Cognitive Workload Analysis of Context Aware Clinical Decision Support Compared to traditional CDS Alerts

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Introduction

We have shown for a nursing workflow at an ambulatory federally qualified community health center (FQHCC) that in-line, context-aware clinical decision support (ICA-CDS) is more effective1 and sustainable2 in depression screening and more effective with minimal training in falls risk screening3 when compared to traditional pop-up interruptive alerts. Decision support that produces consistent, positive results, that does not require a great deal of work to train staff or maintain, and is easier and quicker to use would be of value to EHR design theory. 4, 5 To study this, we proposed measuring the cognitive load of the workflow technique using the NASA Task Load Index, and measuring the effects each workflow has on the time needed to complete the patient rooming task. We compared the cognitive workload of two different clinical decision support techniques for yearly depression screening performed by a nurse in a patient rooming workflow. We theorized that traditional alert-based CDS will demonstrate higher workload and take longer to complete than ICA-CDS when compared to control.

Design

For this study we designed a mock patient rooming workflow that was performed by the subject under supervision. The observer recorded the time it took to complete each workflow. The subject then completed a survey after each workflow protocol. Our survey tool was the NASA Task Load Index, which has been used in studies to demonstrate workload differences in EHR use after changes to a system. 6 The study subjects were nursing staff at an outpatient FQHC. Approval was obtained from the IRB from our local hospital (Providence, Waco, TX). Participants were provided with five different workflows, each with a specific set of instructions. Participants followed the instructions step by step to complete the objective, then filled out the NASA Task Load Index to rate the difficulty of each workflow. One workflow was a control, a base rooming workflow with no depression screen, while two workflows used alerts and two used ICA-CDS to demonstrate patients’ need for screening in addition to the base rooming workflow. Workflows were randomly presented to the participant. Time was recorded to mark the start and end of each workflow. Using the NASA Task Load Index, we measured Mental Demand (high score = high demand), Temporal Demand (high score = long perceived time to complete), Performance (high score = perceived they failed task), Effort (high score = higher perceived effort), and Frustration (high score = higher frustration). Data for physical domain was collected but not included due to not being relevant. Means were calculated for each of the domains of the NASA Task Load Index. T test was performed to test the difference of the means from each protocol compared to the control.

Results

36 staff members were surveyed, with 5 workflows for each staff member, for a total of 180 surveys. We found significantly higher scores (p > 0.05) between the traditional alert workflow and the control workflow for the Performance (t=2.3) and Effort (t=1.7) domains of the NASA Task Load Index. There was also trending to higher scores for Mental Demand and Frustration, but they did not reach significance. We also found a significant increase in the time it took to complete the workflow using the traditional alert-based workflow (62 s) compared to control workflow (44 s). Between the ICA-CDS workflow and the control workflow, there was no significant difference in any of the NASA Task Load Index domains or in the completion time (44 s each).

Conclusion

Our ICA-CDS, in addition to producing improved screening rates in our population, as shown in previous studies,1 also showed minimal measurable workload difference compared to a control workflow, while traditional alert-based workflow showed increased effort and feeling of task failure compared to control workflow. Additionally, the ICA-CDS workflow did not appear to significantly increase the time it took to complete a patient check-in workflow compared to the control, while the traditional alert-based workflow took significantly longer compared to the control. This suggests that ICA-CDS results in faster task completion with fewer elements of cognitive workload than traditional CDS.

Future Work

We are continuing to collect data from nursing test subjects, so we may find additional power to detect small differences in the measures that seem to show more difficulty with the traditional alert-based workflow. In subsequent studies we may also measure user preference using a clinician satisfaction survey along with a workload study.

References


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