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A fundamental conflict of care: nurses' accounts of balancing sleep
with taking vital signs observations at night

CONCISE TITLE: Balancing sleep with taking vital signs at night

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CONFLICT OF INTEREST

At the time of the research, Portsmouth Hospitals NHS Trust (PHT) had a royalty agreement with The Learning Clinic (TLC) to pay for the use of PHT intellectual property within TLC's VitalPAC product.

VitalPAC is the system used to collect vital signs data in the current research. Until October 2015, PS and the wife of GBS were minority shareholders in The Learning Clinic. GBS worked for PHT from 1985 to 2011. PM, GW, NS and PS are employed by PHT. Until 2015, GBS and PS were unpaid research advisers to TLC. JH, AR-S, AdI, YA, CF, AM and PG have no conflicts of interest.

ABSTRACT

Aims and objectives

To explore why adherence to vital signs observations scheduled by an Early Warning Score protocol reduces at night.

Background

Regular vital signs observations can reduce avoidable deterioration in hospital. Early Warning Score protocols set the frequency of these observations by the severity of a patient's condition. Vital signs observations are taken less frequently at night, even with an Early Warning Score in place, but no literature has explored why.

Design

A qualitative interpretative design informed this study.

Methods

Seventeen semi-structured interviews with nursing staff working on wards with varying levels of adherence to scheduled vital signs observations. A thematic analysis approach was used.

Results

At night, nursing teams found it difficult to balance the competing care goals of supporting sleep with taking vital signs observations. The night-time frequency of these observations was determined by clinical judgement, ward-level expectations of observation timing and the risk of disturbing other patients. Patients with COPD or dementia could be under-monitored while patients nearing the end of life could be over-monitored.

Conclusion

In this study we found an Early Warning Score algorithm focused on deterioration prevention did not account for long-term management or palliative care trajectories. Nurses were therefore less inclined to wake such patients to take vital signs observations at night. However the perception of widespread exceptions and lack of evidence regarding optimum frequency risks delegitimising the Early Warning Score approach. This may pose a risk to patient safety, particularly patients with dementia or chronic conditions.

Relevance to clinical practice

Nurses should document exceptions and discuss these with the wider team. Hospitals should monitor why vital signs observations are missed at night, identify which groups are under-monitored and provide guidance on prioritising competing expectations. Early Warning Score protocols should take account of different care trajectories.

Keywords

Vital signs, adult nursing, nursing care, clinical judgement, guideline adherence, dementia care, qualitative study, sleep disturbance, palliative care

WHAT DOES THIS PAPER CONTRIBUTE TO THE WIDER CLINICAL GLOBAL COMMUNITY?

- Nursing staff on night shifts experience a conflict between the care tasks of supporting sleep and monitoring patients for deterioration. This may result in covert strategies to support uninterrupted 'blocks' of sleep under an Early Warning Score protocol.
- Patients with chronic conditions or dementia may be under-monitored at night while patients requiring palliative care risk being over-monitored under an Early Warning Score protocol.
- A lack of clarity about the optimum frequency of vital signs observations and difficulty in using Early Warning Score algorithms with patients on long-term management or palliative trajectories of care risks delegitimising their use and reducing safety in some patient groups.

INTRODUCTION

Monitoring vital signs is the first step in the 'chain of prevention' of serious events like death or cardiac arrest (Smith, 2010) but reasons for a lack of adherence with monitoring protocols is the least studied (Odell, 2015). Inadequate responses to deterioration were the most common cause of critical incidents reported to a UK national database (Donaldson *et al.* 2014). However routine vital signs observations are less frequently carried out at night (NPSA, 2007). Even under a standardised nursing protocol linking frequency of vital signs observations to patient severity of illness (acuity), vital signs observations remain lower at night than during the day (Hands *et al.*, 2013; National Patient Safety Agency, 2007).

BACKGROUND

Controlling body temperature, managing breathing, supporting sleep and keeping patients safe are all part of the fundamental care work of nurses (Kitson *et al.* 2010). Yet monitoring vital signs at night is likely to disrupt sleep, setting up a potential conflict of care priorities. There is great variation internationally in the minimum frequency of observations and the content of routine vital signs sets (see Smith *et al.* 2017 for a more detailed discussion), although a greater frequency of vital signs observations is associated with a reduction in unexpected deaths and intensive care admissions (Mitchell *et al.*, 2010).

Vital signs observations at night have traditionally been managed in different ways internationally, but current approaches are converging. In the US, where four-hourly vital signs observations throughout the night have been the norm, researchers have argued that a system based on the level of patient acuity allows a proportionate response, balancing risk with the need to support rest (Yoder *et al.* 2013). In the UK, NICE has recommended a graduated monitoring approach with vital

signs observations taken at least every 12 hours in all hospitalised patients, with increasing frequency as patient acuity rises (NICE Clinical Guidelines, 2007). Internationally there has been a development of Early Warning Score (EWS) algorithms, such as the National Early Warning Score (NEWS) (Royal College of Physicians, 2012) in the UK. Early Warning Scores use the extent of deviation of vital sign measurements from an expected, 'normal' range to calculate a score; higher scores require more frequent vital signs observations on a sliding scale. There is evidence that adherence to Early Warning Score-led intervals may reduce mortality (De Meester *et al.* 2013a; Schmidt *et al.*, 2015) and serious adverse events (De Meester *et al.* 2013b). However the optimum period between vital signs observations is not yet established (Smith *et al.* 2017).

