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**TITLE:**

Use of a single parameter track and trigger chart and the perceived barriers and facilitators to escalation of a deteriorating ward patient: a mixed methods study.

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**WORD COUNT:**

4,968

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**ABSTRACT:**

**Aims and objectives:***Aim:*

To investigate nurses' use of a single parameter track and trigger chart to inform implementation of the National Early Warning Scoring tool.

*Objectives:*

To report the characteristics of patients with triggers, the frequency of different triggers, and the time taken to repeat observations. To explore the barriers and facilitators perceived by nursing staff relating to patient monitoring.

**Background:**

Sub-optimal care of the deteriorating patient has been described for almost two decades. Organisations have responded by implementing strategies that improve monitoring and facilitate a timely response to patient deterioration. While these systems have been widely adopted the evidence-base to support their use is inconsistent.

**Design:**

A mixed method service evaluation was carried out in an acute University hospital.

**Methods:**

Physiological triggers (n=263) and characteristics of triggering patients (n=74) were recorded from surgical and medical wards. Descriptive statistics were displayed. Questionnaires were distributed (n=105) to student nurses, health care assistants and registered nurses. Themes and sub-themes were identified from content analysis.

**Results:**

Hypotension was the most frequent abnormality. There was variability in the time to repeat observations following a trigger. A high proportion of triggers were identified in older patients, as was a trend of longer time intervals between trigger and repeat observations. Nurses reported a number of barriers and facilitators to monitoring patients including: 'workload', 'equipment', 'interactions between staff' and 'interactions with patients'.

**Conclusions:**

This study identified a number of barriers and facilitators to monitoring and escalation of abnormal vital signs, highlighting the complexity of the process and the need for a system-wide approach to a deteriorating patient.

**Relevance to clinical practice:**

The trend of longer delays following a trigger in older patients has not been identified previously and could reflect a knowledge gap of the physiological changes and response to acute illness in older people.

**Keywords:**

- Track and trigger charts
- Deteriorating ward patient
- National early warning score (NEWS)
- Critical care outreach
- Monitoring
- Older adults
- Escalation
- Patient safety
- Communication
- Health care assistants

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

- There was a trend towards older patients having longer delays to repeat observations following an initial physiological trigger suggesting the implications of physiological changes of aging should be incorporated into educational strategies that underpin care of the deteriorating patient.
- Interaction between members of the nursing workforce was identified as impacting upon the likelihood of physiological abnormalities being reported and escalated suggesting a need for educational programmes to focus on effective communication within and between disciplines.

## **INTRODUCTION:**

The persistent challenges associated with the provision of timely and effective acute and critical care for a deteriorating hospitalised patient have been acknowledged (Galhotra et al., 2007; Bion & Heffner, 2004). Attempts to address sub-optimal care have led clinicians, policy-makers and academics, to analyse acute healthcare environments to better understand this undoubtedly complex issue and to identify strategies that may improve quality of care for patients experiencing in-hospital deterioration (DeVita, 2005). Strategies that have been explored have focused on the increasing acuity of hospitalised patients; tools that enhance the monitoring of patients deemed to be 'at risk' and the implementation of peripatetic teams to support the care of deteriorating patients beyond the critical care unit (Heaps, Thorley & Langley, 2005).

To ensure a deteriorating patient is seen by the right clinician, in the right timeframe, with an appropriate outcome, a 'system-wide' institutional commitment to the detection, monitoring and escalation of the patient is required (Angus & Black, 2004). Rapid response systems that overarch the detection and management of a deteriorating patient should have, at minimum, both an afferent limb through which the physiological trend is tracked and an efferent limb through which an appropriate response is triggered (DeVita et al., 2006). More specifically, the afferent limb should facilitate the detection of a patient with emergent needs that are unmet and a mechanism through which the immediate care-provider can summon help (DeVita et al., 2006). The efferent limb should include a timely response by external personnel with appropriate skills to address the imbalance between the patient's needs and the local resources available (DeVita et al., 2006). Within the UK, critical care outreach teams (CCOT) were introduced into many hospitals as a component of the efferent limb of the rapid response system (Department of Health, 2000). Since these services were first conceived, significant national heterogeneity has been noted regarding how these teams were operationalised, their characteristics and the personnel within them (Johnstone, Rattray & Myers, 2007). This level of inconsistency appears to exist within an international context also. Similar emergency response teams have been implemented across North America, Australia, New Zealand and Western Europe with inconsistencies in team calling criteria, personnel, scope of practice and nomenclature (Johnstone, Rattray & Myers, 2007; DeVita et al., 2006).

## **BACKGROUND:**

In 1998 a seminal prospective cohort study first introduced the concept of sub-optimal care preceding admission to the intensive care unit (McQuillan et al., 1998). Thirty-nine percent of patients from the cohort studied were admitted to intensive care late in the trajectory of deterioration and the support of airway, breathing and circulation was frequently poor (McQuillan et al., 1998). Mortality was higher in patients who received sub-optimal care prior to intensive care admission when compared to those who received adequate management ( $p=0.04$ ). Whilst the validity of this paper has been criticised in view of the small sample size

(n=100) and the potentially subjective methods of data analysis, it succeeded in stimulating interest within the clinical and academic community regarding premonitory signs of deterioration.

