

Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night

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Abstract

Overnight medical cover in hospital is less than during daylight hours. We aimed to quantify the numbers of patients deteriorating overnight and their clinical outcome. Data was collected in real time on use of the Standardised Early Warning Score (SEWS), 'time to doctor', seniority of medical review and clinical outcome.

136 incidents of clinical concern were noted on the general wards with a median response time of 5 minutes for SEWS>4 and 10 minutes if SEWS<4. 159 incidents were recorded in critical care. There was significant inter-speciality variation in median response times and seniority of responding staff, particularly within critical care, which recorded the slowest times across the hospital.

This will be reassessed following the establishment of Hospital at Night.

Introduction

Out of hours in-patient acute care and patient outcomes are a subject of current interest. Published evidence suggests an increase in mortality in patients admitted acutely to hospital at the weekend, in both North America¹ and Europe.² Furthermore a recent Dr Foster report revealed that standardised mortality rates in UK hospitals are higher for patients admitted at the weekend than those admitted midweek.³ It is postulated that the relative reduction in medical and ancillary staff over the weekend contributes to this discrepancy. Indeed no such mortality differences were seen at the weekend in an admissions unit with consistent staffing and 24 hour access to diagnostics.⁴ Further evidence for the relationship between medical staffing and mortality has been provided by Jarman *et al*, demonstrating that the best predictor of variation of in-hospital mortality in emergency admissions is number of doctors per bed.⁵

Medical cover overnight is by comparison a relatively neglected topic, even though cover is usually lower than at weekends. The Royal College of Physicians of London Night Time Acute Cover Working Group report in 2003 highlighted deficiencies in the quality of healthcare overnight.⁶ Almost half of hospitals surveyed had fewer doctors providing overnight cover compared to the weekend. In fact two-fifths of acute units had 2 or fewer doctors providing overnight cover. Doctors working overnight were covering on average 67

patients each with the maximum number exceeding 200. Furthermore there was no overnight resident specialist registrar in over a quarter of units. An increase in early mortality (within 48 hours) has been found in those patients admitted at night.⁷

The advent of the European Working Time Directive (EWTD) has provided further challenges to the provision of acute care overnight. Initially enacted into UK law in 1998, it decreed that by August 2004 no junior doctor should work more than 58 hours per week, falling to 48 hours per week by August 2009.

In order address these problems, the 'Hospital at Night' scheme was devised by the NHS Modernisation Agency and was adopted by the BMA and the Royal Colleges, and is now being widely implemented across the United Kingdom. The scheme was piloted in 2003 and aims to 'redefine how medical cover is provided in hospitals during the out of hours period'.

The crux of Hospital at Night is that medical cover to the vast majority of in-patients, including acute admissions is provided by a single multi-disciplinary team, and duties are defined by competencies rather than professional demarcation. Key elements include

- Supervised multi-speciality handover
- Extended roles of nursing staff including limited prescribing duties
- Bleep filtering through central coordination
- Moving a significant proportion of non-urgent work from the night into the daytime

The Royal Infirmary of Edinburgh is an 870 bedded teaching hospital. Until the implementation of Hospital at Night in 2006 it employed a mixture of on-call cover and site shift based cover. On-site cover for the Combined Assessment Unit, 18 wards (excluding cardiothoracic) and 4 critical care areas - Coronary Care Unit (CCU), Renal HDU (RHDU), General HDU (GHDU) and Transplant HDU (THDU) consisted of 8 Pre-registration house officers (PRHOs) and 4 Senior House Officers (SHOs). A further 4 SHOs were available on-call at home. The cardiothoracic ward was covered by the on site registrar who also covered

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Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night

cardiothoracic HDU/ITU. A surgical registrar, anaesthetic registrar and ITU registrar were also on site, but there was no medical registrar. Other speciality registrars and consultants provided on-call cover from home.

Our study, carried out prior to the implementation of Hospital at Night, aimed to quantify the numbers of patients at risk of deterioration overnight and studied response times to medical review. Clinical outcomes for those patients reviewed overnight were collected. We also evaluated the use of a validated early warning scoring system (Standardised Early Warning System, SEWS) overnight. A SEWS score of 4 or more should prompt medical review within 20 minutes, and the SEWS score on admission has been shown to correlate with mortality and length of stay.⁸ The study informed the local Hospital at Night working group, to enable the accurate matching of capacity and demand.