Evidence suggests vital signs observations are taken less frequently at night than during the day, even when an Early Warning Score protocol is used (Hands *et al.*, 2013; National Patient Safety Agency, 2007). Most night time vital signs observations are taken at the beginning and end of the night shift (Hands *et al.* 2013; Yoder *et al.* 2013). Hands *et al.* (2013) found that although more acutely unwell patients were observed more often during the night, the frequency of vital signs observations was not as often as required by the Early Warning Score protocol. While vital signs observations were performed as scheduled 73% of the time between 12:00 and 17:59, they were only carried out 25% of the time between 00:00 and 05:59. There was a significant difference between adherence with protocol-scheduled daytime and night-time vital signs observations, which persisted across all levels of acuity ($p < 0.001$).

Somewhat surprisingly, no study has directly explored why vital signs observation sets are performed less frequently at night (Hands *et al.* 2013; Odell *et al.* 2009). While there is some evidence about why nurses monitor certain vital signs (see Flenady *et al.* 2017) or follow an Early Warning Score protocol, the reasons are not night-time specific (see Odell *et al.* 2009). In their systematic review of the evidence, Odell *et al.* (2009) found nurses use vital signs observations to support clinical 'intuition' - potentially using 'pattern recognition' of deteriorating patients in their specialty area - and family concerns about the patient's condition. Other factors identified in the papers included relationships with other health professionals, issues with equipment (difficulties in access, poor maintenance or broken or missing equipment) and the clinical environment.

Despite the paucity of evidence, existing literature suggests areas requiring further examination. We know from Hands *et al.* (2013) that acuity does moderate frequency of vital signs observations to a certain extent, which may reflect attempts to manage competing priorities in a systematic way (Hands *et al.*, 2013). It is possible the night-time difference relates to attempts to support sleep. However there is no research evidence exploring how nursing staff navigate these dilemmas in their routine work at night. Qualitative research is needed to explore why vital signs observations reduce at night (Buist & Stevens, 2013). This study aimed to explore why adherence with Early Warning Score protocol-led observation schedules is poorer at night by analysing nurses' accounts of decision-making about taking vital signs at night.

METHOD

Design

This was a qualitative interpretative study based on semi-structured interviews with nurses, exploring decisions surrounding use of a local Early Warning Score protocol at night.

Setting – The Night Surveillance Study

The study was based in a large English NHS acute district general hospital that has used an Early Warning Score-led monitoring protocol on all adult medical and surgical wards since 2009. This is implemented using mobile devices running VitalPAC™ software (Smith *et al.* 2006). VitalPAC™ uses the National Early Warning Score (NEWS). NEWS was developed from the VitalPAC™ Early Warning Score (ViEWS) which was validated using a vital signs database with 198,755 observation sets, based on 35,585 completed acute medical admissions to the Medical Assessment Unit (MAU) of a large English NHS acute district general hospital (Prytherch *et al.* 2010). The MAU is the common entry point for general medical emergency patients aged 16 or over (excepting those transferred directly to critical care). The ViEWS score was compared with 33 other aggregate weighted track and trigger system scores (AWTTs), and performed better over a range of outcomes, with an area under the receiver-operating characteristics curve (AUROC) of 0.888 (0.880-0.895, 95% CI) on in-hospital mortality, as compared to other AWTTs, which scored between 0.803 (0.792-0.815) and 0.850 (0.841-0.859). Members of the Royal College of Physicians National Early Warning Score Design and Implementation Group (NEWSDIG) made minor adjustments to ViEWS to develop NEWS and made recommendations for the associated frequency of vital signs observations and subsequent escalation actions. NEWS has also been similarly validated (Smith *et al.*, 2013). Table 1 shows the vital signs measured per observation set and the score allocated on the NEWS for each vital signs response. As shown in Table 2, when compared to the NEWSDIG recommendations, the study hospital's protocol

requires less frequent monitoring and recommends the consideration of continuous observations only at the upper end of the NEWS scale.

The study hospital considered a ward to be adherent with the protocol if they were taken within 133% of the scheduled time interval so, for example, if observations are due hourly they are counted as on time they are taken within 1 hour and 20 minutes of the previous observations. The Trust sets a target of 80% of all observations taken on time according to this criterion. Only 37 of the 39 wards using VitalPAC™ met this criteria at night (scoring at 96.3% and 81.9% adherence). This suggests there may be between-ward differences that need exploring at night, which may relate to patient group or speciality differences in how ward care is managed.

Interviewees were recruited through a quantitative survey investigating knowledge, beliefs, attitudes and decision-making concerning vital signs observations at night on general medical and surgical wards. This was carried out in June 2015 as part of the Night Surveillance Study. Participants were asked to indicate on the survey if they would be interested in taking part in a follow-up interview, and, if so, to share contact details.

