# User-Centered Design of a Model-Driven Rule Authoring Environment

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## Abstract

*This research describes the design process for a model-driven rule authoring environment. Clinical decision support rule authoring is a complex endeavor, involving the need for both content domain and technical expertise, and is fraught with the potential for error, as rules are refined and adapted from narrative recommendations to formal statements to setting-specific adaptations. Several prior studies have focused on the usability issues surrounding front-end tools such as electronic health records and computerized provider order entry systems; studies of back-end tools are rare. In addition to facilitating the design of the authoring environment, this study also seeks to extract the important risks and challenges faced by clinical decision support rule authors.*

## Introduction

CDS rule authoring remains a time-consuming and costly challenge for healthcare organizations wishing to deploy CDS. These challenges have historically limited the penetration of CDS. However, with increasing pressures to deliver higher quality care in a challenging reimbursement environment, and with federal Meaningful Use incentives mandating the use of CDS, it is no longer practical for most healthcare organizations to continue to put off CDS implementation. Therefore, a CDS rule authoring environment that is 1) interoperable, 2) flexible, and 3) user-friendly is desired. The Office of the National Coordinator for Health IT (ONC) has led the development of the Health eDecisions Interchange Schema to address the first requirement, while the 2nd requirement was the subject of previous work conducted by members of the study team. This study sought to address the third requirement by eliciting a mental model of rule authoring as well as the unique challenges perceived by CDS rule authors today.

## Methods

**Semi-structured Stakeholder Interviews**

- Conducted 7 interviews with representatives from 4 healthcare organizations
- Interviews were semi-structured and formative in nature

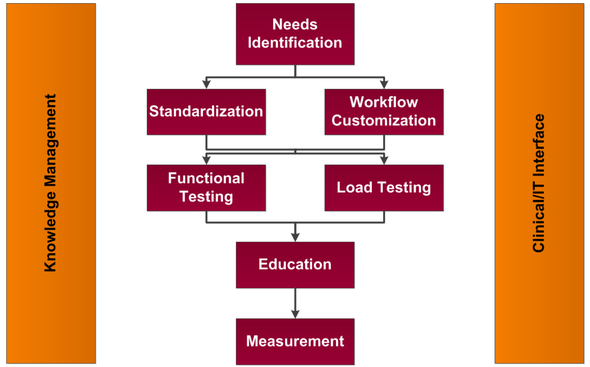
**Thematic Analysis**

- Created a coding scheme consisting of 9 concepts common to most interviews
- Interviews were transcribed and coded according to this scheme
- Several themes emerged during the review process

**Distillation of Principles to Guide the Creation of a CDS Authoring Tool**

- The study team reviewed each theme in the context of a CDS authoring tool
- Some of the resulting principles had previously appeared in the published literature

## Mental Model




## Themes

***Theme 1: The Clinical/IT interface is still a significant issue, but standardization is now a greater issue.***

> *"Anybody in the company can do a request, but we tell them right there that we do want this to come from the system team and it does need to be something that we can implement across the board."*

- Organizations are becoming adept at eliciting requirements from clinical stakeholders.
- Intra-organizational standardization (of clinical and workflow aspects) is a challenge

***Theme 2: Clinical stakeholders must be consulted and educated about any changes affecting their workflow.***

> *"…you have to go meet with the end users and you have to go see how things work into their workflows and how they're actually using things because we can sit behind computers and offices and make up things all day long that will never work for people that are actually out there taking care of patients."*

- CDS should happen **with** clinicians, not **to** them.

***Theme 3: Measurement and Management are broadly recognized as emerging issues.***

> *"…you can tell a mature clinical decision support environment by the challenges...by the fact that they are finding as many challenges in maintaining their knowledge as they do in creating new knowledge."*

- CDS should have a positive impact supported by practice-based evidence
- A growing, evolving rule corpus requires robust management processes in order to ensure scalability and effectiveness.

***Theme 4: CDS should originate from clinical goals.***

> *"…when you let the end user tell you exactly what to do, they don't know how that interacts with other things...so you do need to put some guiding principles and parameters around there, you wouldn't want to give them full reign to just be able to go out and make their own whole rule."*

- Stakeholders should first focus on the clinical content of a rule
- Implementation details should be decided later via an interdisciplinary process involving key clinical and non-clinical stakeholders

## Lessons Learned

| Theme | Lesson learned in relation to the creation of a CDS artifact authoring tool |
|---|---|
| 1 | The authoring tool should support consensus building. Specifically, the tool should provide alternative views of the CDS content to facilitate review by a variety of stakeholders. |
| 2 | The authoring tool should facilitate clinician understanding and participation. The underlying content repository should support the storage and retrieval of associated educational artifacts. |
| 3 | Measures of CDS effectiveness are in increasing demand. The tool should facilitate the creation of quality measures linked to decision support artifacts. |
| 4 | The authoring tool should support goal-oriented, workflow-agnostic CDS artifacts as a starting point in the CDS lifecycle. These artifacts will then be evolved as the implementation details are settled. |

## Ongoing and Future Work

The lessons learned set the requirements for the actual development of a CDS Editor:

- **Model-driven** : the editor is driven by a modular ontology, based on the Health eDecisions (HeD) CDS intervention interoperability schema and the HL7 vMR information model.
  - Alternative information models will be provided
- **SME-friendly** : different views are available, with different levels of detail.
  - The editor will be subject to usability testing by clinicians and knowledge engineers
- **Reusable "Primitives"** : CDS artifacts can be built and described using workflow-independent templates.
  - The translation to a setting-specific version is automatic, but can tuned by the user
- **KCMS integration** : the editor will be backed by a semantic content repository
  - Artifacts will be indexed by content, and linked to each other
- **Runtime integration :** artifacts can be imported and exported to and from the HeD format.
  - Automated translation to additional executable formats will be provided

## Notes

Disclaimer: Views expressed are those of the authors and not necessarily those of the organizations with which the authors are affiliated.

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