Applying User-Centered Design Methods with Usability Testing to the Iterative Improvement of Conversational, On-Demand Mobile Clinical Decision Support System for Perioperative Management

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Introduction
Clinical practice guidelines (CPG) are a constructive response to the clinical situations providing systematically developed statements that include recommendations intended to optimize patient care. A considerable body of research has focused on effectively representing CPG with clinical decision support (CDS) system. As a usability testing of CDS is essential to assess physician users’ satisfaction, the effect of CDS deployment on physician burnout, and care outcomes, content validation is also important to increase the value of CDS tools. Usability study of CDS is getting more important to decrease resistance from physicians and make the adoption cycles frictionless. This article highlights the Think Aloud usability testing in order to expose all significant usability deficiencies of the preop-app in terms of user interface and the medical contents for cycles of iterative improvement.

Method
The mobile application, preop-app, was built by two Internal Medicine specialists to better deliver curated clinical content from perioperative cardiac risk assessment CPG to the physician users. The tool contains a series of algorithmic clinical questions, and the physician users simply answer the questions by clicking one of the provided answers. After the creation of the app, a qualitative observational study was conducted at the Englewood Hospital, a regional hospital in New Jersey. The Think Aloud testing was completed with 12 Internal Medicine residents. The participants were divided into three groups containing 6, 3, 3 individuals respectively. The tool was updated iteratively after conducting usability testing with each group. After individual usability session, the participant’s comments were reviewed for thematic analysis in order to update the app. The Think Aloud usability testing was completed with successive participants until saturation was demonstrated.

Results and Discussion
Participants were all medical doctors. Our sample was 58% female with ten third-year residents, one second-year resident, and one first-year resident. All residents have evaluated pre-operative cardiac risk for patients in a resident clinic.

The participants’ feedback included the following themes: (1) user interface (UI), (2) clinical content, and (3) overall impression of the app. In further deciphering the comments, we identified the user experience as UI discoverability, UI comprehensiveness, unexpected behavior, content presentation, terminology, content availability, content validity, and practical benefit.

The overall users’ experience was promising, and Average Systemic Usability Scale (SUS) was 86.7 during “Think Aloud” testing. SUS scores range from 0 to 100, with 100 being a perfect score, and 68 is considered average. This raw score would correspond to above 95th percentile rank for the Think Aloud testing.

Conclusion
Think Aloud usability study allowed us to successfully capture user experience and usability deficits for iterative versioning of the mobile CDS for perioperative management. The overall physician users’ satisfaction was promising, and a future efficacy testing of the app may help evaluate the novel CDS system further.