Sampling

Seventy survey respondents indicated their interest in participating in an interview. Inclusion criteria for the interview were that the member of staff had worked night shifts on wards using VitalPAC™ and the associated protocols at the hospital during the period immediately following the survey launch. Forty-eight members of staff were eligible. Of these, 44 provided complete and accurate contact details. The aim was to build a 'deviant case' purposive sample (Patton, 2002, p. 243) of staff from the wards with the extremes of adherence levels with the Early Warning Score protocol. This

would allow exploration of differing ward contexts that fostered (or reduced) the ability or willingness to carry out vital signs observations as scheduled by the protocol. Audit data from the hospital was used to stratify wards into quartiles reflecting percentage of scheduled vital signs observations taken on time at night according to the protocol. Both telephone and face-to-face interviews in a neutral place were offered in order to recruit as many people as possible. In the first wave of recruitment, eligible respondents from the wards in the top and bottom quartiles who had indicated interest in participation were approached. During this phase only 10 interviewees were recruited. Volunteers from the ward with the greatest reduction in adherence with scheduled vital signs observations (from daytime to night-time) were approached next, and one additional person volunteered. Finally, in order to increase our sample, all other volunteers were approached. Interviews were carried out alongside recruitment. Saturation of initial themes written in research memos was reached on the penultimate interview.

Interviews

Interviews lasting between 19 and 61 minutes were carried out using a semi-structured interview schedule, either face-to-face in a neutral setting (n=9) or via telephone (n=8). The interview guide was developed by JH in consultation with the rest of the study team. Findings from existing research into potential reasons for missed observations were included as topics alongside open questions to allow new data and accounts to emerge. The topics covered were: patient mix, care provided, ward specialty, patient care and role responsibilities, views of the reasons for the ward's level of adherence to scheduled vital signs observation sets, barriers to completing vital signs observations when scheduled, impact of existing ward routines (if any), attitude and approach to waking patients at night time to take scheduled observations, ward consequences (if any) if vital signs observation sets were missed or delayed, opinion of frequency of vital signs observation sets, use of escalation procedures and impact (if any) of ward performance targets related to adherence to scheduled vital

signs observation sets. JH conducted all of the interviews. Audio recordings and detailed transcriptions were made with the permission of the interviewee. Memoing was used alongside the interviews to capture interesting topics after each interview, with memos saved in NVivo alongside transcripts.

Analysis

Qualitative analysis was carried out following the method described by Lofland *et al* (2006). This is a constant comparative method informed by grounded theory, but allowing the use of some initial top-down codes related to areas of interest in the project. NVivo software was used for the analysis. Two members of the team (JH and AR-S) coded the data. Both coded three transcripts blind and compared and agreed coding of transcripts and generation of new codes. The remaining transcripts were divided between JH and AR-S for full coding. Codes created and coding of individual transcripts were discussed at regular intervals, with differences recorded in NVivo memos and discussed to reach a consensus. Finally, after coding of all transcripts was completed, each coder checked the other's transcripts, suggesting changes where they did not agree with the coding. Differences of opinion were discussed until final coding was agreed.

Ethical considerations

The parent study – the Night Surveillance Study - received ethical clearance from the University of Southampton and governance approval from the hospital's Research and Development Office. After discussing the study all interested people were given participant information sheets. Interviewees were assured that the decision not to take part or to withdraw would not affect their professional role, job or future promotion prospects. Interviews took place after written, informed consent was obtained from staff. Ward names were anonymised and personally identifying details of participants

(such as combination of speciality and grade) have been omitted from all reports of findings. Data was stored in adherence with the Data Protection Act (1998) and the University of Southampton's data storage policy.

RESULTS

Participants

Twenty of the 44 members of staff approached agreed to participate. 18 agreed to specific interview dates and 17 attended interviews during March and April 2016. Basic demographics of the interview sample are given in Table 3. All 17 interviewees were women, with thirteen registered nurses (RNs), two Health Care Support Workers (HCSWs) and two student nurses (who also worked as support workers - HCSW/SNs). Health Care Support Workers are unregistered personnel with no formal training requirements who provide assistance to nurses and hands on care to patients under the supervision of Registered Nurses. In some countries the term Nursing Assistant or Nurse's Aide is used for workers fulfilling similar roles. Overall twelve wards were represented. Six participants were recruited from four wards in the highest quartile of adherence. Three worked in the lowest quartile of adherence, each based in a different ward. One interviewee was recruited from the ward with the largest reduction in adherent vital signs observations from daytime to night time. Finally, seven more nursing staff members were recruited from four wards from the middle two quartiles of adherence. The ward specialities represented ranged from medical, surgical and speciality-specific adult wards, including gynaecology, stroke rehabilitation, emergency medicine, oncology, trauma and orthopaedics, surgical and older people's care. While the original aim of building a deviant case sample was not met, the achieved sample resembled a maximum variation sample (on the dimensions of adherence and to a certain extent role, ward experience and ward speciality).

