Human factors and ergonomics-based work system assessment to facilitate quality improvement dissemination

Anping Xie, PhD,[1, 2] Danielle W. Koontz, MAA,[3] Annie Voskertchian, MPH,[3] James C. Fackler, MD,[2] Aaron M. Milstone, MD, MHS,[1, 3, 4] and Charlotte Z. Woods-Hill, MD[5]

[1]Armstrong Institute for Patient Safety and Quality, Johns Hopkins University, USA; [2]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, USA; [3]Department of Pediatrics, Division of Infectious Diseases, Johns Hopkins University School of Medicine, USA; [4]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, USA; [5]Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia, USA

THE WORK IN CONTEXT

Successful dissemination of quality improvement (QI) programs requires a proactive work system assessment (WSA). We applied a human factors and ergonomics (human factors) approach to facilitate WSA in the dissemination of a QI program for optimising blood culture use in pediatric intensive care units. Initially, we conducted an interview-based WSA to disseminate the program to two hospitals. Semi-structured face-to-face interviews guided by the Systems Engineering Initiative for Patient Safety 2.0 model were conducted with 32 clinicians to identify work system factors influencing blood culture ordering practices. The interview results were shared with the local QI teams to adapt interventions and customise implementation strategies. Following the small-scale dissemination, we further disseminated the program to a collaborative consisting of 15 hospitals. Given the number and geographic span of these hospitals, we could not conduct in-person interviews at each hospital. With limited capabilities and resources, the local QI teams could also not easily conduct their own WSA. Therefore, we devised a WSA survey based on findings from the interviews and administered it to 347 clinicians from the 15 hospitals. The survey results were summarised, shared, and discussed with individual hospitals to inform program adaptation and implementation. In addition, physician champions leading local QI teams assessed the use of the WSA survey. Both the WSA survey data and the evaluation of the WSA survey showed that the survey-based WSA tool could help participating hospitals understand their current blood culture ordering practices and identify potential barriers to implementing the program. This study highlighted the importance and challenges of doing a WSA in QI dissemination and demonstrated how a human factors based WSA could be effectively and efficiently performed in small and large scale dissemination. Future research is needed to expand the application of human factors based WSAs and develop additional tools to address other challenges of QI dissemination.

KEYWORDS

Quality improvement, work system assessment, dissemination

A brief outline of the work carried out

While great efforts have been made to improve healthcare quality and safety,[1-3] the dissemination of successful quality improvement (QI) programs to a broad range of healthcare settings is neither straightforward nor spontaneous.[4] Every healthcare setting has its unique contextual features (for

example staff, workflow and culture). A proactive assessment of local work systems and processes is essential to inform the adaptation of interventions and the customisation of implementation strategies. A human factors and ergonomics (human factors) approach is proposed to guide local work system assessment (WSA) and the dissemination of QI programs.[5]

In 2014, we initiated a QI program at Johns Hopkins Hospital (JHH) to improve blood culture use in the pediatric intensive care unit. A paper-based clinical decision support tool was developed to guide clinicians to consider possible sources of infection (for example surgical site infection), evaluate non-infectious sources of fever (for example opioid withdrawal), and review risk factors of patients for bloodstream infections (for example a compromised immune system). The implementation of the program resulted in a reduction in the total number of blood cultures collected by 46% and in the percentage of blood cultures collected from central venous catheters from 73% to 40%.[9]

Given its success at JHH, we decided to scale-up the program and assess its broader impact on blood culture use, antibiotic use, and patient outcomes. The dissemination process included two phases: phase one: small-scale dissemination to two hospitals and phase two: large-scale dissemination to a fifteen-hospital collaborative. Using a human factors approach, we adapted and conducted a WSA at each phase to facilitate program dissemination.

Findings/solutions (the outcome)

Phase one

To facilitate the small-scale dissemination of the program, we conducted an interview-based WSA. Specifically, we spent two days each at the two hospitals and interviewed a total of 32 clinicians (comprising, fifteen attending physicians, two fellow physicians, one physician assistant, two nurse practitioners, eight nurses and four nurse managers). During the interviews, a semi-structured interview guide based on the SEIPS (Systems Engineering Initiative for Patient Safety) 2.0 model was used to elicit information about current blood culture ordering practices and potential challenges to the implementation of the program. The interview data showed that blood culture ordering practices could be influenced by various work system factors, including people (for example patient condition, clinician characteristics), tasks (for example tasks of individual clinicians, team tasks), physical environment (for example unit layout), tools and technology (for example telecommunication tools, electronic health records), organisational conditions (for example communication, organisational hierarchy, organisational culture, shift rotation, patient and family education), and external environment (for example scientific evidence, guidelines by professional societies).[6] These findings were shared with the QI team at each hospital to adapt interventions and inform implementation strategies. Following this approach, the two hospitals achieved a 21-37% reduction in blood culture use.[10]

Phase two

Based on our experience with the small-scale dissemination, an initial WSA was critical to the dissemination of the program. However, given the number and geographic span of the hospitals participating in the large-scale dissemination, we could not visit each hospital and conduct in-person interviews with local clinicians. With limited capabilities and resources, the QI team at each hospital could also not easily conduct their own WSA. Therefore, we adapted the interview-based WSA to a survey-based WSA. A WSA survey was devised based on findings from the interview-based WSA and administered to all fifteen hospitals. A total of 347 clinicians completed the WSA survey. In addition, physician champions at twelve of the fifteen hospitals evaluated the use of the WSA survey. Both the data collected by the WSA survey and the results of the evaluation of the WSA survey showed that the survey-based WSA tool could help participating hospitals understand

their current blood culture ordering practices and identify potential barriers to implementing the program from the perspectives of different clinicians. The survey-based WSA tool was suggested to be used to facilitate future large-scale dissemination efforts.

Impact

Broad and rapid dissemination of QI programs is critical but challenging. While existing frameworks focus on the principles and processes of dissemination,[12-14] limited practical tools are available to be used at different steps of the dissemination process. In this study, we highlighted the importance and challenges of doing a WSA in QI dissemination and demonstrated how a human factors based WSA could be effectively and efficiently performed in small and large scale dissemination using different tools (for example an interview-based tool, a survey-based tool). Future research is needed to expand the application of the human factors based WSA and develop additional tools to address other challenges of QI dissemination.