

Nurses and Health Information Technology: Working With and Around Computers

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Information technology is nearly ubiquitous in health care settings. Nurses need basic computer skills and information literacy to effectively practice nursing. In addition, nurses must be prepared not only to work around complex health information technology, but also to communicate with individuals who can address the underlying problems.

As technology use expands in health care, as it has in virtually every aspect of our society, nurses are finding that, to practice nursing, they must use computers. Encouraged by incentives in the Health Information Technology for Economic and Clinical Health Act, as well as by anticipated improvements in patient outcomes and organizational efficiency, health care organizations are rapidly implementing health information technology (HIT), especially electronic health record (EHR) systems.

To work effectively with HIT, nurses must have basic computer skills, typically defined as the ability to use office software (eg, word processing and spreadsheet programs), communicate electronically (eg, via e-mail), and conduct Internet searches. A survey conducted by the National League for Nursing in 2006 demonstrated that 60% of the schools of nursing in their sample required their graduates to be computer literate [1]; therefore, most recently graduated nurses have basic computer skills. Nurses who feel that they lack basic computer literacy can learn these skills through an introductory class at a local community or technical college. Some public libraries and community groups also offer classes in basic computer skills.

In addition, nurses must have information literacy, defined as the ability to locate and gather pertinent, accurate, up-to-date information and to evaluate it for a particular need. Information literacy is essential for evidence-based practice. Nurses wishing to improve their information literacy may sharpen their skills through continuing-education offerings or classes offered by medical libraries. Additionally, some schools of nursing have created online tutorials to help students attain information literacy and have made the tutorials available to the public; tutorials offered by Rutgers University (http://www.libraries.rutgers.edu/rul/rr_gateway/research_guides/nursing/tutorial/) and New York University (available at: <http://library.nyu.edu/research/subjects/health/tutorial/>) are notable examples.

Basic computer skills and information literacy prepare nurses to effectively incorporate HIT into their practices, but they do not immunize nurses against problems created by technology. The introduction of new technology, from a new blood pressure monitor to a new EHR system, creates changes in work flow (hereafter referred to as "workflow," as preferred by the National Library of Medicine [available at: http://www.nlm.nih.gov/cgi/mesh/2011/MB_cgi?mode=&index=25524&view=expanded]), defined in this context as the processes one follows to complete a task and reach clinical goals. Although the hope associated with the introduction of HIT is for improved workflow and safety, that is not always the case. In fact, poor design or implementation of technology can create new risks, reduce anticipated safety benefits associated with the technology, and increase the likelihood of errors [2].

When technology makes a health care process slower or less efficient, or when it requires steps that are impossible or seem unnecessary, clinicians create work-arounds. Work-arounds are described as "informal temporary practices for handling exceptions to normal workflow" [3p1561], or, alternatively, as processes that are different from the anticipated, intended sequence of steps to achieve a specific goal. Work-arounds are beneficial in that a goal is achieved even when the anticipated process for achieving that goal cannot be completed. In health care, this may mean that a patient receives a needed medication or that an order is received and completed. Work-arounds are at times necessary to ensure that care is given.

However, work-arounds have negative impacts, as well. For example, when work-arounds are used to circumvent safety procedures, the unanticipated practices yielded by the work-around can increase the risk of harm. Moreover, a work-around masks the underlying problem that caused the worker to employ the work-around in the first place. Because the goal is met, employing a work-around and taking no further action to solve the underlying problem make it

Electronically published September 23, 2011.

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N C Med J. 2011;72(4):317-319. ©2011 by the North Carolina Institute of Medicine and The Duke Endowment. All rights reserved. 0029-2559/2011/72416

likely that the problem will continue to exist. In health care, this means that, by adapting their practices to work with HIT that imposes impediments to care processes, nurses inadvertently make it possible for problematic technology to remain in use.

The following fictional vignettes, based on commonly reported types of work-arounds, illustrate this phenomenon.

Vignette 1: Bar Code Medication Administration (BCMA) Work-around

Background. County Hospital uses a BCMA system. The BCMA system requires a nurse giving medications to use a handheld device to electronically scan a bar code affixed to the medication dose to be administered and a bar code on the wristband of the patient to whom the medication will be given. The BCMA system then compares the medication to the patient's active orders and returns an alert if it appears that any of the 5 "rights" of medication administration (ie, right drug, right dose, right route, right time, and right patient) are about to be violated. The BCMA is intended to increase safety and prevent medication errors.

Anna is a registered nurse preparing to administer an intravenous antibiotic at 3 AM on a busy inpatient medical unit at County Hospital. Anna checks the medication order in the electronic medication administration record, scans the bar code on the antibiotic, and scans the wristband affixed to the head of her patient's bed. The BCMA system returns no alerts, and she administers the antibiotic without disturbing her patient's sleep.

Analysis. Intended to improve safety and decrease medication administration errors, the introduction of BCMA has resulted in many types of work-arounds. Analysis of BCMA work-arounds is a topic of research interest, with the understanding that work-arounds signal a lack of congruence between the medication administration process and the BCMA system [4, 5].

In this vignette, the nurse used a work-around to satisfy the scanning requirements of the BCMA while also meeting the nursing goals of ensuring that the patient receives adequate sleep and administering ordered medications. Unfortunately, the work-around circumvented a safety procedure, increasing the risk of administering the medication to the wrong patient. Such work-arounds are created because bar codes on patient wristbands are often inaccessible or unreadable because of position, dressings, or damage [2]. BCMA work-arounds may also be related to problems with hardware (eg, multiple scanning attempts are needed to read the bar code), task (eg, the BCMA scanning procedure is slower or more cumbersome than other methods), organizational factors (eg, BCMA procedures are not compatible with workflow), and environmental factors (eg, the medication bar code is in a location inaccessible to the scanner, such as a refrigerator) [2].