Every interviewee was involved in either delegating vital signs observations to others or taking vital signs observations herself; all were able to provide rich information about different approaches to taking vital signs observations at night. Vital signs observations were reported to be taken at night by a mixture of HCSWs and nurses, with different arrangements agreed by ward or shift. On some wards, registered nurses took vital signs observations of the most unwell patients. On others, when registered nurses were busy, all vital signs observations were delegated to support workers. In some cases the arrangements were not always clear to the interviewee.

Three key themes emerged from the data. These were the difficulties of balancing sleep and taking vital signs observations, using judgement to decide which observations were 'necessary' to merit waking a patient and over- or under-monitoring of particular patient groups at night.

Balancing the competing care tasks of supporting sleep and taking vital signs observations at night

All interviewees identified supporting sleep as a core part of night-time care, regardless of the adherence level of the ward. Waking patients to take vital signs observations was described as a challenging part of the job.

...During the day, it's okay; the patients don't mind. They usually tell you that they're not doing anything else; they're more than happy. During the night, they can be quite distressed because you're going to wake them up... (RN12 – Medium adherence ward)

Supporting sleep was seen as important in supporting patients' recovery. Interference with sleep was described as increasing the chance of deterioration and the length of time to discharge.

... Most healing takes place when you're in a deep sleep and if you're breaking that, all the good work that you've done has been broken just by that one time... (RN8 - Medium adherence ward)

Creating a restful night-time environment – or 'settling down' - was seen as a central part of the night shift work for most interviewees. This involved dimming lights, completing all necessary patient work (e.g. physical care, medication rounds) and reducing noise to a minimum.

...So at night time we try as much as possible to settle people on a certain time. Like at least 10.00pm because of course they need their rest and try to minimise all the noise that we can do... (RN1 - High adherence ward)

On some wards, particularly those accepting admissions throughout the night, it was particularly challenging to support patients to sleep.

...I just feel that night shift obviously is just as busy as the day shift now [...] It's such a high turnover that there's something always going on so it's hard for patients to actually sleep. [...] Some people struggle all night to sleep and then we go and wake them up and do their obs. Sometimes, it's a pointless exercise... (HCSW3 - Low adherence ward)

However, taking vital signs observations was also identified as a core piece of nursing work.

...That's our baseline how to treat you or assess how stable you are. It's like doctors isn't it? They always have a stethoscope. [...] And us nurses, this is *our tool*. It's a basic tool of us nurses to say that yeah she's poorly because of this showing up... (RN1 - High adherence ward)

This meant night-time nursing staff faced a dilemma: how to support sleep while also carrying out vital signs observations. Interviewees described the importance of allowing patients to gain the largest feasible uninterrupted 'block' of sleep.

...It depends on what time we finish the night time stuff. So if we finish at 11, then waking them up at two or three is okay, but if we don't finish until twelve or one then I would be reluctant to wake them up any earlier than four before I did it again, just because I think they just need a solid block of undisturbed sleep...
(HCSW/SN2 - Low adherence ward)

Only one interviewee (on a medium adherence ward) claimed she had never woken someone at night to take vital signs observations (although she said she would if they had interrupted breathing due to sleep apnoea). Another interviewee (based on a medical ward) described how the nurse in charge on one shift asked her not to wake patients to do vital signs observations.

Interviewees reported using different strategies to support the longest 'block' of sleep. These did not always meet the requirements of the Early Warning Score protocol. Sometimes an observation was done earlier than required while a patient was still awake, or vital signs observations were taken when someone woke in the night. These strategies adhered to the protocol and allowed patients to sleep for the full interval between vital signs observations. Some nurses described being able to carry out vital signs observations without waking their patients, particularly when patients were connected to automatic monitoring equipment at night. However this could be undermined by noisy equipment, and was particularly difficult when using a blood pressure cuff. Others decided to measure only the vital sign that was scoring highly, rather than the whole set required by the Early Warning Score protocol (which would be recorded as non-adherent).

Avoiding sleep disturbance was also affected by the proximity of other patients, even if the patient requiring vital signs observations was awake.

...in the four-bedded wards, if you take machines in [...] everything's noisy. And then you have to put a light on, because you've got to see what you're doing. So that's all quite disturbing to other people as well. So it's weighing up between the two. You know, if they need them, they need them, but if you feel that they're okay, you wouldn't necessarily do it... (RN10 – High Adherence Ward).

The role of nurse judgement

Individual clinical judgements

Interviewees who worked both day and night shifts reported taking vital signs observations they felt were 'unnecessary' during the day because it did not interfere with sleep. However at night, this judgement of 'necessity' became central. Formal and informal clinical judgements were made using the appearance of the patient; patient, family and visitor views about what is and is not 'normal' for the patient; other physiological signs; 'gut feeling' and existing knowledge and clinical expertise about their patient group or condition. These could be used to increase as well as decrease the frequency of vital signs observations required by the Early Warning Score protocol. Higher acuity scores produced by the protocol calculation were used as part of this decision but vital signs observations were not necessarily taken as frequently as the protocol required. Instead efforts were made to support the longest possible period of uninterrupted sleep.

