Paediatric Early Warning Trigger – A Cry for Help

Abstract:
T Bolger, N Clarke, S Crowe, C Martin, S Koe
Paediatric Emergency Department, AMNCH, Tallaght, Dublin 24

In paediatrics, it is crucial to ensure that the child who is clinically deteriorating is rapidly recognised and treated. We implemented a Paediatric Early Warning Trigger (PEWT) in our unit to improve recognition of these patients. Our trigger was a series of physiological measurements with a PEWT call if any result was outside the accepted range. We retrospectively compared 12 months prior to the introduction of the trigger (January to December 2009) to the three years post the introduction of the trigger (January 2010 to December 2012). We compared the time from deterioration to involvement of senior staff during the two time periods. We also examined the rates of crash calls and PICU transfers in the two periods. We found that the time from deterioration to senior clinician involvement reduced from 312 minutes to 166 minutes and the rate of transfers to PICU among the triage category 142 patients reduced by 50% in the three years post trigger introduction compared to the pre-trigger period. This study demonstrates the effectiveness of a Paediatric Early Warning Trigger in an Irish setting. We have been able to maximise senior clinician input into our sickest children in a more timely fashion.

Introduction

The old adage that sick children can deteriorate quickly remains true today. It is equally important to monitor for deterioration after making an accurate diagnosis. When a child has a cardiac arrest, this is most often at the end of a sustained period of deterioration. Early intervention in the deteriorating paediatric patient has been shown to improve clinical outcomes. The focus of treatment for all sick children should be on preventing rather than treating cardiac arrest. A number of paediatric early warning scores have been studied. Their aim is to identify the deteriorating patient before they are in extremis. A recent UK based study found that 85% of inpatient paediatric units were using an Early Warning Score. An Early Warning Score is a set of algorithms relating to the physiological parameters that are scored based on severity. The score will result in a series of graded therapeutic interventions. An early warning trigger is a single trigger and single response system based on similar physiological parameters. Our hospital is a 66-bed inpatient paediatric unit with a Paediatric Early Warning System (PED). There are 33,000 attendances in the PED. While we do not have a Paediatric Intensive Care Unit (PICU), we are supported by anaesthetists on-site and we do not have ambulance by-pass for critically ill children. We noted, during our morbidity and mortality audits in 2009, that our transfer rates to PICU was rising and peaked at almost one transfer per week in 2009. Anecdotally, we felt that the time to escalate care to the sickest patients was suboptimal. We introduced a Paediatric Early Warning Trigger (PEWT) based on a modified Bristol PEWS. The response of a trigger breach was to instigate a full acute team review within 5 minutes. We compared the clinical outcomes before and after its introduction. Our hypothesis in this study was that the time taken to maximise the clinical input into these children would reduce following the introduction of the PEWT. We used the time of anaesthetic review as the time of maximising clinical input. An expected consequence of this improvement would also be less paediatric cardiac arrests in the hospital.

Methods

The PEWT was introduced in the hospital in December 2009. We undertook a retrospective audit of the patients charts for the period January - December 2009 and compared them with the period December 2009 - December 2012. All charts of patients with a PEWT call in this period were included. The PEWT is completed at the time of initial patient assessment by a doctor within 10 minutes of arrival to ED, the time of maximising clinical input. An expected consequence of this improvement would also be less paediatric cardiac arrests in the hospital.

Results

Annual attendances in the PED went from 28,000 patients in 2008 to 34,000 in 2012. Figure 1 demonstrates that within this extra workload was an increase in number of cardiac arrests and critical illness transfer to another centre were included in the study. In the pre-PEWT group, we assigned a surrogate time of PEWT call at the time of first trigger breach and we compared this with the time of first anaesthetic team review. The proportion of these within the critically ill hospital population reduced during the study. There were 149 trigger breaches by 137 patients since the introduction of the PEWT. 66 trigger breaches related to breathing while 50 breaches related to disability/neurological parameters. There were 27 due to circulation and 6 related to airway. We obtained from the charts included demographics, clinical diagnosis, elapsed times to first trigger breach, elapsed times to PEWT/crash call, elapsed times to anaesthetic review, which clinical parameter was triggering a PEWT, initial assessment of patient at time of PEWT, any extra treatment instigated by the PEWT and the outcome following the PEWT. The PEWT was a single page document which listed baseline clinical parameters as documented in Table 1. If any one of these parameters were breached, then a PEWT call was made. The aim of the PEWT was to ensure that a rapid cardiologist, Paediatric and Anaesthetic staff were assembled at the bedside and making decisions regarding the level and place of care which the patients condition was requiring.

