Using Health Information Technology to Improve Safety in Neonatal Care

A Systematic Review of the Literature

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KEYWORDS

- Health information technology • Patient safety • Neonatology • NICU
- Quality improvement • Medical errors

KEY POINTS

- Health information technology (HIT) interventions have been increasingly used in the provision of neonatal care. They are often moved into neonatal settings with little evaluation, however, and should be adequately tested before full adoption.
- We identified 4 qualities characterizing HIT interventions that achieved patient safety improvements: addresses a critical clinical need and leverages unique IT capabilities, and can be rigorously evaluated and generalized beyond the initial site.
- Quality improvement methodology can facilitate meaningful testing and implementation of HIT interventions.

INTRODUCTION

Issues in patient safety were brought to the forefront by the Institute of Medicine reports "To Err is Human"[1] and "Crossing the Quality Chasm."[2] Compared with adults, children experience higher rates of patient safety events, such as central line–associated blood stream infections and medication errors with potential for harm.[3,4] Within

the pediatric population, neonates are uniquely vulnerable to errors primarily because of their physiologic immaturity, medication dosing that is influenced by weight and age, and the need for intensive care.[3,5] Some errors occur more commonly in the neonatal population, including identification errors due to multiple births and breast milk errors.[6–8]

Health information technology (HIT) has been used to streamline clinical workflow and improve patient safety in inpatient settings. In some studies, technology has been used to identify errors, prevent medication errors, assist with medical decision-making, improve communication, and detect early clinical deterioration.[9–13] For example, early studies of Computerized Physician Order Entry (CPOE) showed that it reduced errors by several methods, including forcing inclusion of key pieces of information in orders (eg, route) while allowing ready access to dosing recommendations.[14,15] Links to clinical guidelines and individual laboratory results may facilitate decision-making and streamline care.[16,17] Conversely, the introduction of new technology has also been shown to introduce new errors into the environment by changing clinician work flow and task performance, introducing unfamiliar systems, and by adding to workload.[18–20] As such, HIT interventions need to be carefully tested in different populations and environments, because the interaction of the technology with the health care environment will produce different clinical impact in different populations.[21] Several HIT-based interventions have demonstrated improvements in patient safety among adults and have subsequently been adopted in the neonatal intensive care environment. In this systematic review, we sought to evaluate the specific evidence for use of HIT interventions to improve patient safety in neonatal care.

METHODS
Search Strategy

A search strategy was designed to identify all potential publications related to the intersection of "health IT," "patient safety," and "neonatology" (see Appendix 1 for complete search queries). A search of MEDLINE, Cumulative Index of Nursing and Allied Health Literature, Scopus, and Embase was conducted for all articles published from 2000 to 2016, with key words and topic categories (eg, MeSH terms) related to the listed topics. A second key word search was then applied on the titles and abstracts of the returned articles to exclude articles that did not contain the key words of all 3 topics. The identified articles were manually reviewed by title and abstract to exclude studies that did not meet inclusion criteria. Finally, the remaining articles and a set of studies identified by reference searches were reviewed for findings and themes.

Inclusion and Exclusion Criteria

We included articles with a focus on neonatology, safety, and HIT conducted in settings caring for newborns and infants 30 days old or younger. For patient safety articles, we included studies that sought to optimize safe patient care and prevent medical errors and adverse events. We included studies that examined the impact of HIT on safety outcomes such as medical errors and adverse events and those that reported the usability, feasibility, and acceptability of HIT interventions. We did not consider studies that used HIT to identify disease in asymptomatic patients (newborn screening or retinopathy of prematurity screening) to be related to patient safety, but we did include studies that used HIT for early detection of disease or critical events based on a patient's current signs and symptoms. We also included studies that improved care through reduced variation or enhanced communication and