...So if a patient for instance has got a low blood pressure you would then recheck it. You wouldn't leave it until the next set of vital signs observations you would do or if they've got irregular heart rate or if they're on certain medications you would need to do it again. You wouldn't just think oh they've got a systolic of 80 [mmHg] it will be fine until the morning [laughs]. You would use your clinical indications to weigh up whether it would be acceptable to do another set of vital signs observations or whether it's appropriate to wake people in the middle of the night to carry them out... (HCSW/SN2 - Low adherence ward)

The impact of ward and hospital expectations

Individual nursing decisions sat within a wider context of ward-specific protocols, colleagues' expectations, and hospital-level surveillance and target-setting. Ward-level post-operative protocols overrode Early Warning Score-driven vital signs observations. These wards all had medium or high adherence with the Early Warning Score protocol. Interview data suggests their higher level of adherence may be an artefact of following the post-operative frequencies for vital signs observations recording, which were often more frequent than the intervals required by the Early Warning Score protocol.

...Whereas because we're slightly different in our surgical management that we would automatically do obs, we've never on [our ward] got to be 'do your once-a-day obs'. We don't do that. We automatically do four-hourly or six-hourly anyway... (RN9 - Medium adherence ward)

Two of the interviewees on medium adherence wards reported needing to provide a 'fresh set of obs' for Doctors coming on shift at 6am. These threatened their ability to protect longer periods of sleep.

...so if you do them again at 4 o'clock there are chances that I have to do it again at seven, because the consultant wants a fresh set of obs, and that's two obs for a patient that's hopefully going home today... (RN13 – Medium adherence ward)

Finally, the study hospital had used ward performance targets to increase adherence with the Early Warning Score protocol. Our interviewees suggested that while these increased adherence they could damage nurses' sense of professional autonomy – particularly more experienced nurses.

...it's a red clock [alert that an observation is late] so basically, you've red clocked out. You've blown it. There is no clinical judgement on our part - especially with the patients we've got. [...] You've got a black mark against

your name. But if you could go in and say, 'I'm not doing this because' [...] and not be penalised [...] But the people that do the [...] bar charts and the pie charts [...] they don't see that... (RN8 - Medium adherence ward)

Under- and over-monitoring of certain patient groups

The Early Warning Score protocol was perceived as inappropriate for certain patient groups, but for very different reasons. In some cases, a patient's existing condition meant interviewees carried out less scheduled monitoring at night than on other patients. These patients therefore risked being relatively under-monitored. In other cases, where a patient was not expected to recover, regular monitoring was felt to be too intrusive.

'You know that's not going to improve': patients with Chronic Obstructive Pulmonary Disease (COPD)

Interviewees from all quartiles of adherence discussed issues relating to the monitoring of people with COPD. One predictable vital sign abnormality (such as oxygen saturation) could trigger a greater number of vital signs observations. Responses to COPD patients varied. They included carrying out the vital signs observations, skipping these observations, carrying out incomplete vital signs observation sets (recorded as non-adherent by the protocol system) or lengthening the time between vital signs observations required by the Early Warning Score protocol (also non-adherent). Some interviewees noted that they would explicitly gain a doctors' written advice to do so, others that they knew the doctors would be 'happy with that', while others did not mention doctors' input or views at all.

...the patient with COPD, they're going to have low saturations and the score is going to be higher, but there is no way they're going to improve it because their baseline is low sat. You don't need to repeat it because you know that that's not going to improve... (RN12 – Medium adherence ward)

'It's alright with other patients but with the Alzheimer's it's so hard'

Seven interviewees spoke about their approach to patients who were 'confused' or had a dementia diagnosis. Some interviewees discussed 'confused' patients having problems sleeping or becoming more agitated than other patients when woken at night, which could wake others. Attitudes to waking patients with dementia varied, with one interviewee on a medical assessment ward describing how they modified their observation-taking technique for patients with dementia, especially for 'poorly' patients, suggesting recourse to clinical judgement:

...It's all right with other patients, but with the Alzheimer's it's so hard [...] we're really struggling, especially if they're fighting [...] I need another hand [...] so if we cannot do the upper, so we'll just do it at the bottom, at the lower torso. So for example, the saturation reading, you need to do it, so if you cannot do it in the fingers, we'll just do it in the toe. So at least there's something [...] because we don't want to guess, especially if the patient is poorly... (HCSW4 – High adherence ward).

However one interviewee described how this could conflict with her ability to maintain a night time environment that was conducive to sleep. This suggests that some nurses may deliberately avoid waking patients who require more support at night.

...there are times when a demented patient who didn't sleep - so noisy - refused to have the blood pressure checked, and then eventually went to sleep; so you have, uh, should I check the blood pressure or what? If I check it she'll wake up, and then the rest of the patients will be annoyed too. [...] Most of the time - during the time it wasn't compulsory, it's the nurse's discretion. I leave it as it is... (RN13 - Medium adherence ward)

There was variation in commitment to taking vital signs observations from these patient groups at night. Interviewees who missed or reduced scheduled observations at night came from all quartiles of adherence with the Early Warning Score protocol. This suggests that even in wards that appear to

be highly adherent to the protocol, confused patients and patients with COPD may be under-monitored at night.

