, and this was largely because of an anticipated lengthy run time to scene. This suggests that other resources were not ideally located to respond and supports the need for a critical care team based within Essex and Hertfordshire during

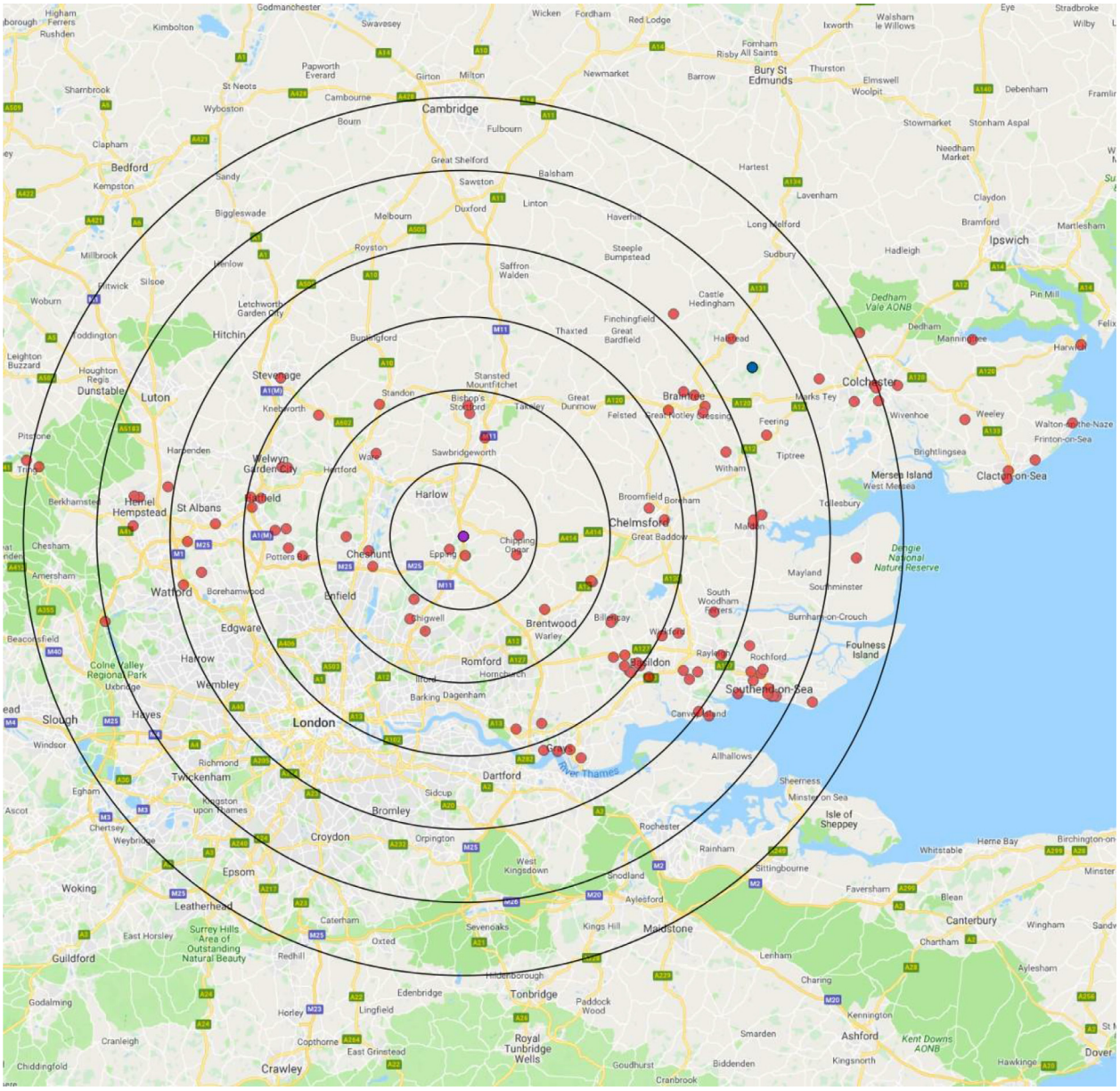

Figure 4. A map showing geospatial distribution of incidents from 21:00 to 07:00 in Essex and Hertfordshire recorded in the prospective study, relative to EHAAT's North Weald air base (central to the inner circle). The inner circle represents a radius of 15 km, and each subsequent circle represents an increment of 15 km.

Table 3
The Frequency of Incidents Recorded in the Prospective Study by Distance from Essex & Herts Air Ambulance's Air Bases

Distance From Base	Earls Colne Air Base	North Weald Air Base
Within a 15-km radius	7	5
Within a 30-km radius	16	18
Within a 45-km radius	23	43
Within a 60-km radius	39	68
Within a 75-km radius	71	89
Within a 90-km radius	85	98
Outside a 90-km radius	23	10

night hours. Analysis of the geospatial distribution of incidents showed that the majority fell within closer proximity to the North Weald than the Earls Colne base, suggesting that a night resource would be best placed to operate from North Weald. A rapid response vehicle now operates from this base during night hours. However, because of the substantial distances of some incidents from this base and potentially lengthy drive times, it may be useful to explore the option of night flying.

