

# Nurse–Technology Interactions and Patient Safety

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## KEYWORDS

- Critical care nursing • Technology interactions • Alarm fatigue • Interruptions
- High reliability organizations • Human factors and ergonomics

## KEY POINTS

- Nurses are the primary end-users of technology in intensive care units, but nurse–technology interactions receive fragmented attention and can lead to patient safety challenges.
- Nurse–technology interaction includes the input of data into technology and extraction and interpretation of data output, while accounting for the systems in which these processes occur.
- Applying systems-oriented thinking, like high reliability organizations and human factors and ergonomics, has the potential to enhance nurse–technology interactions and improve patient safety.

## INTRODUCTION

In intensive care units (ICUs), physiologic monitors, ventilators, and infusion pumps are fixtures at every bedside, and additional complex technology is routinely used to save and prolong lives. Nurses are the end-users of most technology in the ICU, and the ways in which they interact with technology affect quality of care and patient safety. However, little attention is paid to nurse–technology interactions. Nurses rarely receive comprehensive formal education on the use of many of the ubiquitous technologies, and technology is implemented with little consideration for nurses' workflow. Nurses at the bedside are often not given a voice in technology selection; they are instructed to use new devices and find ways to adapt. However, when a new technology is not found to be easy to use or useful, nurses adapt by developing workarounds, or by using the technology ineffectively or inefficiently, at the expense of quality of care.

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In this article, we explore ICU nurse–technology interactions, past, present and future. We examine:

- The historical relationship between nursing and technology;
- Current challenges related to nurse–technology interactions; and
- Ways in which nurse–technology interactions may be enhanced in the future.

The World Health Organization defines health technology as “the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of life.”<sup>1</sup> Health technology has also been described as a social construct, thus moving it beyond tangible devices and systems.<sup>2</sup> For the purposes of this article, we define health care technology as the information systems, medical devices, hardware, software, and telecommunications used in the provision of health care.

### HISTORICAL PERSPECTIVES

In the early and mid-20th century, “physicians thought of nurses much like stethoscopes and surgical instruments, as physical or bodily extensions of physicians.”<sup>3(p3)</sup> Nurses were not masters or developers of technology, but technology themselves; they were not taught to interpret data, only to report it. However, as new technology was introduced at an increasingly rapid rate in the second half of the 20th century and hospitalized patients became sicker, nurses, by necessity, were progressively more autonomous in their use of technology and analysis of data.<sup>2</sup>

Still, nurses’ unique and critical role in effective use of technology was underappreciated. Fairman and Lynaugh<sup>4</sup> provide the following description of the introduction of cardiac monitors to a general floor at Bethany Hospital in Kansas City, Kansas, in the 1960s, highlighting the pitfalls of an ill-prepared nursing workforce:

*[W]hen Dr. Day introduced cardiac monitors on the general floor, no one taught the nurses about arrhythmias or how to turn off the monitor alarms. Nurses, feeling left out of the process and unable to respond, began to call the physicians at all hours of the day and night when alarms sounded. Shortly thereafter the monitors were removed.*<sup>4(p75)</sup>

Even as nurses gained more ownership over the use of technology in hospitals, some nurses sought to distance the profession from technology, criticizing the mechanization of nursing and the disruption of the nurse–patient relationship.<sup>2,3,5</sup> Others saw nurses’ growing autonomy over technology as a legitimizing force, one that would bring with it respect for nursing as a profession independent from medicine.<sup>3</sup> Those who embraced technology and those who did not were typically divided between nurses in clinical practice and nurse theorists and educators. Sandelowski<sup>3(p132)</sup> summarizes the issue as “the true nurse, to the frontline nurse, was a doer; the true nurse, according to nurse educators, was a thinker.” Although nursing discourse has often held technology at arms length, addressing it with skepticism, nurses at the bedside—especially in ICUs—have had to form intimate relationships with the technologies they use.

### CURRENT CHALLENGES RELATED TO NURSE–TECHNOLOGY INTERACTIONS

Nursing’s awkward history with technology has created challenges in nurse–technology interactions today. Nursing students receive little formal education on health care technology, but in practice they are often responsible for managing incredibly complex technologies, with the potential to cause harm to the patient if used

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