A comprehensive concept analysis was conducted to define the meaning of sub-optimal care and provide a common understanding between clinicians, academics and policy makers (Quirke, Coombs & McEldowney, 2011). Key themes identified included: antecedents and outcomes of deterioration; increasing patient complexity and acuity; health care workforce; education of health care professionals and organisational factors (Quirke, Coombs & McEldowney, 2011). Furthermore, in the majority of these papers sub-optimal care was viewed as both a preventable and/or avoidable phenomenon.

Cohort studies have shown that patients who suffer cardiac arrest within a ward environment frequently have aberrations in vital signs associated with their clinical deterioration (Hillman et al., 2001; Goldhi, White & Sumner, 1999). The robust multi-site ACADEMIA study that was carried out in the UK, Australia and New Zealand corroborates the prevalence of pre-monitory signs preceding collapse (Kause et al., 2004). In 141 cardiac arrests that were analysed, 112 events (79.4%) were noted to have documented antecedents (Kause et al., 2004).

Given the unequivocal findings that in-hospital collapse is rarely an abrupt, unheralded event (Smith & Wood, 1998), healthcare professionals who are responsible for monitoring patients should be able to detect physiological changes that signify deterioration as an important component of the afferent limb of the rapid response system (DeVita et al., 2006). Track and trigger charts have been widely implemented within the UK to facilitate this level of patient monitoring (Smith et al., 2008a).

Historically, there have been several hundred track and trigger tools used in clinical. In addition to creating a confusing minefield for rotational clinicians, this wide inconsistency has potentially hampered the development of a robust evidence-base to underpin their use (Royal College of Physicians, 2012). Indeed, despite the national implementation of these tools the evidence base to support their use has been historically inconclusive with many track and trigger systems demonstrating a weak, and at best, moderate ability to discriminate between patients who survived and those who died within 24 hours of hospital admission (Smith et al., 2006).

In 2012, a working party of expert clinicians and academics proposed the National Early Warning Scoring (NEWS) chart as a superior track and trigger tool to supersede existing systems (Royal College of Physicians, 2012). The NEWS is an example of an aggregate weighting track and trigger system (AWTTS) that evolved from a digital prototype - the VitalPAC™ Early Warning Score (ViEWS). This prototype was tested against 33 other AWTTS using a database of 198,775 vital sign recordings (Prytherch et al., 2010). Unlike other systems the ViEWS demonstrated a strong ability to discriminate patient mortality within the first 24 hours of admission (Prytherch et al., 2010).

The imminent roll-out of NEWS provided a unique and timely opportunity to examine existing practices in the monitoring of ward patients by nursing staff. Whilst there is an abundance of published literature documenting the predictive capability of various track and trigger charts, there remains a significant knowledge-gap regarding how nurses use them in clinical practice. In order to better understand current practice within the local context, a service evaluation was designed to investigate the utilisation of an existing single parameter track and trigger chart prior to it being replaced by the NEWS chart. It was anticipated that the results of the audit would contribute to the operational and educational plan for NEWS implementation with a specific focus on the escalation of monitoring in a patient with documented abnormal physiology.

## **METHODS:**

A mixed-methods service evaluation was carried out in a tertiary referral University Hospital within central London, prior to the implementation of the NEWS tool. The audit was planned to measure existing practices that might inform the educational and operational strategy for implementing NEWS. Prior to this evaluation, no longitudinal data from the existing track and trigger chart had been had been collected, despite it being widely used across the organisation for five years.

For three weeks in February 2013 audit data were collected from four ward areas using the existing track and trigger chart that captured aberrations involving three physiological parameters (table 1). Questionnaires were subsequently issued to explore nursing staff perceptions of track and trigger systems. Ethics committee approval was not required as this study formed part of a NEWS implementation service evaluation. However, the study was authorised by the Hospital's local research and development department.

### **Phase 1 – track and trigger chart audit:**

Four ward areas were selected *a priori* based on a number of characteristics. Two medical wards (medical ward 1 has 25 beds; medical ward 2 has 20 beds) and two surgical wards (surgical ward 1 has 20 beds; surgical ward 2 has 24 beds) were selected and were categorised by the local critical care outreach team (CCOT) as either “strong” or “struggling” based on a number of broad characteristics including: visible ward leadership, staffing levels, perceived morale and visible support from a clinical educator. The hypothesis that informed this categorisation was that ward areas labelled as “strong” would demonstrate a more efficient response to a triggering patient when compared to those labelled as “struggling”.

A data collection pro forma was designed and tested for face validity in a small pilot that was carried out on the acute medical admissions unit. Any abnormal physiological sign (a trigger) was recorded on the pro forma alongside the date and time of the trigger event. Subsequently, each discrete set of vital signs were documented until the patient was no longer seen to be triggering. A trigger was defined as any single discrete vital sign measurement falling outside of acceptable parameters in accordance with the locally utilised track

and trigger tool (see table 1). Data to describe relevant patient characteristics including age and gender were also collected.

The audit process involved the researcher attending all participating wards at least three times each week and inspecting all observation charts for evidence of triggers since admission or the previous episode of data collection. Where triggers were identified they were entered into a Microsoft® Excel® spreadsheet (version 14.3.6).

Descriptive statistics were displayed including mean and standard deviation or median and interquartile range based on the distribution of the data, as well as frequency and percentages for categorical data. Data were also displayed using histograms.