'If the patient deteriorates, it's just going to be end of life'

Another dilemma was supporting patients whom staff judged were nearing the end of life, but were not yet registered on a formal End of Life care pathway (where the Early Warning Score protocol could be overridden). Staff judged it was more important to support sleep given that halting deterioration was not the clinical aim. Instead monitoring vital signs observations formed part of the decision about when the formal End of Life pathway would be activated.

...A patient that is approaching end of life, [...] they're not formally on an end-of-life pathway but they are palliative and we know that we're not going to escalate - it's going to be documented by the consultant that we're not going to escalate their care to intensive care. [...] If the patient deteriorates, it's just going to be end of life... (RN12 – Medium adherence ward)

Interviewees argued that vital signs observations may be needed less frequently for these patients (once or twice a day to monitor the effectiveness of medication) so did not need to be performed at night.

DISCUSSION

This study aimed to explore the reasons why vital signs observations monitoring reduced at night, even with an Early Warning Score protocol in place. Ward staff decisions about whether or not to follow the protocol were influenced by their own judgement about the necessity and urgency of the vital signs observations required, ward factors, hospital surveillance targets and patient-specific factors. Most of these factors could be expected to influence observation taking during the day. However while staff would carry out what they judged to be 'unnecessary' vital signs observations

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during the daytime, the protocol was more likely to be resisted at night as it would mean interrupting patients' sleep. This mirrors some of the findings in Odell et al (2009), which highlighted the role of nurse clinical judgement, but explains why this may become more pronounced at night. While most of our interviewees did take vital signs observations at night if they felt they were necessary, some described how they or the nurse in charge had a policy of not taking vital signs observations at night. However our study also found that unqualified personnel were carrying out observations and sometimes making clinical judgements. This raises concerns about the impact of staff competence on safety (such as adverse events and mortality). More research needs to explore if this is a commonplace practice and how it affects patient safety.

The Early Warning Score reading was used as part of the clinical decision for almost all interviewees as an indicator of acuity rather than required frequency of vital signs observations. This could explain why previous research has found that increased acuity increases adherence to the observation schedule at night, but not to the level expected by the Early Warning Score protocol (Hands et al 2013).

The impact of ward factors was more complex. Both ward-level protocols and perceived doctor expectation of vital signs observations appeared to override the Early Warning Score protocol. In some cases the frequency of vital signs observations required by post-operative protocols was greater than that required by the Early Warning Score protocol. This could explain some of the high adherence rates among wards using such protocols, suggesting they are an artefact of a different process rather than reflecting adherence with the Early Warning Score protocol. Where a 'fresh' set of vital signs observations was felt to be expected by a doctor at the end of a night shift, this could lead to a prolonged period of time without vital signs observations in order to support a longer period of sleep for patients. These findings could explain the peaks in other research that continued

to follow traditional ward round timings, even when an Early Warning Score protocol is in place (De Meester et al., 2013a; Hands et al., 2013; Yoder et al., 2013), particularly if additional, early vital signs observations are done before a patient goes to sleep in order to support the longest possible period of sleep. Staff also discussed how the proximity of sleeping patients might lead to an observation being missed, even if the patient requiring that observation was awake.

Most of the interview focused on staff approaches to the use of the Early Warning Score protocol at night before ward performance targets were introduced. While interviewees described greater adherence with the Early Warning Score protocol after targets were introduced, this was at the risk of potentially over-monitoring patients such as those nearing an end-of-life process as well as reducing nursing autonomy and morale.

Patient factors reflected three different underlying issues. For patients with COPD, there was a problem with applying the Early Warning Score protocol as their 'normal' range differs from that embedded in the Early Warning Score algorithm. However not all staff reduced vital signs observations with this group. While it was raised in the majority of interviews, interviewees noted this applied to a very small proportion of patients on their ward. This seemed to be a talismanic issue about the limitations of applying one algorithm to all patients and monitoring adherence across the range of patient groups. Some interviewees felt people with COPD were 'over-monitored'. However when vital signs observations are missed, there is a risk of diagnostic overshadowing through missing other markers of deterioration. Conversely, patients who were approaching an End of Life pathway may be over-monitored at a difficult time, highlighting important differences between palliative and preventative 'care trajectories' (after Allen *et al.* 2004). These hint at the potential limitations of

basing clinical decisions on algorithms, and highlight the important 'hidden work' carried out by nurses in integrating and anticipating care trajectories (Allen 2015).

However there is also a risk that a lack of transparent decision making could increase the risk of other kinds of avoidable deterioration and the endurance of unnecessary discomfort. Most concerning perhaps was the potential for 'confused' patients or patients with a formal diagnosis of dementia to be under-monitored at night. Unlike with the other two groups, the reasons for missing vital signs observations in this group related either to ward management (not waking other patients), concerns about causing distress but also about increasing workload. While some staff had developed a way to take vital signs observations that was less distressing, this highlights the potential for less monitoring of a vulnerable group who may be less able to verbalise concerns about their own sense of deterioration.

