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Use of Human Factors and Ergonomics to Disseminate Health Care Quality Improvement Programs

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Human factors and ergonomics (HFE) is recognized as a key systems engineering approach to improve health care quality and safety.¹ HFE is a scientific discipline that studies the interactions among people and other elements of a system and applies theory, principles, data, and methods to design in order to optimize the well-being of people and the overall system performance.² An HFE approach to health care quality and safety emphasizes the deployment of HFE tools, knowledge, and professionals and the participation of local stakeholders in the design or redesign of health care work systems and processes to improve patient, employee, and organizational outcomes.³

In the past 2 decades, an increasing number of studies have applied HFE to address health care issues such as delivery of radiation therapy, computerized medication ordering, and prevention of health care-associated infections.³ These studies demonstrated that deploying HFE in the design and implementation of interventions can improve the quality and safety of care and the well-being of health care professionals. Yet, most initiatives have focused on individual health care settings, with limited application of HFE when disseminating quality improvement programs across a broad range of health care settings.

Different health care settings have distinct organizational culture, leadership, resources, and other contextual features that pose substantial challenges when disseminating quality improvement programs across settings.⁴ Before a program is disseminated, it is critical to examine the local work systems and processes, adapt the intervention and its implementation, and acquire buy-in from local stakeholders. This is a complex process, which an HFE approach can help facilitate. For example, to disseminate a quality improvement program that optimized blood culture use in critically ill children, Xie et al⁵ conducted a work system assessment to proactively identify and mitigate work system

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factors influencing blood culture ordering practices. On the basis of the findings of the work system assessment, a participatory ergonomics approach was used to engage local stakeholders in the adaptation of the interventions (eg, revising the content and format of a blood culture decision support tool) and the customization of the implementation strategies (eg, providing biweekly feedback on blood culture use to team members; discussing new blood culture practices during monthly staff meetings; integrating new blood culture practices in new resident orientation; and holding a “blood culture competition” among team members). This HFE approach led to successful adoption of the blood culture program by 3 pediatric intensive care units at 2 hospitals, resulting in a significant reduction in blood culture use.⁶

Yet, it is neither a straightforward nor spontaneous process to apply HFE when disseminating quality improvement programs. Especially for large-scale dissemination, it usually requires a considerable investment of time and resources, which may not be accessible in all health care settings. Therefore, innovative strategies are needed to facilitate the application of HFE when disseminating quality improvement programs. In this article, we discuss the following 3 strategies: (1) develop an HFE tool kit for dissemination, (2) recruit HFE professionals to health care organizations, and (3) train health care professionals in HFE.⁷

DEVELOP AN HFE TOOL KIT FOR DISSEMINATION

To disseminate a quality improvement program, it is critical to provide both content of the program and a practical guide describing how to adapt the program to local context. The guide could be a tool kit and include the overarching principles guiding the adaptation of the program, the adaptation process with a series of chronologically and logically organized activities, and tools to use at different stages of the adaptation process (Table).

Current HFE principles and tools that are used for single-site or small-scale quality improvement projects may not be applicable to large-scale dissemination programs. For example, direct observations and interviews are thorough and manageable assessment tools in single-site or small-scale quality improvement projects. In large-scale dissemination programs, however, it will likely be infeasible and perhaps unnecessary to conduct observations and interviews at each participating site. One alternative is to develop a survey-based work system assessment tool and administer it remotely at each site.

In addition, novel HFE principles and tools could be devised specifically for large-scale dissemination. For example, innovative techniques for leveraging cross-site collaboration and learning are needed to encourage sharing of implementation strategies among sites in large-scale dissemination programs.

RECRUIT HFE PROFESSIONALS TO HEALTH CARE ORGANIZATIONS

To effectively apply the HFE tool kit, health care organizations could recruit HFE professionals and these professionals could convene multidisciplinary quality improvement teams to conduct local initiatives. The on-site HFE professionals need not only broad and diverse knowledge about HFE but also extensive experience in health care settings and

strong interpersonal and learning skills. They can play various roles in multidisciplinary quality improvement teams, and their roles may change over time based on the needs and dynamics of various teams. For example, as an HFE application progresses from external to internal regulation, the role of the HFE professional may change from a leader and facilitator to a consultant and advisor.

TRAIN HEALTH CARE PROFESSIONALS IN HFE

Health care organizations could also invest in HFE training for their employees. Such training could remove potential gaps between the core values of health care and HFE. For example, while health care focuses on the performance of staff, HFE considers the entire system in which health care professionals work. Health care professionals trained in HFE would be able to recognize these potential gaps and be better prepared to find a common path forward, which is critical to the integration of HFE in a health care organization and the long-term success of quality improvement efforts.

Health care organizations could start by offering training on the general principles of HFE and then training on applying these principles in health care. In addition, health care professionals could gain knowledge and experience through continuous collaboration with HFE professionals. To build capacity within health care organizations, a small group of patient safety officers, quality improvement staff, or other employees could be trained in HFE. Then, this group could lead local quality improvement efforts and spread their HFE knowledge to other staff members and eventually this train-the-trainer model will spread HFE knowledge throughout the organization.

In summary, we believe HFE can play an important role in the dissemination of quality improvement programs across diverse health care settings. To achieve this, health care organizations need to build capacity by leveraging HFE expertise and developing tools that guide local adaptation of interventions developed for large-scale quality initiatives. Additional studies are needed to evaluate the effectiveness of HFE in facilitating the dissemination of quality improvement programs and to determine optimal strategies for integrating HFE when disseminating quality improvement programs.

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Table.**Examples of HFE Tool Kit for Dissemination**

HFE Principles Guiding Program Adaptation	
<ul style="list-style-type: none"> ● HFE design principles (eg, usability, shared mental model, systems approach) ● HFE implementation principles (eg, top management commitment, stakeholder participation, communication and feedback, learning and training, project management) 	
Adaptation Process	HFE Tools
<ul style="list-style-type: none"> ● Initial work system assessment 	<ul style="list-style-type: none"> ● Observations, interviews, and surveys ● Cognitive task analysis ● Workflow analysis
<ul style="list-style-type: none"> ● Intervention adaptation and implementation 	<ul style="list-style-type: none"> ● Participatory ergonomics ● Proactive risk assessment
<ul style="list-style-type: none"> ● Intervention evaluation 	<ul style="list-style-type: none"> ● Observations, interviews, and surveys ● User testing

Abbreviation: HFE, human factors and ergonomics.