Electronic health record system increases clinicians' cognitive workload, study finds

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A study at two urgent care clinics found that adopting a new electronic health records system doubled the amount of cognitive effort health care workers expended to perform their work during the first six months after implementation.

The increase in cognitive workload also persisted for at least 30 months, the researchers found. The team reported its findings in a study published in the journal *Applied Ergonomics*.

In a collaborative study with Carle Health Systems in Urbana, Illinois, researchers examined how the urgent care clinics' transition to the new EHR system affected staff members' workloads as well as their perceptions of the old and new systems' usability.

"What we found surprised us a little," said the study's first author, Karen Dunn Lopez, the director of the Center for Nursing Classification and Clinical Effectiveness at the University of Iowa. "After two and a half years of continuous use, clinicians' cognitive workload remained very high, and they still found the new EHR system more difficult to use than the prior paper- and computer-based hybrid system."

With the hybrid system, clinicians used paper forms for tasks such as prescribing, writing clinical notes and medical orders. Seldom used while delivering patient care, the computer system then was primarily a repository for doctors' notes after they were dictated and transcribed, and for documents that were scanned and uploaded after seeing the patients, said co-author Daniel G. Morrow, an educational psychology professor at the University of Illinois Urbana-Champaign.

While the hybrid system evolved with the collaboration of Carle's information technology staff and clinicians, an external vendor developed the new EHR system.

"Any time you change technology, you tend to change the whole work system to some extent. It's important to take a user-centered approach to designing these systems and have users' perspectives in mind so you can forecast how their work processes will change," said Morrow, who holds an appointment at the Beckman Institute for Advanced Science and

Technology.

Under the federal Health Information Technology for Economic and Clinical Health Act, health care providers in the U.S. were offered financial incentives to adopt EHR systems with certain features that constituted "meaningful use." The 2010 law was part of an initiative to modernize health care delivery nationwide, improve quality and make data more accessible.

However, this changeover was fraught with complaints that the new systems' complex interfaces turned routine tasks into protracted multi-step processes, decreasing efficiency and forcing clinicians to devote "pajama time"—their off-duty hours—to entering data from patient visits, Dunn Lopez said.

She began working on the project during graduate school at the University of Illinois Chicago, where Morrow was teaching a course at the time. The team collected the data used in the study from 2011-14.

Study participants rated their perceived workloads under the old and new EHR systems using the NASA-TLX survey. The survey asks respondents to rate work tasks on a 0-100 scale based on their mental, physical and temporal demands, as well as the levels of effort and frustration involved and workers' perceptions of their own performance.

Clinical staff completed the surveys prior to the new EHR system's implementation and again at six to eight months and 30-32 months post-implementation. The clinicians included 22 members of the nursing staff, such as registered nurses and medical assistants, and 11 members of the provider staff, such as physicians, physician assistants and advanced practice nurses.

The researchers also observed the participants performing tasks with the

new EHR interface, reviewed the system's pages and compared its design to standard usability guidelines.

Although the providers' and nurses' scores were similar on the pre-implementation surveys, there were marked differences after using the new system for six months.

Compared with the nurses, the providers reported greater increases in cognitive workload, including higher mental and temporal demands and levels of frustration.

Part of the increased workload occurred because, under the meaningful use standards, some tasks previously performed by the nursing staff shifted to the provider staff, said co-author Kayla Banks, Carle Health Systems' vice president of women's health and children's services.

However, since the provider staff's scores increased on all the survey's subscales except that for physical activity, the researchers said the data suggested that some of the increased cognitive workload resulted from their performing tasks with the new EHR system while they were with patients rather than afterward.

Additionally, Morrow said "minor design flaws such as slow response times when clinicians clicked on buttons and nonstandard labeling of tools negatively impacted their perceptions of the system's usability and caused mounting frustration during their workdays."

The negative usability ratings were trending downward at 30 months' post-implementation, however, and might have declined to the pre-implementation levels if the study had continued several months longer, he said.

Although usability may improve over time, health care organizations

"can't say 'mission accomplished' and withdraw support quickly after adopting new EHR systems," said Banks, an adjunct instructor in nursing with the Carle Illinois College of Medicine. "There's an ongoing need to modify workflows to accommodate increased workloads and look for iterative improvements. Nurses especially may be less likely to report that systems are not user-friendly or if their cognitive workload is significantly worsened."

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