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Development of a Web-based Observational Tool for Detecting Intravenous Medication Errors with Smart Infusion Pumps

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Abstract /Objective

Computerized smart infusion pumps have been widely implemented to decrease the rate of intravenous (IV) medication errors in hospitals. However, these devices have not always achieved their potential, and important IV errors still persist. Findings from a previous study [1] that *assessed the frequency of IV medication errors and the impact of smart infusion pumps identified major issues related to use of smart infusion pumps in a single facility, but generalizability of these results is uncertain. Additionally, lack of standardized methodology for measuring these errors remains an issue. In this study, we developed an observational tool to capture IV medication errors through iterative participatory design with interdisciplinary experts and then tested the tool by using incident cases regarding smart pump errors. We found that the tool could capture all smart infusion pump errors and is ready for testing for use as standard data collection tool in different hospital settings.*

Keywords: Patient Safety, Medication Error, Infusion Pumps

Methods

We developed an observation tool for a nationwide smart pump project that aimed to investigate medication errors using smart pumps in multiple sites. This tool was designed to detect various smart pump infusion errors by supporting systematic collection of intravenous (IV)/drug information administered to individual patients and comparing that information to existing physician orders. It is designed to support identifying the "five rights" of medication use (e.g., right patient, right drug, right time, right dose, and right route) and to categories each detected error using the National Coordinating Council for Medication Error Reporting and Prevention NCC MERP Medication Error Index. The tool was built using an electronic data capture tool, REDCap, which allows users to build and manage online databases quickly and securely. In addition, observational data form multiple sites can be gathered in one database as de-identified data. An iterative participatory software development process was used to develop a series of prototype data collection tools incorporating the expertise of multidisciplinary research team members from ten different hospitals (Figure 1.) All infusion incidents reported in 2011-2012 (n=20) that required investigation of the infusion pump from the Biomedical engineering department at BWH, were used as test cases to validate the tool. In addition, the tool was piloted on two clinical units where nurses used the tool to record smart pump infusion medications and corresponding orders for twenty patients.

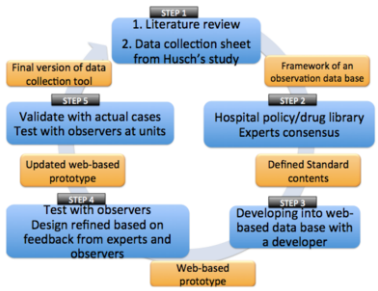

Figure 1- Iterative Participatory development Process

Results

After validating each incident report, 9 cases were identified as programming or setting errors that had the potential adversely affect the "five rights". Among these, 7 incident cases resulted in a wrong rate, one case resulted in wrong dose, and the one was an omission of an administration. The errors were categorized using the NCC MERP Index. Errors ranged from ratings C (n=1) to E (n=1) and the most D (n=7), "an error occurred that reached the patient and required monitoring" was most frequent.

Discussion

The tool is still under development and after testing with ten sites, the tool will be finalized and used for a large data collection. To ensure inter-rater reliability with rating medication errors, the research team is collaborating on a standard protocol for rating and process for achieving consensus.

Conclusion

A web-based observation tool to detect smart pump infusion errors was developed and validated using incident report cases and direct observation. All error cases could be captured by the tool and nurse data collectors reported that the tool supported accurate and complete data collection.

References

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