Methods

Data was collected over a 17-night period for the 18 wards plus Combined Assessment Unit, and 28 nights for the four critical care areas. The critical care audit was continued for a longer period in order to obtain comparable numbers with the ward areas. Audit forms were left in each ward, and nursing staff recorded details of any overnight event requiring medical review. Details included the nature of the clinical event, the initial SEWS of the patient, the response time of the medical staff, and the SEWS at 1 hour and 4 hours after treatment, and at the first routine morning observations. Each ward was telephoned daily at the start of each nightshift to ensure awareness of the study and forms were collected each morning.

Clinical outcome was assessed through two separate methods. Firstly a change in SEWS overnight (where recorded) was used as a surrogate marker for clinical

status. Secondly, outcome was also recorded in terms of stabilisation on the ward, escalation to critical care, or death (expected/unexpected) by 0800 the following morning.

As data collection relied largely on already busy nursing staff filling out audit sheets, a small number of clinical incidents overnight may have been missed. Furthermore SEWS recording at 1 hour and 4 hours following an incident of clinical concern was, at times, incomplete.

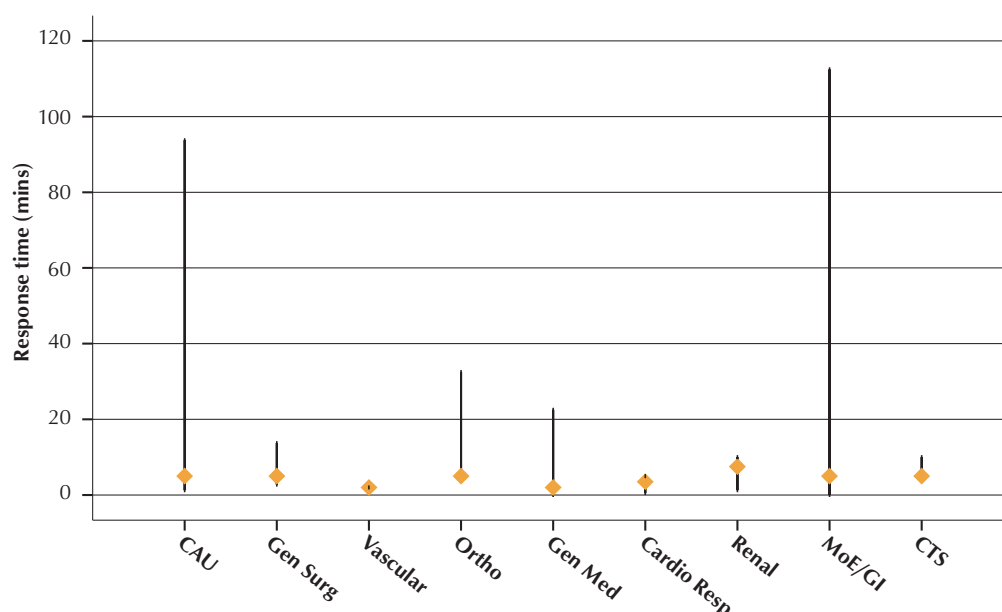
Results

Combined Assessment Unit and Ward Arc

136 incidents of clinical concern were recorded (in 134 patients). 80% of these occurred in the ward arc, the remaining 20% in the Combined Assessment Unit. SEWS was found to be more completely undertaken and documented in the Combined Assessment Unit, with 92% of patients having the 5 major physiological variables (blood pressure, pulse, oxygen saturation, respiratory rate and temperature) recorded in comparison with just 50% on the ward arc.

Clinical events triggering SEWS ≥ 4

In 56 out of the 136 clinical incidents the patient had a SEWS of 4 or more. 17 (30%) of these were in the Combined Assessment Unit (CAU) and the remaining 39 (70%) in the ward arc. The median response time for these incidents was 5 minutes (range 0–280 minutes). 82% of the time medical staff attended the patient within 20 minutes. The median response times across the ward arc can be seen in graph A (note some specialities were cross covered by one doctor overnight and thus are grouped together). Median and quartile response times for surgical wards, medical wards and CAU to patients with SEWS ≥ 4 are shown in Graph A.



Graph A. Median and quartile response times for surgical wards, medical wards and CAU to patients with SEWS ≥ 4 .