Discussion

This study clearly demonstrates, the usefulness and clinical impact of a simple, single-trigger, single-response Paediatric Early Warning System. We reduced our transfer rates of critically ill children and rates of crash calls through earlier recognition of the clinical state of these patients. We have also reduced the time taken to involve senior clinicians in the care of deteriorating children. There have been multiple iterations of early warning scores for children. The first published data was from the Brighton PEWS by Monaghan et al. The PEW System Score has been shown to be a stronger predictor of cardiopulmonary arrest and can predict arrest by 11 hours. The Bristol PEW tool demonstrated a sensitivity of 82% and a specificity of 93% in predicting PICU admission. The Bristol PEW tool has achieved a sensitivity of 58% in predicting escalation of care. Bhandava reported that cardiopulmonary arrests reduced by 37% in the cardiology/neurology unit and 25% in general medical unit with an aggregate reduction in two
Our goal was to have a simple trigger which relied on information already being collected by nursing staff. We hoped to develop a tool which would be useful in general and paediatric hospitals. We have achieved this by keeping the trigger to a single parameter resulting in a single, full team response. Studies have demonstrated that making a tool easier to use has a positive effect on the implementation of the tool in the Paediatric Emergency Department setting. Studies have shown that a single parameter trigger is more readily accepted than more complex triggers. This positive effect is reinforced in a number of systematic reviews on this topic. Tibbals et al demonstrated non-significant reductions in hospital-wide cardiac arrests and mortality post implementation of a PEWS-like system. Brilli et al was able to show that cardiorespiratory arrests on the general wards reduced for 0.27/1000 patient days to 0.11/1000 patient days (p<0.03). Chan et al concluded in their systematic review that while cardiorespiratory arrest outside of ICU was reduced by 37% there is limited evidence to suggest improved survival. The use of PEWS in the Emergency Department setting is controversial. Bradman et al found that the Brighton PEWS had a low sensitivity (measured at 36%) for predicting those children needing admission. While another study found that the same PEWS was unable to distinguish between those requiring ward or ICU admission. Edgell et al. found a sensitivity of 70% and a specificity of 96% in predicting PICU admission using their Paediatric Advance Warning Score (PAWS). This demonstrates that the PEWS is not as useful as a triage tool. Many of our patients would have been breaching the PEWS at triage but are suitable for routine emergency treatment and ultimately discharge from the Emergency Department. This may go some way to explaining why the time from breach to escalation of care remained at 166 minutes after the implementation of PEWS and the 50% reduction in the quantum is the more relevant result.

There was a fear that the introduction of this trigger would result in an excess of unnecessary reviews of patients. However, this was not experienced in our study. All patients who were reviewed following a PEW call had breached a physiological parameter. All demonstrated a deteriorating clinical condition and in the first year of operation, the total number of transfers and PEWT calls were the same as the previous years transfers. Only 15% of the patients had their care continued on a general paediatric ward indicating that the PEWT was generally appropriate. Both periods were examined retrospectively so we have shown significant reduction but we cannot claim a definite causal link. With the education surrounding the introduction of the PEWT, we can assume an increased awareness of the deteriorating child among the clinical staff. The education took place at the induction of new staff and sporadically throughout the period. There were no other alterations in staffing numbers experienced in the hospital during this time period which could have impacted on the outcomes.

This is the first study demonstrating the effectiveness of PEWT in an Irish hospital setting. We have demonstrated a significant reduction in the time to anaesthetic review for sick patients within our hospital. This early recognition has led to a reduction in transfers to paediatric ICU and crash calls during the study period. We have increased awareness of the need for closer monitoring of those patients who are not improving clinically and the PEM has become the standard of care within the hospital. The imminent arrival of the National PEWS document from the HSE is to be welcomed and the clinical improvements, which we have demonstrated, can be replicated across the Irish hospitals.

References