Enabling Clinicians to Directly Deploy Clinical Logic in a Patient Safety Dashboard

Evan Kirshenbaum MS[1], Jaap Suermondt PhD[1], Natalie Pageler MD[2, 3], Chris Longhurst MD MS[2, 3], Jessica Wayne RN[2], Margie Godin RN[2], Andrew Shin MD[2, 3], Deborah Franzon MD[2, 3]

[1]HP Labs, Palo Alto, CA, [2]Lucile Packard Children's Hospital, Palo Alto, CA,

[3]Stanford University School of Medicine, Stanford, CA

Abstract: *Compliance with, implementation of, and monitoring of evidence-based guidelines can be challenging in clinical environments. We created a real-time patient safety dashboard, deployed since June 2011. We report on our current research to make it very easy to go from a clinical specification to deployment, thus enabling clinicians to specify (and change) clinical status conditions and to automate the process of going from specification to automatically and deterministically translated executable code.*

Despite widespread awareness that many thousands of patients die from preventable medical errors each year [1, 2], patient safety remains a daunting problem in clinical environments. Compliance with evidence-based guidelines (e.g., to prevent catheter-associated bloodstream infection (CABSI) and ventilator-associated-pneumonia (VAP)) is desirable and even mandated, but implementation and monitoring of these guidelines can be challenging – especially in high-pressure patient-care environments such as a pediatric ICU. We created a real-time patient safety dashboard at Lucile Packard Children's Hospital at Stanford (LPCH), deployed since June 2011, providing a unit-wide overview as well as detailed safety indicators for each patient [3, 4]. The dashboard is integrated with the hospital's EMR (currently Cerner Millennium with mPages) and the safety measures are coded using a combination of Cerner Command Language (CCL, a variant of SQL), JavaScript Object Notation (JSON) and HTML.

A challenge in deploying and supporting the dashboard at LPCH and in making it easily replicable at other institutions is that whenever a change in or expansion of the underlying clinical logic is indicated, it takes dedicated IT resources with detailed knowledge of the underlying deployment infrastructure to make it happen. We report here on our current research to make it very easy to go from a clinical specification to the deployed logic of the dashboard in a wide variety of settings. The goal is to **enable clinicians to specify** (and change) the conditions that could be used to determine the status of the dashboard and to **automate** the process of going from specification to automatically and deterministically translated executable code. First, we are building connectors to existing data sources (either in EMR systems such as Cerner or in other back-end systems or data warehouses). Second, we are developing a specification language that is very close to a natural language description of the conditions under which alerts should be raised, but underneath this will be a formal language, specified with a grammar. Our goals are that it should be simple for anybody with medical knowledge to learn how to write specifications with minimal training and, more importantly, that it should be possible for anybody with medical knowledge to be able to read and understand specifications (without training), and either convince themselves that they are correct or spot mistakes and propose corrections. We expect that this will enhance the portability of the dashboard from one institution to another, as well as greatly reducing the need for IT support during the deployment and fine-tuning process. Finally, we show our work on tools to use this language to enable the clinical staff to directly test and roll out changes to the dashboard logic (without relying on programming by the IT staff) whenever there is a change in clinical protocol or institutional policy or when a new source of false positives or negatives is discovered.

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