MoE/GI = Medicine of the Elderly/Gastroenterology

CTS = Cardiothoracic Surgery

Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night

	1 hour post intervention (n=40)	4 hours post intervention (n=34)	Routine morning observations (n=44)
SEWS improved	28 (70%)	30 (86%)	36 (82%)
SEWS stable	10 (25%)	3 (9%)	6 (14%)
SEWS deteriorated	2 (5%)	1 (3%)	2 (5%)

Table 1. Illustrates the change in SEWS (if recorded) as a surrogate marker of clinical status following clinical associated with SEWS ≥4 (n=56).

The Kruskal-Wallis test showed no statistically significant differences between the response times of different specialities.

Of the 56 incidents (SEWS > 4) in 54 patients, 42 patients remained on the ward at 0800, 7 had been transferred to critical care and 5 patients had died (3 cardiac arrests and 2 were not for escalation of treatment)

Clinical events with SEWS <4

In 80 out of the 136 clinical incidents the patient had a SEWS of less than 4. 10 (13%) of these were in the CAU with 70 (87%) in the ward arc. The median response time or these incidents was 10 minutes (range 0–330 minutes). The response times across the ward arc can be seen in the graph below.

Response times in CAU were quicker than across the ward arc (p<0.005, Mann Whitney U test). There were further statistically significant differences between speciality wards (p<0.05, Kruskal-Wallis test).

By 0800 the following morning, 69 patients remained on the ward, 9 were transferred to critical care and 2 patients had died (2 cardiac arrests). Again the change in SEWS shows the majority had improved or stabilised after intervention.

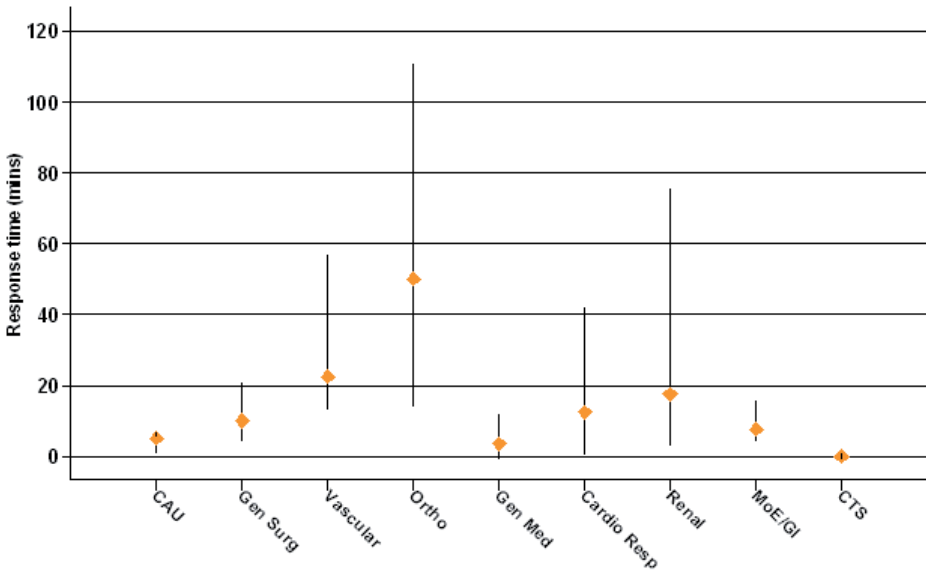
Critical Care Corridor
Coronary Care Unit (CCU)

38 incidents were recorded in 33 patients, of which 14 were admissions to the unit.

By 0800 in the morning, all 33 patients remained on the unit and there were no deaths or transfers to intensive care during the study.

Renal High Dependency Unit (RHDU)

51 incidents were recorded in 39 patients and 2 were new admissions. 34 incidents occurred in renal patients and the remaining 17 in surgical boarders.