Scatter plots were drawn to visually explore the relationship between age of patient and time to repeat observations and systolic blood pressure and time to repeat observations. Using a Pearson's Product Moment Correlation Coefficient (PPMCC) lines of best fit were plotted and  $R^2$  values reported to describe the strength and direction of the relationship between variables (Matthews & Ross, 2010).

Data for time to repeat observations were grouped for the two "strong" and two "struggling" ward areas. Data were not normally distributed and the difference in time to repeat observations between the two groups of ward areas was explored using Mann-Whitney U (Fowler, 2002). Data analysis was conducted in SPSS version 20, IBM Corp. Released 2011 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp).

## **Phase 2 – the questionnaires:**

A questionnaire was designed to assess self-reported knowledge and practice relating to the monitoring and response to vital signs. Based on preliminary examination of the data derived from the audit, a decision was made to explore four major domains within the questionnaires: knowledge (5 questions); prioritisation and decision-making (5 questions); understanding of the use and application of track and trigger charts (5 questions); organisational barriers and facilitators to the use of track and trigger charts (5 questions). All questions in the four domains within the questionnaire were open-ended (table 2).

A pilot study was carried out with registered nurses (RNs) and health care assistants (HCAs) working on an acute medical unit. Four RNs and 3 HCAs participated in the pilot. No major changes were made to the questionnaires based on feedback from the pilot study. All recruitment of participants was conducted through ward managers and ward administrators who were notified in writing and in-person prior to the questionnaires being issued. Formal distribution occurred over a 4-week period whereby questionnaires were disseminated in staff pigeonholes and during shift-change handovers. To preserve anonymity the



completed questionnaire was returned to a locked box. This work was assessed to be a service evaluation and consent was implied by the return of a completed questionnaire.

The knowledge testing questions were analysed as either correct or incorrect in accordance with published information (Adam & Osborne, 2009) and locally sourced expertise from the local critical care team. Answers to open-ended questions involved participants' personal insights and experiences and provided a potentially rich source of qualitative data (Pope, Ziebland & Mays, 2000).

In order to analyse the answers to these open-ended questions an inductive model of content analysis was utilised (Elo & Kyngas, 2008). During the 'preparation phase' questionnaires were grouped by profession i.e. RN, HCA and pre-registration student nurses (PRSNs). Questionnaires were then repeatedly read and subjected to a process of open coding where major content categories were noted in text margins (Elo & Kyngas, 2008). The questionnaires were initially scrutinised in professional batches allowing themes and sub-themes from within and across the professions to emerge. Following the initial phase of 'open coding' themes were reviewed and 'collapsed' into a higher-order classification or generic theme each with a number of sub-themes below them (Elo & Kyngas, 2008). This process continued until all data from the initial open coding process was appropriately categorised (Elo & Kyngas, 2008).

## **RESULTS:**

### **Phase 1 - track and trigger chart audit:**

During the three-week period data from 74 triggering patients were collected across 4 ward areas; 2 medical wards and 2 surgical wards. More of the triggering patients were male (n=41, 58%) compared to female (n=33, 42%). The median age was 74 years (IQR 22) with an age range of 20 to 105 years (Table 3). Ten triggering patients had a valid 'not for resuscitation' (NFR) document (14%).

Patients triggered the criteria on multiple occasions (range 1-2 times) resulting in 263 occasions when patients triggered criteria including 15 occasions when they triggered 2 parameters. Across all 4-ward areas abnormal blood pressure was the most frequently recorded physiological trigger (n=156, 59%). Where blood pressure was the recorded trigger, on 152 occasions the blood pressure was abnormally low (hypotension), compared to only 4 episodes of severe hypertension. Abnormal heart rate was the second most frequently documented physiological abnormality (n=71, 27%). The majority of the heart rate triggers involved tachycardia (n=67) with fewer reported occasions of bradycardia (n=4).

Abnormal respiratory rate was the least frequently reported (n=36, 14%). All of these recorded respiratory rate triggers involved fast breathing (tachypnoea). On surgical ward 2 an abnormal respiratory rate did not feature in any recorded trigger events (table 3).

The time until repeat observations following a trigger event was variable between the different wards. The median time for repeat observations was shortest on surgical ward 2 at 60 minutes. Medical ward 2 had the longest median time to repeat observations of 312 minutes (table 3).

A sub-analysis was undertaken on trigger events where repeat observations were performed within 4 hours of a trigger (240 minutes). S2 had the greatest proportion of repeat observations in less than 240 minutes in context of all trigger records 30/38 (79%). M2 had the smallest proportion of repeat observations in less than 240 minutes of documented trigger 28/74 (38%). There was a weak inverse correlation between patient's age and time to repeat observation ( $R^2$  0.054). The Pearsons Product Moment Correlation (PPMC) for age and time to repeat observations was -0.233 with younger patients more likely to have a shorter time to repeat observations (figure 1).

Scatterplots drawn for the entire data set and for each of the four ward areas showed no linear relationship between the systolic blood pressure and the time to repeat observations. These data were therefore subjected to no further analysis. Data were amalgamated for both surgical 2 and medical 1 - labelled as "strong wards". The same process was applied for surgical 1 and medical 2 – "struggling wards". In the "strong" wards the time to repeat observation ranged from 5 minutes to 690 minutes (median 225, IQR 180). On the "struggling" wards the time to repeat observation ranged from 10 minutes to 1415 minutes (median 270, IQR 399) (figure 2). Seventy five (56%) trigger events had repeat observations undertaken in under 240 minutes on the strong wards; 52 (45%) trigger events had repeat observations in the same period on the struggling wards. There was a statistically significant difference in time to repeat observation times between the strong and struggling ward areas ( $p=0.035$ ).