Work-arounds are likely to appear when technology is introduced, if the related work processes are not well-under-

stood or are not reengineered to successfully incorporate the new technology [6]. Understanding the nature of and reasons for BCMA work-arounds is necessary to configure BCMA systems and processes for safe and efficient administration of medication.

Vignette 2: Hardware Inefficiency Work-around

Background. The nursing assistants on the adult inpatient unit at County Hospital use a portable meter to check patients' blood glucose levels. The meter stores each patient's identification and blood glucose reading. When not in use, the portable blood glucose meter may be placed in a centrally located docking unit, which uploads the stored blood glucose readings into the appropriate EHR for each patient, decreasing the risk of error from transferring blood glucose readings manually from the meter to the EHR. Once uploaded to the EHR, blood glucose results are accessible to all nurses and physicians caring for the patient.

Johanna, a nursing assistant, checks prelunch blood glucose levels for several patients. As the portable blood glucose meter records each patient's identification and blood glucose reading, Johanna writes each patient's name, room number, and blood glucose level on a clipboard she carries with her. After she has completed the blood glucose checks, she gives the clipboard to Jon, a registered nurse who will assess the readings she has recorded and complete any necessary follow-up. At the end of her shift, Johanna returns the blood glucose meter to its docking unit. All readings stored in the meter are quickly uploaded to the appropriate EHR for each patient.

Analysis. Inaccessible or inconveniently located hardware is a common cause of work-arounds. In this vignette, the nurses and nursing assistants found returning the portable blood glucose meter to its docking unit to be problematic and developed a work-around. The solution described—duplicate documentation on paper—solved the immediate problem but created the risk of introducing errors in the manual transcription of blood glucose readings from meter to paper.

Researchers have observed that work-arounds may increase overall workload [7], as in this vignette. Documenting blood glucose levels on paper and ensuring that the paper documentation is given to the correct nurse would be unnecessary if the system worked as envisioned. The work-around also increases the work of nurses and physicians, who must search for the most recent blood glucose reading, which may not be in the EHR.

Work-arounds similar to this one may occur when technology does not fit well with workflow. Replacing the meter in the docking unit requires extra steps and time. The docking unit might be in a seldom frequented location, thereby limiting its accessibility, whereas the registered nurse to whom the clipboard is given is readily accessible. In addition, because hospitals are busy and nursing work is often unpredictable, portable units are easily set down and forgotten,

rather than placed in docking or charging units. Attempts to place docking units in locations that facilitate accessibility may be helpful, but wireless communication between the meter and the EHR system may be a superior solution for the problem presented in this vignette, making information more immediately available in the EHR to all clinicians.

Other work-arounds related to hardware problems include those related to mobile workstations that are too heavy, bulky, or unwieldy to take into patient rooms; battery failures on mobile units; insufficient numbers of workstations; and workstations placed in inconvenient locations [2, 6]. Understanding workflow, workers, and how workers interact with technology is necessary for successful selection and deployment of the best hardware solutions for health care.

Discussion

Nurses are skilled at creating work-arounds. Trained to be creative and to adapt to unique situations, nurses readily make adjustments in their plans and processes, using available resources to achieve an immediate goal. In addition, high workloads and time demands in health care lead to the use of work-arounds, because nurses feel pressured to “get the work done” however they can [6p5]. In fact, certain characteristics that are valued of and by nurses—individual vigilance, efficiency, and empowerment to solve problems—encourage the use of work-arounds [8].

Work-arounds are not errors. In an error, a planned sequence of steps does not lead to the intended goal; in a work-around, the outcome generally is achieved, but by using a process different from the one that was intended. Although safety concerns are raised by work-arounds, in some instances the work-around may actually be a safer and more efficient process [6]. However, by its very nature, a work-around is a process designed to circumvent, rather than correct, an underlying problem. Work-arounds enable clinicians to give patients needed care, but they do not address the root problem; therefore, the same problem in workflow occurs again.

Working around a problem to solve the immediate concern is referred to as first-order problem solving [8]. On the surface, first-order problem solving appears successful, because the goal was achieved. However, it can be counter-productive, because the problem is not used as an opportunity for change or learning.

In addition, second-order problem solving, which addresses the cause of the work-around, is needed. Second-order problem solving may include communicating about the problem to people who can address its cause, sharing ideas about what caused the problem, suggesting alternatives, and experimenting with solutions to the problem. The goal of second-order problem solving is lasting change and improvement [8].

To accomplish second-order problem solving, nurses must communicate about the problems they encounter with HIT that cause work-arounds. Administrators must be avail-

able to talk about process problems; to seek out and value information about problems, rather than to value individual first-order problem solving; to foster an atmosphere that encourages discussion of problems, rather than punishment or ridicule; and to provide clear follow-through when problems are reported, because overworked nurses will take the time to report problems only if they believe there will be some resolution [2, 6, 8].

In summary, to work effectively with HIT, nurses must have basic computer skills and information literacy. In addition, nurses must be prepared to effectively address problems encountered in processes that use HIT. Work-arounds are manifestations of nurses’ creativity, resilience, and ability to solve problems to achieve important goals. They also provide powerful insights about the ways that nurses work with HIT, how HIT functions, and problems that HIT and associated processes introduce. Nurses and organizations must now move beyond working around problems with HIT to communicate about and address the underlying problems that necessitate work-arounds. Doing so will facilitate the development and deployment of HIT that enhances nursing practice and improves patient outcomes. NCMJ

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Acknowledgment

Potential conflicts of interest. J.P. has no relevant conflicts of interest.

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