

A Technical Review and Analysis
of Clinical Decision Support Technologies
In Current Use at
The Veterans Health Administration

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2 Introduction

This report is part of a larger study commissioned by the VA to assess the information technologies for clinical decision support (CDS) currently in use at VA facilities. This portion of the study provides a comprehensive *technical review and analysis* of the various software components that provide CDS functionality. We refer to these components, which range from small modules within the overall VistA system to entirely separate applications, as “CDS Technologies.” The purpose of this work is to better understand the following aspects of these technologies:

1. The technical design and implementation of CDS technologies with respect to knowledge representation, tooling, and standardization
2. How the design and implementation of the CDS technologies facilitate or limit their practical effectiveness
3. What opportunities exist to improve the design and implementation of the CDS technologies so as to overcome their limitations and/or better conform to best practices.

The VA health care delivery system is a large and diverse enterprise characterized by both centralized leadership and locally autonomy. Although all VA facilities use the core VistA software system, many also use local extensions to this system, including third-party applications that have been integrated with the core system. For purposes of this review and analysis, we focused primarily on those CDS technologies that have been approved as “Class-I” applications and are in use at most or all VA facilities.

Although no definitive benchmarks exist for assessing the effectiveness of knowledge representation, tooling, and standardization in CDS technologies, there exist certain commonly recognized attributes that such technologies should strive for. These attributes include:

- The ability to fully and precisely express required decision-support logic
- The ability to customize decision-support content to accommodate local or user-specific preferences
- The ability to safely and reliably provide decision support where it is needed, e.g., with a minimum of false-negative errors
- The ability to provide decision support that is relevant and accurate to the clinical care of patients, e.g., with a minimum of false positive errors or intrusive interventions
- The ability to execute decision-support logic without introducing system delays that are unacceptable to users
- The ability to efficiently develop decision-support content, including facilities to re-use or share content developed by others
- The ability to efficiently and effectively maintain decision support content as the practice of medicine evolves

In this report, we present our findings on the knowledge representation, tooling, and standardization of 16 CDS technologies with respect to these qualities (as applicable). We also provide preliminary recommendations on potential improvements to the technologies. We divide the technologies into two classes: *General purpose* (those that enable decision support with respect to multiple domains or tasks) and *special purpose* (those that enable decision support with respect to a specific domain or task). Finally, after surveying each of the technologies in turn, we compare and contrast their respective qualities and summarize the conclusions and lessons learned from this review.

3 Research Methodology

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