## **Phase 2 – the questionnaires:**

One hundred and five questionnaires were distributed. Thirty-one questionnaires were returned for analysis. Eleven (35%) were completed by registered nurses (RN); 7 (23%) by pre-registration student nurses (PRSN) and 13 (42%) by health care assistants (HCA). Response rates were similar from wards labelled "strong" and "struggling". In total, 5 questionnaires were incomplete.

Registered nurses (RNs), health care assistants (HCAs) and pre-registration student nurses (PRSNs) were all involved in monitoring and documenting vital signs. HCAs identified that, on average, they undertook 3 sets of observations per shift. Student nurses reported undertaking 4 sets of observations per shift.

The total proportion of correct answers for the 5 knowledge testing questions was 76% for the registered nurses (RN); 80% for the pre-registration student nurses (PRSN) and 66% for the health care assistants (HCA). Analysis of open-ended responses for RN, PRSN and HCAs identified three main themes. The themes were: 'equipment' with sub-themes of: 'lack of resource' and 'faulty equipment'; 'workload' with sub-themes of: 'lack of staff' and 'availability of senior staff for advice'; 'interactions and expectations of staff' with sub-

themes of: ‘conflicting priorities’, ‘trusting colleagues’ and ‘communication and hierarchy’; and ‘interactions with patients’ with the sub-theme of: ‘patient consent’.

#### *Equipment:*

HCA, PRSN and RN all reported equipment issues as a barrier to effective patient monitoring. The most frequently reported issues were a lack of equipment for monitoring vital signs (8/26%), including both electronic and manual devices, as well as encountering equipment that was faulty, broken or inaccessible:

*“...The barriers include when machines are broken or missing and the only manual sphyg is on the crash trolley...” (PRSN)*

#### *Workload:*

All three groups reported workload as a barrier to both the effective monitoring of patients and the process of escalation.

HCAs (5/38%), PRSNs (5/71%) and RNs (7/64%) reported a lack of staff in relation to high workload as a barrier to the effective monitoring of patients:

*“...Busy wards means nurses do not have time always...” (PRSN)*

In addition, both registered and non-registered staff reported a lack of availability of a senior registered nurse or nurse in charge as a barrier to immediate escalation of a deteriorating patient:

*“...Sometimes maybe they are busy or talking on the phone so it could be a barrier to tell them quickly...” (HCA)*

*“...The registered nurse may be busy with other matters like giving patients medication or talking with the doctors...” (HCA)*

#### *Interaction and expectations of staff:*

One HCA and one PRSN stated that conflicting priorities between different members of nursing staff was a barrier to diligent patient monitoring:

*“...Nurses ask you to start doing other things when you are supposed to be doing something else...” (HCA)*

*“...Things that hinder...having to do an odd job for someone else...” (PRSN)*

The sub-theme of ‘trust’ was reported in questionnaires completed by all groups (16/52%). RNs reported that trust was related to the delegation of observations to non-registered staff. All of the RNs reported the recording of vital signs as the primary responsibility of the registered nurse:

*“...I do not think it [delegation of monitoring vital signs] is appropriate...I think it is one of the most important parts of a nurses job and only by doing them do you know exactly what is going on with your patient...” (RN)*

*“...It feels like I’m doing the work of 2 because I am still responsible for any monitoring...it should not be their responsibility...” (RN)*

Some registered nurses (5/45%) appeared more comfortable with the concept of delegating vital signs monitoring to non-registered staff but on an individualised basis depending on the HCA’s perceived level of ability:

*“...Monitoring vital signs is a nursing duty however some healthcare assistants are very experienced and knowledgeable...” (RN)*

The RNs more comfortable with the delegation of measuring and recording the vital signs considered the interpretation of the information should remain the responsibility of an RN:

*“...I feel that the ‘task’ of observation taking could be delegated but that the onus of interpretation of results should be very much on the registered nurse...” (RN)*

With regard to escalation of a deteriorating patient by a registered nurse to the nurse in charge, the sub-theme of trust also emerged. RNs reported the importance of the nurse in charge being clinically credible and trustworthy as important factors in relation to escalation:

*“...Often due to their [nurse in charge] experience they can reassure if there is not a real problem or advise for the next appropriate step...you need to be able to trust your nurse in charge...” (RN)*

*“...They [nurse in charge] may have knowledge and experiences that may help identify causes of low BP and offer suggestions to help before contacting medical team or whilst waiting for the medical team...” (RN)*

The theme of trust was raised by PRSNs in relation to escalation of a deteriorating patient to their supervising RN. In the case of student nurses specifically, trust appeared more related to having trust that the RN would not dismiss their concerns:

*“...The busy nature of ward nursing means it is the case that a single observation will be dismissed as insignificant or that the only suggested action is more regular monitoring...” (PRSN)*

*“...Barriers include them [the registered nurse] not wanting to know and refusing to see the patient for you...” (PRSN)*

The sub-themes of communication and hierarchy emerged in different forms by all groups. The escalation of a deteriorating patient through a step-wise hierarchy was highlighted well by one HCA:

*“...The nurse in charge will make a report and he/she will be the one responsible for discussing the patient’s condition with the medical team...” (HCA)*

