Usability Testing of an Interactive Surgical Dashboard
in a Large Congenital Heart Disease Center

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Abstract

Large sets of clinical data present an enormous opportunity to support clinical decision making and to improve care quality, but cannot be fully utilized without interactive data visualization and dashboards. In this study, we conducted a formal usability testing to validate the design of a new interactive surgical outcomes dashboard to demonstrate its effectiveness and to seek opportunities for improvement.

Introduction

Our research team had the opportunity to work with the Heart Institute at Cincinnati Children's Hospital Medical Center to conduct evaluation studies on visual dashboards. Evaluating usability is a highly necessary task for any tool designed for interactive data visualization of large sets of clinical data[1,2]. An interactive, visual-based dashboard was recently designed to replace the existing dashboard, which was dated, static, and table-based. This new dashboard aims to provide an effective self-service tool for cardiologists, surgeons, and other clinicians at the Heart Institute to explore their surgical outcomes data in near real time. Because this data is used to make clinical decisions, it is imperative to conduct rigorous evaluations to investigate the usability of the dashboard prior to its official use. The purpose of this study is to conduct formal usability testing to validate the design of this dashboard.

Methods

This study was conducted at the Heart Institute of Cincinnati Children's Hospital Medical Center. The participants included Pediatric Cardiologists, Surgeons, Perfusionists, and Physician Assistants. All of them were invited to a 30-minute semi-structured interview. The user recruitment used convenience sampling through the professional network of the authors. Figure 1 shows the flow of the usability testing. After completing the tasks using each dashboard, a survey was administered to collect the participant's feedback. This structured survey was revised from the Systems Usability Scale (SUS), which contains 10 standard and validated questions assessing systems usability in a 5 point Likert scale. Following the scoring guideline of SUS, a final score above 68 was considered "above average" in the system usability. The difference of the score means was examined using pairwise t-test.

Results

A total of 12 clinicians were recruited. Table 1 lists the average SUS score of each participant. The new interactive dashboard had an average score of 82.9, which is considered above average. On the other hand, the old, static dashboard had an average score of 63.5, which is considered below average. The two-tailed pairwise t-test indicates that these two sets of scores were significantly different ($p=0.006$).

Conclusion

We conducted usability testing on a recently designed, interactive surgical dashboard and its existing static counterpart. The interactive dashboard had a significantly higher SUS score. We will continue to analyze the data collected in the usability testing (e.g. audio recording and observation notes) to identify specific usability issues and room for improvement. In particular, we will focus on developing an educational plan to facilitate the smooth transition to the new dashboard.

References

1.   Caban JJ, Gotz D. Visual analytics in healthcare--opportunities and research challenges. J Am Med Inform Assoc JAMIA. 2015 Mar;22(2):260–2.
2.   Zhang Y, Sun W, Gutchell EM, Kvecher L, Kohr J, Bekhash A, et al. QAIT: a quality assurance issue tracking tool to facilitate the improvement of clinical data quality. Comput Methods Programs Biomed. 2013 Jan;109(1):86–91.
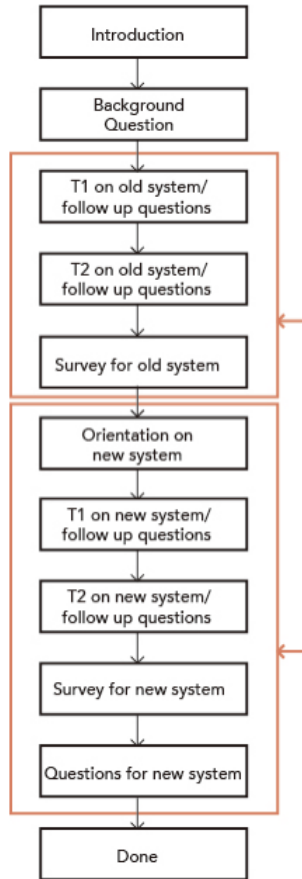
Figure 1. A visual representation of the sequence of events conducted during each test session.

Table 1. Average SUS Score by participant

Participant	Existing Report	New Dashboard
P01	72.5	90.0
P02	70.0	97.5
P03	77.5	82.5
C01	40.0	92.5
C02	62.5	77.5
C03	55.0	90.0
C04	62.5	75.0
A01	85.0	90.0
A02	32.5	87.5
A03	72.5	82.5
S01	52.5	62.5
S02	80.0	67.5
Average	63.5	82.9*

* a significantly higher average score of the new dashboard (p=0.006)