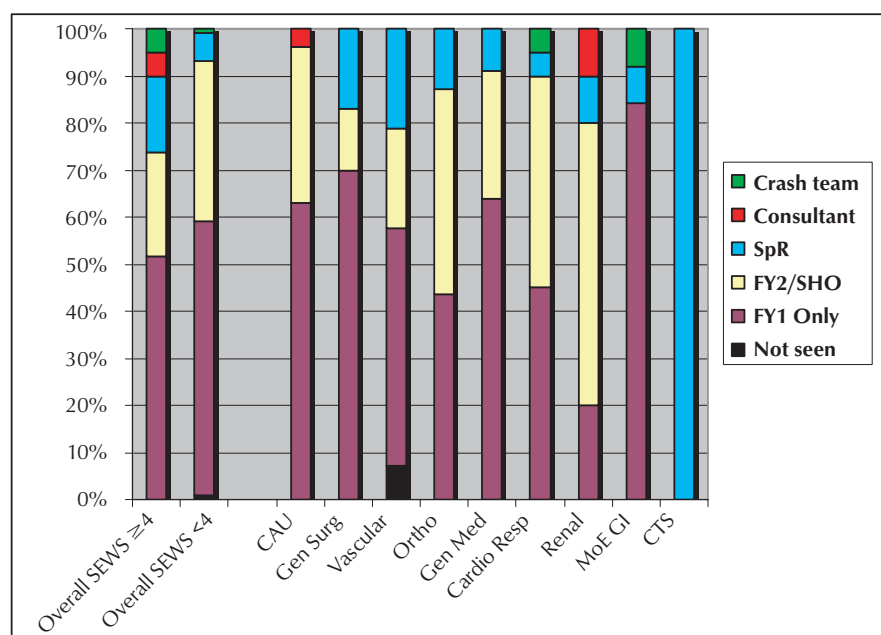


Graph B. Median and quartile response times for surgical wards, medical wards and CAU to patients with SEWS <4.

	1 hour post intervention (n=66)	4 hours post intervention (n=48)	Routine morning observations (n=77)
SEWS improved	24 (36%)	25 (52%)	38 (49%)
SEWS stable	33 (50%)	16 (33%)	29 (38%)
SEWS deteriorated	9 (14%)	7 (15%)	8 (10%)

Table 2. Illustrates the change in SEWS (if recorded) as a surrogate marker of clinical status following clinical associated with SEWS <4.

Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night



Graph C. Illustrates the seniority of medical staff (ie most senior doctor) attending an incident of clinical concern according to both SEWS and according to speciality.

By 0800 each morning, all 39 patients remained on the unit and there were no deaths or transfers to intensive care.

General High Dependency Unit (GHDU)

57 incidents were recorded in 45 patients and 9 were new admissions. 32 incidents were in medical patients, 19 in surgical patients and 6 in orthopaedic patients.

42 out of the 45 patients remained on the unit. 2 patients were deemed inappropriate for escalation of care and 1 patient was transferred to intensive care.

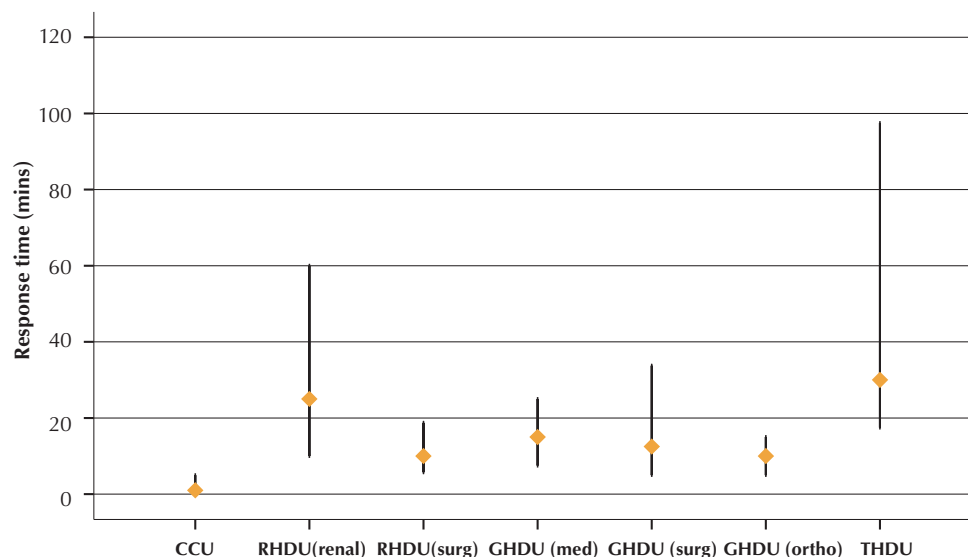
Transplant High Dependency Unit (THDU)

13 incidents were recorded in 11 patients and 1 was a new admission.

10 of the 11 patients remained on the unit at 0800 and 1 was transferred to intensive care.