Questionnaires completed by the HCAs and PRSNs both details the importance of their RN colleagues having open communication skills and a proactive manner as important facilitators to escalation:

*“...Sometimes nurses they approach you and ask you about observation charts which could be a facilitator...” (HCA)*

*“...A nurse who asks questions about the patient (as there may be things I don’t think of or know) with good open communication is a real facilitator to escalation...” (PRSN)*

Two PRSNs reported frustration when RNs dismissed their concerns but were unable to provide a satisfactory rationale as to why they too were not worried about the reported abnormality, particularly when the abnormality was ‘subtle’:

*“...Sometimes the nurse does review the blood pressure reading and says that they are not concerned, but they do not explain why...” (PRSN)*

“...There is a reluctance of some staff to investigate tachycardia and tachypnoea...” (PRSN)

#### *Interaction with patients:*

The only group that reported patient factors as a barrier or facilitator to monitoring and escalation were the PRSNs. The PRSN appeared more aware of the potential disruption that the regular measuring of vital signs could have on patients and the possibility that they may not consent to observations being recorded:

*“...Patients may refuse observations, usually in the case of confusion or delirium...”* (PRSN)

One PRSN suggested that recording vital signs at pre-set intervals was important in ensuring patients felt comfortable about the process:

*“...If obs are done routinely at a time people expect it, that is a facilitator, usually this is at a quiet time, if an HCA helps...”* (PRSN).

#### **DISCUSSION:**

Seventy four patients were identified as triggering physiologic criteria with the majority of these patients older than 70 years. This finding supports the theory that the ageing population is contributing to abnormal physiology found in hospitalised patients (Quirke, Coombs & McEldowney, 2011, Pittard, 2003). The data here also shows a trend of older patients having longer time intervals between an initial trigger and a repeat set of observations. Given that age-related changes may blunt normal compensatory mechanisms an older adult with aberrations in vital signs could be more unwell than a younger counterpart with good physiological reserve (Gonik Chester & Rudolph, 2011). This is the first audit of vital signs that has identified a trend between age and repeat monitoring after a physiological trigger. To explore further the potential clinical significance of this finding, a further study with a larger sample of patients would be required.

The initial response to a physiological abnormality should be an increase in the frequency of vital signs monitoring, which forms a vital component of the afferent limb of the rapid response system (Royal College of Physicians, 2012; DeVita et al., 2006). Prompt re-recording of vital signs following a trigger was considered a surrogate marker of nursing recognition that the physiology was abnormal and that the patient required closer surveillance beyond routine monitoring every four hours. Across the data set there was high-level variability in the time taken to re-record blood pressure specifically, following the initial trigger. Surgical ward two was the only ward where the median time to repeat observations following a trigger did not exceed one

hour. One possible explanation lies with the tool itself. Single parameter track and trigger systems (SPTTS), such as the chart audited, are poor at discerning between patients at risk of deterioration and those with a transient abnormality (Smith et al., 2008b). Given the frequency of isolated triggers in this data set, it is possible that nursing staff had become desensitised over time and that the trigger had subsequently lost impact.

Another possible explanation for the lack of response to a trigger could be a knowledge deficit amongst nursing staff. Lack of knowledge has been cited as a causative factor in the breakdown of the afferent limb of the rapid response system, leading to recommendations for improved education for nursing staff in the monitoring and interpretation of vital signs (Odell, Victor & Oliver, 2009, McArthur-Rouse, 2001). However, given that a high proportion of RNs, HCAs and PRSNs achieved correct answers in the knowledge testing questions in the questionnaire, it is unlikely that a lack of knowledge alone explains these findings. It seems more plausible that the inconsistent response to a trigger is explained by the interplay of a range of factors. The reported differences between the “strong” and “struggling” wards supports this argument further.

The two audited wards perceived by CCOT to be “strong” demonstrated a more efficient response overall to a trigger compared to those perceived to be “struggling”. Whilst this comparison is limited by the application of an anecdotal label by a small team of specialist nurses, it is thought provoking. As transient visitors to each of the wards the CCOT nurses had developed, over time and through repeated exposure, a sense of how “holistically safe” the ward environment was. Those wards with strong visible ward management, a perceived commitment to education and adequate nurse to patient ratios, were labelled through discussion as “strong”. Those without these characteristics were conversely labelled as “struggling”. The over-arching concept that a well-managed and adequately resourced ward creates a clinically safer environment for patients has been acknowledged (Fenton & Phillips, 2013, Pinnock, 2012).

The delegation of vital signs monitoring to non-registered staff is undoubtedly a contentious issue. It has been postulated that some registered nurses view the recording of vital signs as a ‘degrading job’ and that this negative attitude towards the task itself may be contributing to the broader problem of deteriorating patients not being identified (Odell, Victor & Oliver, 2009, Hogan, 2006). The results here do not support this perspective, as all of the RNs who completed the questionnaires viewed vital signs monitoring as *their* responsibility. Despite this all HCAs who completed questionnaires reported taking patient observations regularly. This interesting contradiction might suggest that whilst RNs appreciate the monitoring of patients to be an important component of *their* work; complicated work-streams, organisational barriers and an often un-surmountable workload, demands that they frequently devolve the task to health care assistants or pre-registration student nurses (Quirke, Coombs & McEldowney, 2011).