When clinicians dispatched a critical care resource to incidents, a range of positive impacts on patient care was described. These included the delivery of enhanced interventions, triage to a major trauma or other specialist center, assistance with difficult airways or the decision to cease resuscitation, and scene management. In some cases, paramedics reported a lack of impact, and this was largely because of the minor nature of the injury or issue and a lack of clinical intervention by the team. For the 52 incidents for which a critical care team was not available, clinicians felt that this adversely impacted patient care in the majority of cases. Examples of adverse impacts cited included unmet need for analgesia, sedation, blood products, and advanced interventions. Clinicians also felt that a critical care

team could have assisted with triage, clinical leadership, and scene management. These findings suggest that there is scope for EHAAT to provide benefit to critically ill and injured patients during night hours.

Findings of the current study are broadly consistent with those of KSSAAT's studies to ascertain demand for night operations.[10,11] Lyon et al's prospective simulated tasking and retrospective review of incidents during night hours identified an average of 2.5 activations per night,[10] whereas the retrospective review of all night HEMS missions attended over a 2-year period reported an average of 1.9 missions per night.[11]

Because the current findings mirror those of Lyon et al,[10] it could be speculated that demand may be similar in other regions. Therefore, the current findings may be of use to other HEMS organizations considering an extension to operational hours. Furthermore, the methods could be replicated within other services to inform operational decision making. The geospatial mapping could be particularly valuable in determining optimal locations of critical care resources.

The current study had several limitations, the implications of which should be considered. The data collection period represents only a snapshot in time, and it will be necessary to review the numbers and locations of incidents attended by EHAAT's critical care team during night hours at regular intervals. Furthermore, although EHAAT responds to some incidents outside the county boundaries of Essex and Hertfordshire, for pragmatic reasons only incidents within the 2 counties were recorded. Therefore, the figure of 2.08 incidents is likely to be a conservative estimate of the number of incidents appropriate for critical care response during night hours. The survey was not always completed when a participating clinician was staffing the desk. However, to mitigate against this, clinician shift reports were examined for 59 nights of the 68 nights on which a participating clinician was on the desk but no survey entries were made. This identified 137 incidents judged as appropriate for a critical care response on the basis of the clinician's notes, equating to an average of 2.32 incidents per night. This figure is similar to the average number of incidents per night reported in the survey and also to the findings of Lyon et al's prospective simulation and retrospective review.[10] Because the shift report analysis was not preplanned, it did not have the methodological rigor of the survey, and the results should therefore be considered as secondary to the survey findings. Breakdowns of incidents by weeknight and hour of the night were not produced. This is because the critical care desk is not staffed by a clinician every night due to sickness or leave, meaning that such breakdowns would not necessarily be reflective of trends in critical care incidents but rather of patterns in staffing.

Findings have indicated a potential need for prehospital critical care in Essex and Hertfordshire during night hours and suggested that a resource would be well placed at EHAAT's North Weald air base. However, the current study forms only part of the picture on the demand for night operation of EHAAT's critical care resources. Findings were considered alongside results of a retrospective study of major trauma positive incidents and out-of-hospital cardiac arrests during night hours and a qualitative study of clinicians' perceptions of the demand for night operation. Future work will review the numbers and locations of incidents attended by EHAAT during night hours to ascertain the continued demand for 24/7 operation and ensure optimal use of the charity's resources. It will also be important to conduct a cost-benefit analysis of the extended operational hours, including data on patient outcomes.

Acknowledgments

The authors wish to thank Professor Richard Lyon, Air Ambulance Kent Surrey and Sussex, for advice on the study design, and the critical care paramedics who collected data for the study. We also thank Keir Rutherford, who reviewed the study documents and survey content.

References

1. Cowley RA. A total emergency medical system for the state of Maryland. *Md State Med J*. 1975;45:37–45.
2. Lecky FE, Woodford M, Bouamra O, et al. Trauma audit and research network lack of change in trauma care in England and Wales since 1994. *Emerg Med J*. 2002;19:520–523.
3. Lockey DJ, Healey B, Crewdson K, et al. Advanced airway management is necessary in prehospital trauma patients. *Br J Anaesth*. 2015;114:657–662.
4. Garner AA, Mann KP, Fearnside M, et al. The Head Injury Retrieval Trial (HIRT): a single-centre randomised controlled trial of physician prehospital management of severe blunt head injury compared with management by paramedics only. *Emerg Med J*. 2015;32:869–875.
5. Botker MT, Bakke SA, Christensen EF. A systematic review of controlled studies: do physicians increase survival with prehospital treatment? *Scand J Trauma Resusc Emerg Med*. 2009;17:12.
6. National Institute for Health and Care Excellence. *Major trauma: service delivery: NICE guideline [NG40]*. Available at: https://www.nice.org.uk/guidance/ng40. Accessed May 13, 2020.
7. National Institute for Health and Care Excellence (NICE). *Major trauma: assessment and initial management: NICE guideline [NG39]*. Available at: https://www.nice.org.uk/guidance/ng39. Accessed May 13, 2020.
8. Perkins GD, Cooke MW. Variability in cardiac arrest survival: the NHS Ambulance Service quality indicators. *Emerg Med J*. 2012;29:3–5.
9. Skogvoll E, Bjelland E, Thorarinsson B. Helicopter emergency medical service in out-of-hospital cardiac arrest – a 10-year population-based study. *Acta Anaesth Scand*. 2000;44:972–979.
10. Lyon RM, Vernon J, McWhirter E, et al. The need for a UK helicopter emergency medical service by night: a prospective, simulation study. *Air Med J*. 2015;34:195–198.
11. Curtis L, Salmon M, Lyon RM. The impact of helicopter emergency medical service night operations in South East England. *Air Med J*. 2017;36:307–310.