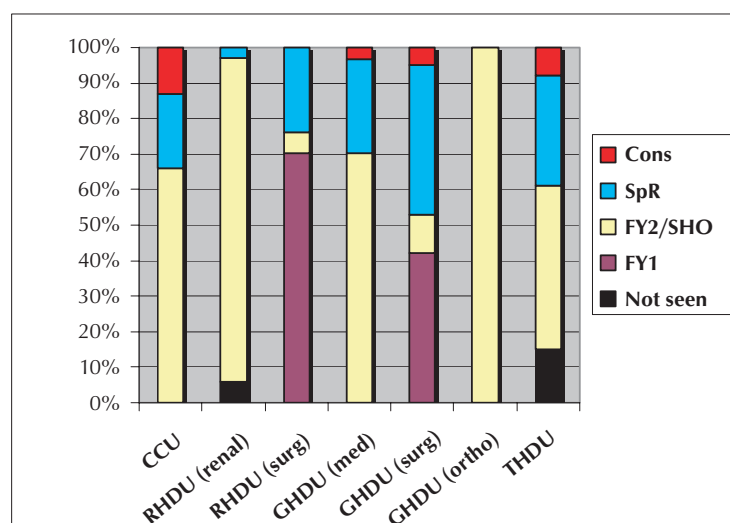
The Kruskal-Wallis test indicated there was a statistically significant difference between the groups ($p < 0.05$) and the post hoc Tamhane's T2 multiple comparison test was used to determine which means differed. When the data was grouped by wards there was a statistically significant difference between CCU and RHDU ($p < 0.05$) and CCU and GHDU ($p < 0.05$). When grouped by speciality then there were significant differences between cardiology (CCU) and renal (RHDU plus THDU), $p < 0.05$.

Graph F demonstrates critical care unit response times were amongst the slowest in the hospital. For example patients on the renal ward were seen significantly more quickly than in Transplant HDU ($p < 0.05$) and



Graph D. Median and quartile response times across the critical care corridor.

Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night



Graph E. Illustrates the seniority of medical staff (i.e. most senior doctor) attending an overnight incident of clinical concern across the critical care corridor.

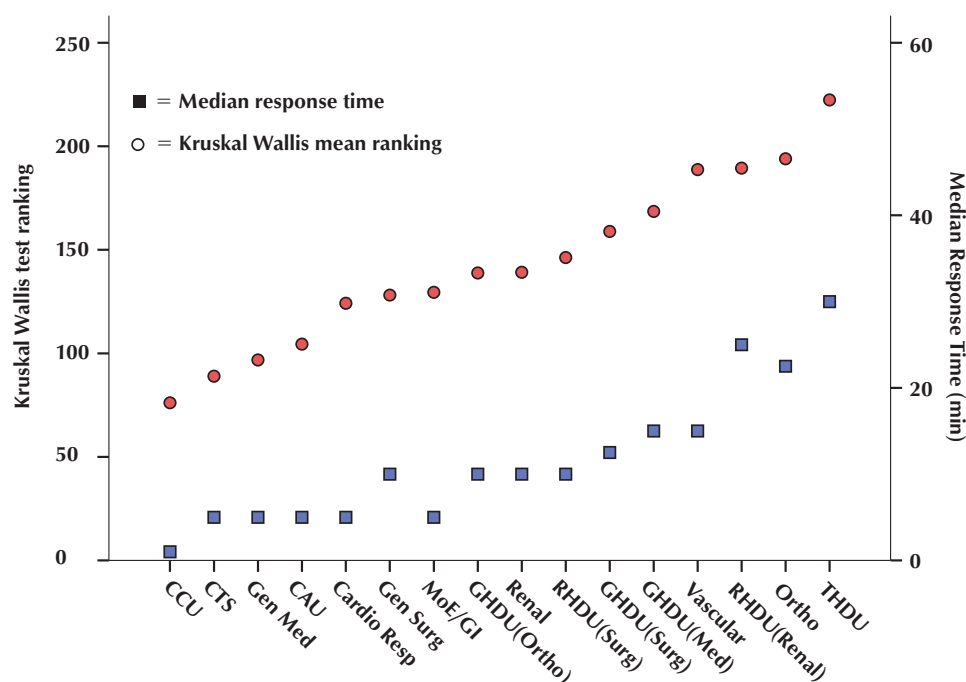
response times to medical patients in General HDU were significantly slower than to patients in the general medical ward ($p < 0.01$) and CAU ($p < 0.001$).