Despite the importance of information being transferred effectively in time critical situations, it has been acknowledged that delays frequently occur in the escalation of deteriorating patients to senior clinicians or

higher levels of care (Smith et al., 2006). This 'failure to escalate' is likely exacerbated by *inter*-professional hierarchy, in addition to reported differences in the interpretation of clinical information by medical and nursing staff (Massey, Chaboyer & Aitken, 2014, Andrews & Waterman, 2005, Manias & Street, 2000). Over half of the questionnaires returned in this study referenced communication and interaction between nursing team members as a barrier or facilitator to effective patient monitoring. Un-registered staff favourably reported those RNs with an open and collaborative approach, as well as those who proactively requested vital signs information from them. Conversely, a conflicting sense of priorities and a disinterested attitude from the RN were reported barriers. Smith et al (2006,p25) described the 'alerting process' in relation to a sequence of 'vulnerable steps' where communication from one health professional to another, presumed to be of another discipline, might breakdown. The findings here suggest that 'vulnerable steps' may exist *intra*-professionally within the nursing workforce even before communication extends to other professional disciplines.

### **Limitations:**

It was assumed that following an initial trigger the re-recording of observations within four hours represented an escalation in monitoring. This assumption is potentially flawed on the surgical wards where observations are often recorded more frequently in postoperative patients as part of a 'routine' or 'traditional' practice rather than a response based on the 'risk profile' of the patient (Zeitz & McCutcheon, 2006).

The response rate for questionnaires was low across all professional groups. Furthermore, several of the questionnaires were returned incomplete. Whilst the questionnaire identified themes pertinent to the specific acute hospital further exploration would be required to extrapolate these findings to the wider context. Due to limitations in personnel, only one individual was involved in analysing the questionnaires limiting inter-rater reliability.

### **CONCLUSION:**

The issues that underpin sub-optimal care of the deteriorating patient are undoubtedly complex and multi-faceted. This mixed-methods service evaluation supports previously published work; highlighting the prevalence of physiological aberrations in older patients and the frequency of blood pressure as the predominant abnormality. Data here demonstrates a high level of inconsistency in the re-recording of vital signs following a trigger. Further, a number of barriers and facilitators that influence the responses of RNs, HCAs and PRSNs to patient deterioration have been identified – supporting further the complexities that underpin this issue.

There is a risk that NEWS may be perceived as a panacea in addressing the problem of sub-optimal care of the deteriorating patient. The effective implementation of NEWS has the potential to strengthen the afferent limb of the rapid response system. However, the implementation of this tool arguably provides organisations



with a wider opportunity to evaluate both the context within which the NEWS tool is to embed, and the educational needs of the nursing workforce to whom it will become an adjunct for patient monitoring.

#### RELEVANCE TO CLINICAL PRACTICE:

The trend of longer periods between the initial trigger and repeat observations in older patients may indicate a lack of knowledge from nursing staff regarding age-related physiological changes. Educational programmes that focus on recognition of the deteriorating patient could provide a forum for age-related changes in acute illness response to be explored more fully.

The importance of interaction between staff was identified as important when escalating abnormal physiological signs. Educational initiatives focusing on deteriorating patient management should be multi-disciplinary in order to enhance communication and develop trust within and between disciplines. Simulated clinical scenarios could provide staff with opportunities to explore communication during escalation in a controlled setting and an environment conducive to learning.

**Table 1: Physiological trigger values**

Parameter	Trigger values
Systolic blood pressure	<100mmHg OR >180mmHg
Pulse rate	<50bpm OR >110bpm
Respiratory rate	<10bpm OR >20bpm

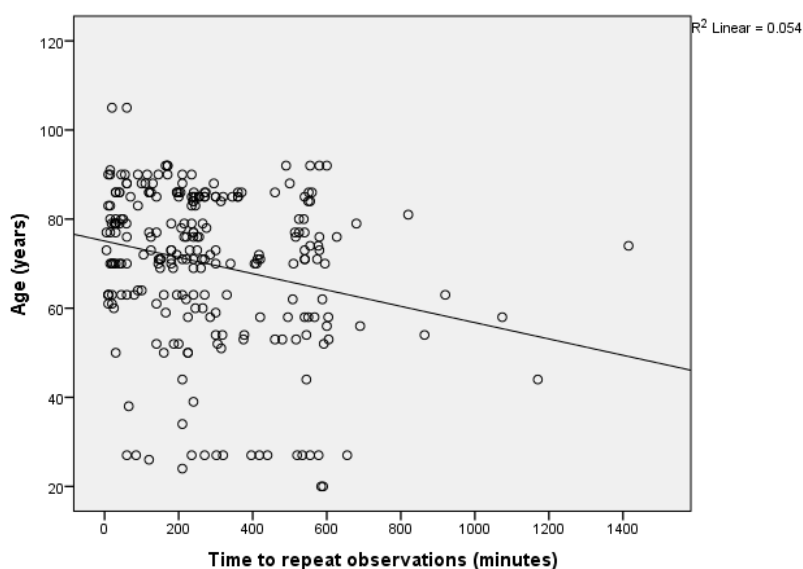
**Table 2: Example questions included in questionnaires**

Domain	Example questions
Knowledge	Hypotension may be a late sign of deterioration. Why?  What is mean by the term 'decompensation' in relation to acute illness?
Prioritisation and decision-making	A patient has a persistent low blood pressure causing them to trigger on the observation chart. Despite the low BP the patient has no other abnormal physiological signs and appears well. What would you do and why?  Despite two 250ml boluses of fluid a patient continues to trigger with a low BP. The junior doctor is contacted and asked to review. The junior doctor states that he/she will attend the ward within 15 minutes but they have still not arrived by 30 minutes. What would you do and why?
Understanding of the use and application of track and trigger charts	What is the aim of a track and trigger observation chart, as you understand it?  In your experience, how helpful are track and trigger observation charts in keeping patients safe?

