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Neonatal Early Warning Tools for recognising and responding to clinical deterioration in neonates cared for in the maternity setting: A retrospective case–control study

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ABSTRACT

Background: All newborns are at risk of deterioration as a result of failing to make the transition to extra uterine life. Signs of deterioration can be subtle and easily missed. It has been postulated that the use of an Early Warning Tool may assist clinicians in recognising and responding to signs of deterioration earlier in neonates, thereby preventing a serious adverse event.
Objective: To examine whether observations from a Standard Observation Tool, applied to three neonatal Early Warning Tools, would hypothetically trigger an escalation of care more frequently than actual escalation of care using the Standard Observation Tool.
Design: A retrospective case–control study.
Setting: A maternity unit in a tertiary public hospital in Australia.
Methods: Neonates born in 2013 of greater than or equal to 34^{+0} weeks gestation, admitted directly to the maternity ward from their birthing location and whose subsequent deterioration required admission to the neonatal unit, were identified as cases from databases of the study hospital. Each case was matched with three controls, inborn during the same period and who did not experience deterioration and neonatal unit admission. Clinical and physiological data recorded on a Standard Observation Tool, from time of admission to the maternity ward, for cases and controls were charted onto each of three Early Warning Tools. The primary outcome was whether the tool 'triggered an escalation of care'. Descriptive statistics (n, %, Mean and SD) were employed.
Results: Cases ($n = 26$) comprised late preterm, early term and post-term neonates and matched by gestational age group with 3 controls ($n = 78$). Overall, the Standard Observation Tool triggered an escalation of care for 92.3% of cases compared to the Early Warning Tools; New South Wales Health 80.8%, United Kingdom Newborn Early Warning Chart 57.7% and The Australian Capital Territory Neonatal Early Warning Score 11.5%. Subgroup analysis by gestational age found differences between the tools in hypothetically triggering an escalation of care.

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Conclusions: The Standard Observation Tool triggered an escalation of care more frequently than the Early Warning Tools, which may be as a result of behavioural data captured on the Standard Observation Tool and escalated, which could not be on the Early Warning Tools. Findings demonstrate that a single tool applied to all gestational age ranges may not be effective in identifying early deterioration or may over trigger an escalation of care. Further research is required into the sensitivity and specificity of Early Warning Tools in neonatal sub-populations.

What is already known about the topic?

- There is no gold standard or validated Early Warning Tool for use in the neonatal population.
- Previous studies have not demonstrated a significant benefit to the use of an Early Warning Tool in the well neonatal population.

What this paper adds

- One Early Warning Tool may not fit all given the physiological and neurological differences between the gestational age groups.
- Incorporating clinical observable behaviours and clinician concern in the design of a tool may improve identification of early signs of deterioration in the neonate.

1. Introduction

One of the greatest challenges a neonate must overcome is the transition to extrauterine life. All newborns are at risk of deterioration as a result of failing to make this transition. Physiological immaturity, related to gestational age, and the impact of infection on the immunologically immature neonate can alter the success of adaptation (Ygberg and Nilsson, 2012; Graves and Haley, 2013). Signs of deterioration in the newborn can be subtle and easily missed (Satar and Ozlu, 2012). It has been postulated by health authorities in Australia and overseas that the use of an Early Warning Tool may help clinicians identify early signs of deterioration and therefore respond promptly to prevent serious adverse events in acute health care settings (National Patient Safety Agency, 2007; Clinical Excellence Commission, 2013; Paliwoda and New, 2015).

Early Warning Tools assist clinicians identify early deterioration by using a systematic process of charting patient vital signs against pre-determined vital sign parameters (Australian Commission on Safety and Quality in Health Care, 2012). Early Warning Tools vary in design but are generally coded with varying colours or shades indicating worsening abnormal parameters, which is designed to alert the clinician by way of set action prompts that an escalation of care is required (McLellan and Connor, 2013; Olroyd and Day, 2011; Paliwoda and New, 2015). Other tools are based on scoring systems or a combination of both where if an aggregate number exceeds a predetermined threshold an escalation process determines the clinician's path of intervention (Australian Commission on Safety and Quality in Health Care, 2012).

Safety and quality units of health care facilities worldwide have undertaken steps to assist clinicians recognise and respond to clinical deterioration (National Institute for Health and Clinical Excellence, 2007; Institute for Healthcare Improvement, 2016; An Roinn Slainte Department of Health, 2014). In 2010, the Australian Commission on Safety and Quality Health Service mandated 15 standards to improve patient outcomes in acute health settings of the 15; 10 apply to direct patient care (ACSQHC, 2010). Standard 9: Recognising and Responding to Clinical Deterioration in Acute Health Care applies to all patients including babies cared for in maternity health settings (ACSQHC, 2012). The study hospital has addressed this standard for adult and paediatric clients by implementing Early Warning Tools (Queensland Government, 2012a). However, to date, an Early Warning Tool has not been implemented for neonates.

The National Consensus Statement of Australia in 2010 recommended six key physiological observations: respiratory rate, oxygen saturations, heart rate, blood pressure, temperature, and level of consciousness, be incorporated into the development of Early Warning Tool to assist in identification of early deterioration (ACSQHC, 2010). Importantly it could be argued that these 'all population' observations do not pertain to newborns in the maternity ward, where presently key physiological observations such as blood pressure and oxygen saturations are not routinely undertaken in the care of newborns in all maternity settings (Queensland Government, 2012; King Edward Memorial Hospital, 2014). It could be further argued that newborn specific observable behaviours that are indicative of deterioration, such as poor feeding, 'spilling', failing to wake for feeds, or falling asleep during feeding; and parental concern would be more applicable (Paliwoda and New, 2015; New South Wales Department of Health, 2011). In response to the Standard, a neonatal Early Warning Tool is being developed for rollout across Queensland (Patient Safety Unit, Queensland Department of Health, personal communication, May 29, 2015). While in other states of Australia, individual hospitals have developed, adapted or introduced Early Warning Tools based on the all population key physiological data for determining clinical deterioration (New South Wales Department of Health, 2012, 2013).

An earlier literature review found there is no 'gold standard' or validated early warning tool for use in neonates, and studies in the adult, paediatric and neonatal