

The Benefits of Ergonomic Mobile Technology Carts in Healthcare Settings

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The Challenges of Integrating Information Technology into Healthcare Settings

Healthcare administrators, insurance companies and patients alike are concerned with spiraling healthcare costs in every setting, from large academic medical centers to community-based acute care and outpatient facilities. Each group has a vested interest in reducing costs while increasing access to valuable patient services. Integrating information technology (IT) into healthcare is one way to streamline work and reduce expenses, and the American Recovery and Reinvestment Act has budgeted \$20 billion for investments in the infrastructure and systems that support healthcare information technology (HIT) and electronic health records (EHRs).

While HIT can provide many benefits, the rapid changes—from managing patient data with paper to creating EHRs—pose several challenges for healthcare professionals and institutions. Healthcare institutions and administrators are rushing to meet deadlines for adopting EHRs in order to comply with Meaningful Use standards, which require institutions to use EHRs to achieve

benchmarks leading to improved patient care if they want to receive federal incentive payments.

And, healthcare workers, who have not traditionally used computers on the job, are challenged to learn to use new HIT systems and integrate computers and data into their daily workflow while continuing to maintain a high level of patient care. An added challenge is that caregivers, who have a musculoskeletal disorder (MSD) rate seven times the national average for all occupations,¹ are now in jeopardy of developing MSDs associated with repeated computer use. In fact, some studies have shown up to a 40% increase in musculoskeletal discomfort following adoption of electronic medical records.¹¹

However, using HIT in the process of collecting patient clinical data, updating daily charts or dispensing medication can only become a routine part of patient-caregiver interactions, and help administrators fulfill Meaningful Use criteria, when computers are seamlessly integrated into the workflows of healthcare professionals. Various mobile computer devices can facilitate the rapid integration of HIT, but mobile technology carts (also known as workstations-on-wheels or computers-on-wheels) are the preferred IT solution in many point-of-care settings.

The Role of Mobile Technology Carts in Healthcare Settings

Even before the introduction of HIT and EHRs, caregivers' work could be characterized as mobile and collaborative; they also require instant access to information. Studies in both small and large hospitals found that, when compared with a stationary PC and a tablet PC, many healthcare professionals expressed a decided preference for mobile technology carts for several reasons. ⁱⁱⁱ

- The ability to move IT from room to room complements caregivers' highly mobile workflow. Mobile carts allow a single computer to be used in many places in a hospital, thus saving space, especially in older buildings whose infrastructure does not easily accommodate costly retrofit technology solutions. ^{iv}
- Mobile technology carts support the collaborative nature of healthcare work because they integrate HIT at the point of care.^v The carts allow caregivers to enter data in real time, in a patient's room, thus saving time and reducing caregivers' need to remember detailed information before transcribing their notes later at a permanently installed workstation. Entering and retrieving electronic patient data *in situ* also improves patient safety because it eliminates the difficulty of deciphering handwriting. ^{vi}
- Mobile technology carts facilitate instant access to patient information, becoming one point of the "triangle of care." Positioning computer screens so that caregivers maintain eye contact with patients supports sharing data on workstation screens and involves patients in their own care. ^{vii}

Mobile technology carts complement caregivers work styles and allow them to spend more time caring for patients and less time worrying about technology. ^{viii} As HIT is more tightly integrated into every aspect of healthcare, then these mobile technology carts need to reflect good ergonomic design in order to reduce the risk of repetitive stress injuries.

Characteristics of Good Ergonomic Design in Mobile Technology Carts

Not all mobile technology carts are designed with proper ergonomic principles, and not all carts that are marketed as being "ergonomic" actually are. Caregivers have reported that poorly

designed mobile technology carts increase their discomfort and impede patient care. Bad design elements include a cart frame with sharp edges, a wheel design that yields ineffective performance and impedes navigation, the lack of a battery power indicator and the inability to automatically adjust the cart's height.

A mobile technology cart that is designed with ergonomics as a priority should be height adjustable and should have a solid frame for stability. It should have a sturdy handle, and for ease of movement, it should not drag or require extra effort to push. The cart should have a clearly visible battery indicator, a work surface with few gaps to facilitate thorough cleaning and round edges that do not present caregivers and patients with cold surfaces and sharp edges.