Organisational barriers and facilitators to the use of track and trigger charts	<p>In your own words please describe your feelings about delegating the monitoring of vital signs (observations) to non-registered staff i.e. health care assistants.</p> <p>Having identified abnormal vital signs a period of increased frequency observations is recommended by the Trust escalation algorithm. Please describe below any barriers that you have encountered in practice to increasing the frequency of vital signs monitoring.</p>
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**Table 3: Details of trigger occasions (n=248) by ward**

		<b>Surgical 1</b>	<b>Surgical 2</b>	<b>Medical 1</b>	<b>Medical 2</b>
No. of triggering patients		15	14	23	22
Median age (years) & IQR		62 (IQR 33)	84 (IQR 11)	78 (IQR 12)	70 (IQR 27)
Age range (years)		24 - 88	20 –105	56-92	27-92
Gender: male		13 (87%)	7 (50%)	12 (52%)	9 (41%)
Trigger types	Total number of triggers	41	41	97	84
	Blood pressure	23 (56%)	25 (61%)	73 (75%)	35 (42%)
	Heart rate	9 (22%)	16 (39%)	10 (10%)	36 (43%)
	Respiratory rate	9 (22%)	0	14 (14%)	13 (16%)
Time taken to repeat observations post trigger	Median (IQR)	195 (210)	60 (175)	240 (190)	312 (385)
	Range	10-920	10-680	5-690	15-1415



**Figure 1: A scatterplot of age and time to repeat observations for the entire data set**

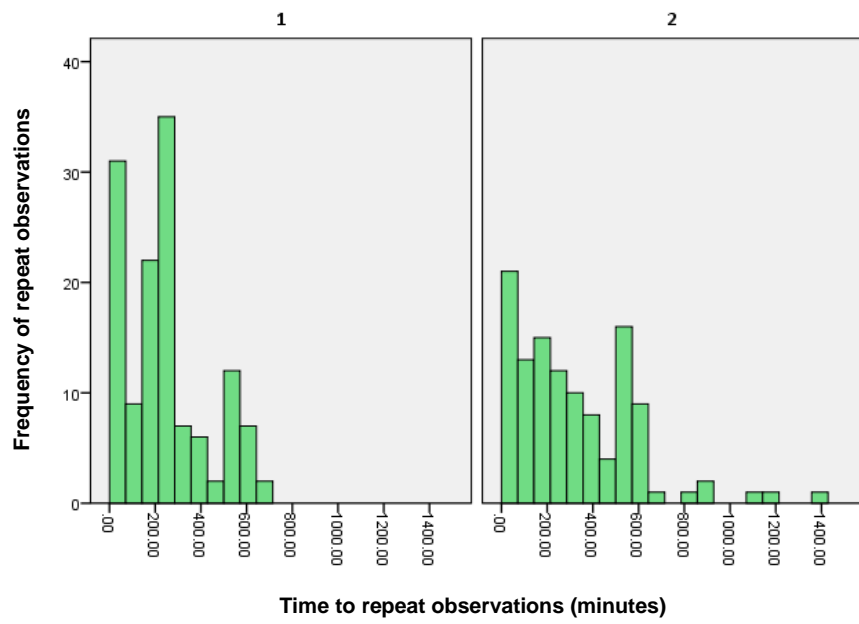


Figure 2: Strong (1) and Struggling (2) ward areas. Histogram of the time to repeat observations post trigger.

## REFERENCES:

Adam, S. K. & Osborne, S. (2009) *Critical care nursing: science and practice*. 2nd edition. Oxford University Press, Oxford.

Andrews, T. & Waterman, H. (2005) Packaging: a grounded theory of how to report physiological deterioration effectively. *Journal of Advanced Nursing*. **52** (5), 473-481.

Angus, D C. Black, N. (2004) Improving care of the critically ill: institutional and health-care systems approaches. *The Lancet*. **363**, 1315-1320

Bion, JF. Heffner, JE. (2004) Challenges in the care of the acutely ill. *The Lancet*. **363**, 970-977

Department of Health (2000) *Comprehensive critical care; a review of adult critical care services*. Department of Health, England.

DeVita, M. Bellomo, R. Hillman, K. Kellum, J. Rotondi, A. Teres, D. Auerbach, A. Chen, W. Duncan, K. Kenward, G, Bell, M. Buist, M. Chen, J. Bion, J. Kirby, A. Lighthall, G. Ovreit, J. Braithwaite, S. Gosbee, J. Milbrandt, E. Peberdy, M. Savitz, L. Young, L. Galhotra, S. (2006) Findings of the first consensus conference on medical emergency teams. *Critical Care Medicine*. **34** (9), 2463-2478.

DeVita, M. (2005) Medical emergency teams: deciphering the clues to crisis in hospitals. *Critical care*. **9**, 325-326

Elo, S. & Kyngas, H. (2008) The qualitative content analysis process. *Journal of Advanced Nursing*. **62** (1), 107-115.

Fenton, K. & Phillips, N. (2013) Developing skills in clinical leadership for ward sisters. *Nursing Times*. **109** (9), 12-15.