Nonetheless, as these findings have highlighted, nurses on night shifts are faced with difficult dilemmas in trying to balance the needs of the individual patient with the needs of other patients. Potential solutions should consider this wider context. This echoes recent work where surgeons and physicians were concerned about the impact of standardised pathways on professional decision making (Martin *et al.* 2017). However rather than rejecting these outright they were able to build more nuanced pathways that actually enhanced clinical decision making and collaboration between professional groups. The findings above provide a strong steer on how deterioration-based algorithms could be adapted to reflect different care trajectories.

STUDY LIMITATIONS

This was a small, qualitative study in a single centre study, so it is not possible to generalise.

Nonetheless it meets the need for an exploratory qualitative, in-depth study of why vital signs observations are taken less at night, as highlighted by Buist and Stevens (2013). As these findings chime with existing qualitative and quantitative research, this suggests some of our conceptual findings may be transferable (Lincoln & Guba, 1985) to nursing practice at night more generally.

Although we designed the study as purposive, using a 'deviant case' purposive sample, we had to open it to all who were eligible and interested due difficulties recruiting enough participants. We were still able to interview nurses from the wards with the extremes of monitoring adherence, but also include a useful cross-section of staff working on a range of wards with differing levels of adherence with the Early Warning Score protocol. One potential weakness of the sampling approach is the use of whole ward statistics, which cannot reflect within-ward variation in staff adherence to scheduled observations. However across quartiles of ward-level adherence, commonalities of judgements of 'necessity' of observations and issues of supporting sleep emerged. When coupled with findings showing the influence of post-operative protocols on adherence statistics, these commonalities take on greater significance and add to the transferability of our findings.

Further qualitative work could aim to recruit a more homogenous group – for example, more or less experienced nurses – which would be instructive in exploring the impact of clinical judgement in greater detail. Ethnographic observations of nurses' decision making practices at night would be invaluable in extending our understanding from nursing staff's accounts of their own practice.

A forthcoming article using our survey data will provide details about generalizable aspects of nurses' decisions about waking patients at night, across wards. Further quantitative work could explore whether the key findings reported here can be more widely generalised, including whether specific vulnerable populations are under-monitored and whether this impacts on clinical outcomes.

CONCLUSION

At night there is a tension between supporting sleep and regular vital signs observations, which interviewees attempted to address by supporting the longest feasible 'block' of uninterrupted sleep. While the majority of interviewees supported the underlying Early Warning Score protocol principles of increasing vital signs observations according to acuity, they questioned the frequency of vital signs observations and the appropriateness or ease of using this system with people with COPD. This was also problematic for people in a transitional phase of their illness where if significant deterioration occurred despite optimal treatment a clinical decision would be made to begin an End of Life pathway.

There were also concerns raised by some interviewees about the difficulties of waking patients with dementia to take vital signs observations, which were more to do with patient or ward management than patient safety. While there is more research to be done to establish the optimum frequency of vital signs observations, a key issue is the widespread perception of 'exceptions' that are not accounted for by the system. These raise two potential safety issues. Firstly delegitimising the whole system and making unwarranted exceptions covert but socially acceptable at ward level. Secondly using overall adherence targets that result in staff undertaking unnecessary vital signs observations and disturbing patients, such as those nearing the end of life, unnecessarily.

Concerns about the balance between the need to support sleep and prevent deterioration merit serious consideration and require further research. A greater understanding of the optimum frequency of vital signs observations to identify and prevent deterioration is needed. Fine-tuning may be needed to reflect the exact length of the intervals, accounting for exceptions and allowing for the use of nursing experience alongside algorithm outputs.

These findings also highlight the importance of taking into account the wider context within which nursing practices occur (Hands et al, 2013). As with all nursing staff, our interviewees' working practices were bounded by ward- and hospital- level protocols, targets and monitoring, and the expectations of medical staff. These served to threaten their ability to protect uninterrupted chunks of sleep, to follow Early Warning Score-led intervals and to make autonomous decisions about the necessity of any given Early Warning Score-scheduled observation.

RELEVANCE TO CLINICAL PRACTICE

Decisions about whether or not it is 'necessary' to wake a patient to do vital signs observations during the night should be a multi-disciplinary team decision. Incorporating a feature into systems of observations recording to give reasons for omissions of vital signs observations may help to identify hidden under-monitoring of particular groups of patients. Local audits and research should explore whether people with dementia, reduced mental capacity or chronic conditions are systematically under-monitored at night and the role and cost implications of wireless continuous monitoring for patients with dementia. Where possible, grouping patients together by their acuity level could allow nursing staff to minimise sleep disruption to patients who do not require night-time monitoring.

It is important to identify certain patient groups whose care trajectories do not fit neatly into the prevention of deterioration model that prescribes the use of an Early Warning Score protocol.

Where patients have chronic conditions that weight the Early Warning Score toward further intervention and greater frequency of vital signs observations this both puts these patients at risk of diagnostic overshadowing if vital signs observations are missed and risks delegitimising the system.

