Minimizing Resource Inputs for Site-Specific Usability Testing

Robert P. Pierce, MD MSPH1; Bernie Eskridge, MD1; LeAnn Rehard, RN, BSN RN-BC1; Brandi Ross, MS-DSA2; Margaret A. Day, MD MSPH1; Jeffery L. Belden, MD1,2
1University of Missouri Health Care, Columbia, MO; 2Tiger Institute, Cerner Corporation, Columbia, MO

Introduction
Poor EHR usability increases user dissatisfaction and risks to patient safety. Typical EHR implementations allow for considerable variation in configuration and usability with no usability test requirements or site-specific implementation guidelines. Jakob Nielsen proposed that usability testing requires only five participants while the Office of the National Coordinator (ONC) set a minimum of 10 test participants for vendor usability testing. We performed a pilot summative usability testing project at University of Missouri Health Care (MUHC) and Tiger Institute with two aims: (1) improving the specific EHR features under test and (2) investigating the minimum inputs and participants needed to support usability testing as part of the regular development and implementation cycle.

Methods
Annual risk assessments are part of routine patient intake in MUHC ambulatory settings. Usability defects were identified in the existing user interface (UI) by heuristic analysis. The UI was redesigned using a collaborative, multidisciplinary, iterative process, in particular to reduce duplicate data entry and to assist the user in accurate identification of overdue screens. Tasks using the existing UI and the redesigned UI were configured, and formal summative usability testing was performed with 12 nurses and medical assistants. Participant audio and screen actions were recorded using Morae® software. The primary outcomes of interest were SUS scores, total errors, and time on task for tasks related to identification of overdue assessments. To determine the number of participants needed for effective usability testing, we compared the results for 10 randomly selected subsets of 3, 5, 7, and 9 participants to the results for all 12 participants.

Results
The 12 participants using the redesigned UI had reduced error rate of 0.10 vs 0.83 errors/task (difference in means -0.73 errors, SD 0.78, 95% CI [-0.50, -0.98,] P<.0001), higher SUS (96.9 vs 80.8, difference in means 16.0, SD 20.8, 95% CI [3.0, 29.1], p=.02) and reduced task time (8.3s vs 6.0s, difference in means 2.3s, SD 4.8s, 95% CI [1.0, 3.6], p<.001). No significant usability problems were found with the redesigned UI. The 40 randomly selected subsets of 3, 5, 7, and 9 participants had differences in means in the same direction as the larger sample in every instance for all three primary outcomes. The difference in means for these subsets was outside of the 95% CI for the entire sample in 13%, 7%, 3%, and 0% of the 3, 5, 7, and 9 participant subsets respectively. The number of comparisons that remained statistically significant dropped, but even among the subsets of 5 participants, all of the comparisons of error rate and half of the comparisons of task time remained statistically significant in favor of the redesigned UI.

Conclusion
Summative usability testing using 3-9 participants yields valuable findings of identical direction and similar magnitude to those of a larger sample, with potentially lower testing resource requirements. Expansion of usability testing to site-specific implementations is warranted. Following ONC guidelines for vendors for numbers of usability test participants may increase barriers to incorporating a site-specific usability test program into the product development and implementation cycle.

References