Discussion

SEWS was better completed and understood in the Combined Assessment Area with the five major observations being recorded in 92% of incidents of clinical concern. This is consistent with current recommendations to undertake a SEWS score at point of entry to care and is supported with a dedicated SEWS education program in CAU to ensure it is part of routine care. SEWS was less well utilised on the ward arc overnight, being recorded correctly in only 50% of instances of clinical concern. This

is likely to be due to a combination of unfamiliarity and a less focused SEWS training programme.

In 82% of clinical incidents triggering a SEWS of ≥ 4 , the SEWS was improved at the time of routine morning observations, with a further 14% stable. In patients with a SEWS score of < 4 , 49% improved and 38% stabilised. There are limitations with the use of SEWS as a surrogate marker for clinical status when the initial score is small, as subsequent increase in SEWS may not reflect significant pathophysiology. However if a SEWS improves from 6 at the time of index event to 0 by the morning, this could be expected to align with clinical improvement. Thus using SEWS as a marker of clinical outcome is likely to be more relevant when the index event triggers a SEWS of ≥ 4 .



Graph F. Comparison of median response times and Kruskal Wallis mean ranking across the ward arc and critical care.

Assessment of clinical risk in the out of hours hospital prior to the introduction of Hospital at Night

Importantly, clinical response times were quicker for patients on the ward arc (including CAU) with a SEWS of 4 or more than those with a SEWS of less than 4 ($p < 0.05$, Mann-Whitney U test). Encouragingly there was 82% concordance across all wards with the 20 minute target for review of a patient triggering SEWS ≥ 4 . Furthermore patients triggering a SEWS ≥ 4 were generally reviewed by more senior medical staff (21% seen by consultant or registrar) than those with SEWS < 4 (6% seen by registrar).

There were no significant differences in median response times to review clinical events triggering SEWS ≥ 4 across the ward arc (including CAU). In patients with a SEWS < 4 , response times in CAU were significantly quicker than the ward arc. There were also significant inter-speciality differences within the ward arc. The areas with the longest response times (orthopaedics, vascular surgery and renal medicine) were those that were covered by PRHOs cross-covering patients in GH DU and also seeing admissions. The shortest response time was in general medicine, which did not receive out of hours admissions, or cover patients in critical care. Longer response times to review patients with lower SEWS is perhaps understandable, but SEWS is just an aid to clinical assessment, and condition specific responses are also required (for example ischaemic chest pain may score a SEWS 0). Indeed this group was not a benign population with 9 patients (11%) transferred to critical care by the morning, and 2 cardiac arrests.

As expected, patients who required review in the critical care corridor were generally seen by more senior medical staff than patients on the ward arc. For example only 17% of incidents in general surgery patients in the ward arc were seen by a registrar or above, compared with 47% in GH DU. A similar picture was seen in medical patients, with less than 10% of incidents in ward patients being reviewed by a registrar or above. That figure rises to 28% when reviewed in GH DU. A greater proportion of events in surgical patients were reviewed by a registrar compared with medical patients. Only 4% of incidents in the Combined Assessment Unit were reviewed by a

registrar or above. This reflects the fact that the majority of patients in CAU had not yet been allocated to a speciality, and there was no overnight general medicine registrar cover.

Response times to incidents of clinical concern varied widely across the critical care corridor. Patients in CCU were seen significantly quicker than patients in RH DU or GH DU. When considering specialities rather than wards, cardiology patients were still reviewed more rapidly than renal patients (regardless of whether they were in RH DU or TH DU). In fact the median critical care corridor response time (10 minutes) was longer than the overall median response time for the ward arc (5 minutes) and as graph F demonstrates, critical care unit response times were amongst the slowest in the hospital. These inequalities can be explained by consideration of how the units were staffed overnight, and also hospital geography. CCU was covered by a resident SHO, which accounts for the rapid median response time of 1 minute, whereas renal patients in RH DU and TH DU were covered by an SHO based on another floor.

Conclusion

SEWS was well understood and utilized overnight in the Combined Assessment Area though there were significant deficiencies across the ward arc. Response times to review patients triggering SEWS ≥ 4 were encouraging. However unexpectedly large inter-speciality variation in response times and seniority of staff to incidents of clinical concern were seen, particularly within the critical care corridor, where it was not uncommon for a patient to wait over an hour before being seen. This data was fed back to the Hospital at Night steering group. The audit is due to be redeployed following the instigation of Hospital at Night in order to reassess the effect on response times, and clinical outcomes.

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