

Advanced Technology in Pediatric Intensive Care Units: Have They Improved Outcomes?



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KEYWORDS

- Pediatric • Intensive care • Outcome • Electronic health record/EHR
- Medical informatics • Computerized provider order entry/CPOE
- Clinical decision support/CDS

KEY POINTS

- In medicine, providers strive to produce quality outcomes and work to continually improve those outcomes.
- Whether it is reducing cost, decreasing length of stay, mitigating nosocomial infections, or improving survival, there are a myriad of complex factors that contribute to each outcome.
- One of the greatest challenges to outcome improvement is in pediatric intensive care units, which tend to host the sickest, most complex, smallest, and frailest of pediatric patients.

INTRODUCTION

An outcome is something that follows as a result of an act or an intervention; the outcome may either be positive or negative. In medicine, providers strive to produce quality outcomes and work to continually improve those outcomes. Whether it is reducing cost, decreasing length of stay, mitigating nosocomial infections, or improving survival, there are a myriad of complex factors that contribute to each outcome. One of the greatest challenges to outcome improvement is in pediatric intensive care units (ICUs), which tend to host the sickest, most complex, smallest, and frailest pediatric patients.

Compared with medicine, the advent of the various subspecialists in pediatric intensive care is recent. For example, The Society of Critical Care Medicine (SCCM), representing the adult intensive care community, recognized pediatric critical care as a discrete field, and created the section of pediatric critical care within the SCCM in

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1981.^{1,2} A sub-board in critical care medicine was established by the American Board of Pediatrics and the first certifying examination was offered in 1987.^{1,2} Neonatology has been present slightly longer, with the terms neonatology and neonatologist first introduced in 1960.³ In 1975, the first examination of the Sub-Board of Neonatal-Perinatal Medicine of the American Board of Pediatrics and the first meeting of the Perinatal Section of the American Academy of Pediatrics were held.³

Despite being young, these fields have benefited tremendously from advances in medical knowledge and technologies to not only help improve day-to-day patient care but to improve outcomes as well. One of the greatest nonmedical advances in the past several decades that has changed daily patient care practices has been the introduction of the electronic medical record (EMR) and with it medical informatics. This change that has occurred in the medical work environment has the potential to facilitate communication and enforce adherence of global best practices.⁴

Computerization has been a hallmark of the twenty-first century, with every major industry investing heavily in these technologies to reduce cost, increase efficiencies, and improve outcomes; health care is no exception to this growing trend. After decades of technological laggard, medicine has begun to acclimatize to the digital data age.⁵ The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, which was signed into law, represents the largest US initiative to date that is designed to encourage widespread use of electronic health records.⁶ EMR systems can include many potential capabilities, but 3 particular functionalities hold great promise in improving the quality of care and reducing costs at the health care system level: clinical decision support (CDS) tools, computerized physician order entry (CPOE) systems, and health information exchange (HIE).⁶ In the ever-changing world of health care delivery these basic EMR functionalities form the basis for improving quality of care and reducing costs; two key health care–related outcomes that are being benchmarked against respective peer groups.

Also, a technology that is increasingly being adopted is telemedicine service. Many institutions are using ICU-based telemedicine services for remote monitoring, staffing, and/or consultation to aid in outcome improvements. Simply stated, ICU telemedicine uses audiovisual technology to provide critical care services from a remote location.^{7,8} In its most common form, ICU telemedicine consists of remote monitoring of ICU patients using fixed installations, either continuously or during nighttime hours.^{8,9} Telemedicine can potentially improve ICU outcomes by increasing access to the expertise of dedicated intensivist physicians,^{8,10} facilitating early recognition of physiologic deterioration,^{8,11} and prompting bedside providers to implement routine evidence-based practices.^{8,12}

ELECTRONIC MEDICAL RECORDS

EMRs have become central to modern medicine. The HITECH Act of 2009 has thrust EMRs into the forefront of every health care organization's agenda. In addition to the federal mandates associated with the HITECH Act, several factors have influenced the adoption of EMRs; these factors include, but are not limited to, supporting patient care activities, cost cutting and operational efficiencies, big-data analysis of patient health records, and incentive dollars associated with meaningful use. The power of EMRs is only matched by their complexities. EMRs vary from home-grown systems in single organizations with the necessary technical and managerial capacity; to interoperability standards for linking multiple information technology systems; to top-down, government-driven, national implementations of standardized, commercial

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