Fowler, J. (2002) *Practical statistics for nursing and health care*. Wiley, Chichester.

Galhotra, S. DeVita, M. Simmons, R. Dew, MA and members of the medical emergency response improvement team (MERIT) committee. (2007) Mature rapid response system and potentially avoidable cardiopulmonary arrest in hospital. *Quality and Safety in Healthcare*. **16**, 260-265

Goldhill, D. R., White, S. A. & Sumner, A. (1999) Physiological values and procedures in the 24 h before ICU admission from the ward. *Anaesthesia*. **54** (6), 529-534.

- Gonik Chester, J. Rudolph, J.L. (2011) Vital signs in older patients: age-related changes. *Journal of American Medical Directors Association*. **12** (5), 337-343
- Heaps, N., Thorley, K. & Langley, S. (2005) Critical care outreach: creating a safe culture. *British Journal of Nursing*. **14** (22), 1208-1211.
- Hillman, K. M., Bristow, P. J., Chey, T., Daffurn, K., Jacques, T., Norman, S. L., Bishop, G. F. & Simmons, G. (2001) Antecedents to hospital deaths. *Internal Medicine Journal*. **31** (6), 343-348.
- Hogan, J. (2006) Why don't nurses monitor the respiratory rates of patients? *British Journal of Nursing*. **15** (9), 489-492.
- Johnstone, C. C., Rattray, J. & Myers, L. (2007) Physiological risk factors, early warning scoring systems and organizational changes. *Nursing in Critical Care*. **12** (5), 219-224.
- Kause, J., Smith, G., Prytherch, D., Parr, M., Flabouris, A., Hillman, K., Intensive Care Society (UK) & Australian and New Zealand Intensive Care Society Clinical Trials Group. (2004) A comparison of antecedents to cardiac arrests, deaths and emergency intensive care admissions in Australia and New Zealand, and the United Kingdom--the ACADEMIA study. *Resuscitation*. **62** (3), 275-282.
- Manias, E. & Street, A. (2000) Legitimation of nurses' knowledge through policies and protocols in clinical practice. *Journal of Advanced Nursing*. **32** (6), 1467-1475.
- Massey, D. Chaboyer, W, Aitken, L. (2014) Nurses' perceptions of accessing a medical emergency team: a qualitative study. *Australian Critical Care*. **27**, 132-138
- Matthews, B. & Ross, L. (2010) *Research methods a practical guide for the social sciences*. 1st edition. Longman, England.
- McArthur-Rouse, F. (2001) Critical care outreach services and early warning scoring systems: a review of the literature. *Journal of Advanced Nursing*. **36** (5), 696-704.
- McQuillan, P., Pilkington, S., Allan, A., Taylor, B., Short, A., Morgan, G., Nielsen, M., Barrett, D., Smith, G. & Collins, C. H. (1998) Confidential inquiry into quality of care before admission to intensive care. *British Medical Journal*. **316** (7148), 1853-1858.
- Odell, M., Victor, C. & Oliver, D. (2009) Nurses' role in detecting deterioration in ward patients: systematic literature review. *Journal of Advanced Nursing*. **65** (10), 1992-2006.

- Pinnock, D. (2012) The role of the ward manager in promoting patient safety. *British Journal of Nursing*. **21** (19), 1144-1149.
- Pittard, A. J. (2003) Out of our reach? Assessing the impact of introducing a critical care outreach service. *Anaesthesia*. **58** (9), 882-885.
- Pope, C., Ziebland, S. & Mays, N. (2000) Qualitative research in health care. Analysing qualitative data. *British Medical Journal*. **320** (7227), 114-116.
- Prytherch, D. R., Smith, G. B., Schmidt, P. E. & Featherstone, P. I. (2010) ViEWS--Towards a national early warning score for detecting adult inpatient deterioration. *Resuscitation*. **81** (8), 932-937.
- Quirke, S., Coombs, M. & McEldowney, R. (2011) Suboptimal care of the acutely unwell ward patient: a concept analysis. *Journal of Advanced Nursing*. **67** (8), 1834-1845.
- Royal College of Physicians. (2012) *National early warning score (NEWS). Standardising the assessment of acute-illness severity in the NHS*. Royal College of Physicians, England.
- Smith, G. B., Prytherch, D. R., Schmidt, P. E. & Featherstone, P. I. (2008a) Review and performance evaluation of aggregate weighted 'track and trigger' systems. *Resuscitation*. **77** (2), 170-179.
- Smith, G. B., Prytherch, D. R., Schmidt, P. E., Featherstone, P. I. & Higgins, B. (2008b) A review, and performance evaluation, of single-parameter "track and trigger" systems. *Resuscitation*. **79** (1), 11-21.
- Smith, G. B., Prytherch, D. R., Schmidt, P., Featherstone, P. I., Knight, D., Clements, G. & Mohammed, M. A. (2006) Hospital-wide physiological surveillance-a new approach to the early identification and management of the sick patient. *Resuscitation*. **71** (1), 19-28.
- Smith, A. F. & Wood, J. (1998) Can some in-hospital cardio-respiratory arrests be prevented? A prospective survey. *Resuscitation*. **37** (3), 133-137.
- Zeitz, K. McCutcheon, H. (2006) Observations and vital signs: rituals or vital for the monitoring of postoperative patients? *Applied Nursing Research*. **19**, 204-211