Allowing for some form of exceptions reporting or even a modified algorithm for specific groups who score outside the 'normal' range might help address both issues. For patients on a slow pathway to End of Life where end of life plans state intervention is not expected if there is deterioration, there could be a more formal alignment with the monitoring protocol, although this may need to be specific to the patient and allow for interventions that are within palliative guidelines.

Where Early Warning Score protocols are being implemented there needs to be a recognition of the role of other influences on timing of vital signs observations, such as ward round expectations or the local implementation of post-operative protocols. Guidance should be agreed about which set of expectations should be applied, or how they might be combined in a clinically appropriate way.

The evidence base relating to Early Warning Score protocols – particularly the optimum frequency of observation sets - is still developing. Individual interpretations, intervals and uses vary between hospitals at national and international levels. Despite these limitations, the majority of our interviewees found having an early warning score calculated by a digital device with reminders to be a useful addition to practice. However, rather than simply following the protocols they instead used them much like a Satellite Navigation System – guiding but not dictating their work. Therefore for nurses currently using such protocols we recommend the involvement of wider teams in decision making and creating auditable documentation for these decisions. For hospitals implementing Early Warning Score protocols, we suggest the use of an exceptions reporting system that can monitor

and highlight exceptions, allowing for the identification of systematic over- or under- monitoring of specific patient groups, particularly at night.

CONTRIBUTIONS

The authors have confirmed that all authors meet all three of the ICMJE criteria for authorship credit (www.icmje.org/ethical_1author.html), as follows: (1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content and (3) final approval of the version to be published.

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Table 1. NEWS score contribution by vital sign readings

	3	2	1	0	1	2	3
Pulse (bpm)	≤40		41-50	51-90	91-110	111-130	≥131
Respiration rate (bpm)	≤8		9-11	12-20		21-24	≥25
Temperature (°C)	≤35.0		35.1-36.0	36.1-38.0	38.1-39.0	≥39.1	
Systolic BP (mmHg)	≤90	91-100	101-110	111-219			≥220
SaO2 (%)	≤91	92-93	94-95	≥96			
Any supplemental oxygen?		Yes		No			Any O2
Level of consciousness using the AVPU* scale				A			V, P or U

*A = alert, V = responds to voice, P = responds to pain, U = unresponsive. Scores taken from the National Early Warning Score (NEWS: Royal College of Physicians, 2012).

Table 2. Comparison of Early Warning Score protocols recommended for NEWS and that in place in the study hospital

NEWS	NEWSDIG recommendations			Current local hospital protocol		
	Risk level	Observation frequency	Escalation	Risk level	Observation frequency	Escalation
0		12 hourly	Continue monitoring			
1	Low	4-6 hourly	· Inform RN who must assess the patient	Low	12 hourly	None
2			· RN to decide if increased frequency of monitoring and/or escalation of clinical care is required		6 hourly	
3				Medium	4 hourly	Inform nurse in charge
4						
5	Medium	1 hourly	· RN to urgently inform the medical team caring for the patient			
			· Urgent assessment by a clinician with core competencies to assess acutely ill patients			
6			· Clinical care in an environment with monitoring facilities			
	High	Continuous monitoring	· RN to immediately inform the medical team caring for the patient – this should be at least at specialist registrar level	High	1 hourly	Nurse actions RN to inform doctor (FY2 or SHO) Doctor actions See patient within 2 hours
			· Emergency assessment by a clinical team with critical care competencies, which also includes a practitioner(s) with airway skills			
7			· Consider transfer of clinical care to a level 2 or 3 care facility i.e. higher dependency or ITU			
						Nurse actions RN to inform doctor (FY2 or SHO) Doctor actions See patient within 30 minutes

8



9+



Critical

30 minutes

Call SpR/Outreach.

Nurse actions

RN to inform doctor
(Specialist Registrar)

Consider
continuous patient
monitoring

Doctor actions

See patient within
15 minutes

Call Consultant,
Outreach or ICU.

Table 3. Demographics of sample by quartile of adherence to scheduled vital signs observation intervals at night

	<i>Lower quartile</i> <i>(n = 3)</i>	<i>Low-mid quartile</i> <i>(n = 6)</i>	<i>Mid-high quartile</i> <i>(n = 2)</i>	<i>Upper quartile</i> <i>(n = 6)</i>	<i>Total</i> <i>(n = 17)</i>
<i>Role</i>					
Registered nurses	3	3	1	6	13
Student nurse/support worker	0	2	0	0	2
Support workers	0	1	1	0	2
<i>Years of ward experience</i>					
0-4 years	1	0	1	1	3
5-9 years	0	4	0	1	5
10-14 years	1	1	0	1	3
15-19 years	0	0	0	0	0
20-24 years	0	1	1	0	2
25-29 years	0	0	0	2	2
30+ years	1	0	0	1	2
<i>Specialty</i>					
Medical	1	0	0	0	1
Stroke Rehab	1	1	0	0	2
Older people (acute)	1	0	0	0	1
Oncology	0	3	0	0	3
Trauma & Orthopaedics	0	0	1	1	2
Emergency Medicine	0	0	0	2	2
Surgical	0	2	1	2	5
Gynaecology	0	0	0	1	1