Some mobile technology carts feature front wheels that do not change direction. Combined with the carts' weight, four standard wheels produce significant drag. Conversely, on some carts all of the wheels change direction simultaneously. Both designs require significant effort to move the cart. Designs that feature a fifth wheel, which reduces drag and improves maneuverability, minimize caregivers' effort during cart transport, especially in small rooms where precise movements are essential.

When cart batteries run low in the middle of caregivers' shifts, their work can be interrupted suddenly; not having reliable access to the cart is disruptive to patient care. To fully support healthcare professionals throughout their shifts in clinical settings, a mobile technology cart should have a clearly visible battery level indicator supplemented with an audible alarm.

Caregivers are at an increased risk for injury from using IT that is not positioned for good, ergonomic health. In fact, poor workstation design that requires repetitive, awkward postures has been identified as a major risk factor for MSDs.^{ix} Ideally, the height of an ergonomic mobile technology cart should be automatically adjustable, requiring only one step, which saves caregivers' time and energy. However, manually adjustable carts can also be ergonomic if they require limited effort to adjust. In both instances, the most important factor is that the carts be height adjustable based on anthropometric data that indicates the correct elbow and eye height, which enables a neutral typing and viewing position. Combined with a negative-tilt keyboard tray—which encourages a neutral wrist posture—this allows caregivers to sit, stand and type in a healthy ergonomic position that reduces their risks of MSDs. The best carts are designed

so that screen and keyboard components are already in a good ergonomic position, so that with one-step height adjustment, caregivers can automatically work in an optimal ergonomic position with minimal effort.

The Added Value of Mobile Technology Carts in Healthcare Settings

Several factors are contributing to increased investments in healthcare information technology and the use of electronic health records in a variety of clinical settings: the need to streamline healthcare practices, reduce healthcare expenses and comply with Meaningful Use standards. One indication that HIT is already an integral component in healthcare settings is that a majority of nurses report using an electronic medical record (EMR) system at least 50% of their shift.^{IV}

In many point of care settings caregivers prefer mobile technology carts to other types of mobile computer devices, so to best support healthcare professionals, who are already at risk for musculoskeletal disorders, mobile technology carts should reflect good ergonomic design by incorporating: one-step automatic height adjustment, a fifth wheel, a work surface with few gaps and a negative-tilt keyboard tray. Ergonomic mobile technology carts not only provide instant access to electronic healthcare records and reduce the risk of workplace injuries but also add value to patient-caregiver interactions, making them a healthcare investment that benefits everyone.

^I Bureau of Labor Statistics, 2010

^{II} K. Nielsen and A. Trinkoff, "Applying Ergonomics to Nurse Computer Workstations: Review and Recommendations," *Computers Informatics Nursing*, 21, no. 3 (2003): 150-157.

^{III} Pia Andersen, Anne-Mette Lindgaard, Mirela Prgomet, Nerida Creswick, and Johanna Westbrook, "Mobile and Fixed Computer Use by Doctors and Nurses on Hospital Wards: Multi-method Study on the Relationships Between Clinician Role, Clinical Task, and Device Choice," *Journal of Medical Internet Research*, 11, no. 3 (2009), doi:10.2196/jmir.1221.

^{IV} Susan Kossman and Sandra Scheidenhelm, "Nurses' Perceptions of the Impact of Electronic Health Records on Work and Patient Outcomes," *CIN: Computers, Informatics, Nursing*, 26, no. 2 (2008): 69-77.

^V Alan Hedge, Tamara James, and Sonja Pavlovic-Veselinovic, "Ergonomics Concerns and the Impact of Healthcare Information Technology," *International Journal of Industrial Ergonomics*, 41 (2011): 345-351, doi:10.1016/j.ergon.2011.02.002.

^{VI} A. Shachak, M. Hadas-Dayagi, A. Ziv and S. Reis, "Primary Care Physicians' Use of an Electronic Medical Record System: A Cognitive Task Analysis," *Journal of General Internal Medicine*, 24, no. 3, (2009): 341-348.

^{VII} J. R. Almquist, C. Kelly, J. Bromberg, S. C. Bryant, T. J. H. Christianson and V. M. Montori, "Consultation Room Design and the Clinical Encounter: The Space and Interaction Randomized Trial," *Health Environments Research and Design Journal*, 3, no. 1, (2009): 41-78.

^{VIII} Deborah Whittemore and Jodi Moll, "COWs and WOWsy Oh My!" *Health Management Technology*, 29, no. 7 (2008): 32-34.