

CDS Connect: Final Report 2023

Clinical Decision Support (CDS) Connect is a freely available, web-based platform that enables the CDS user community to identify evidence-based care, translate and codify information into interoperable health information technology (IT) standards, and leverage tooling to promote a collaborative model of CDS development.



CDS "artifacts" – actionable medical knowledge (e.g., clinical practice guidelines, peer-reviewed articles, local best practices, and clinical quality measures) translated into computable and interoperable decision support

Executive Summary

Healthcare is undergoing a digital revolution that will lead to innovations in using technology and data to impact care. The Agency for Healthcare Research and Quality (AHRQ) launched the CDS Connect project in 2016 to put patient-centered outcomes research (PCOR) findings into practice. CDS Connect provides a public platform focused on integrating evidence-based care more rapidly into clinical practice through electronic health systems and applications.

The 7th year of the CDS Connect project focused on system maintenance and updates to ensure that the tools remain shareable, standards-based, and publicly available. This report organizes the project's year-long accomplishments by the four major components of CDS Connect: the Repository, the Authoring Tool, open-source tools, and CDS artifacts.

Repository

The [CDS Connect Repository](#) was the platform's first prototype tool. It hosts structured, interoperable CDS expressions—known as CDS artifacts—that support decision making by clinicians and patients.

Artifacts in the Repository include contributions developed by the MITRE team, as well as trusted third parties. The Repository demonstrates a way to more rapidly incorporate evidence-based research into clinical practice through interoperable CDS. In accordance with input from the CDS community, the Repository continues to align with an artifact data model based on the Clinical Practice Guidelines (CPG)-on-Fast Healthcare Interoperability Resources (FHIR®).*

*FHIR® is a registered trademark of Health Level 7 (HL7).



This year's Repository efforts included:

- Published a [Repository User Guide](#) for artifact authors.
- Deployed automatic alerts to the CDS Connect team when an artifact's publishing or edit status changed.
- Enhanced Medical Subject Heading (MeSH) taxonomy search performance for Repository visitors.
- Continued development of CPG-on-FHIR[®]-based artifact data model.
- Completed upgrades to Drupal 10 and PHP 8, and removed Lightning, to maintain currency of platform.
- Simplified the process of development and deployment for Repository infrastructure updates.
- Enhanced security around account request and "Contact Us" forms to better detect and prevent spam and automated bot activity.
- Coordinated changes across CDS website project sub-sites, including AHRQ's Center for Evidence and Practice Improvement (CEPI) Evidence Discovery and Retrieval (CEDAR) and CDS Innovation Collaborative (CDSiC).
- Updated Drupal configuration to recognize reverse proxy traffic routing, improving network activity logging and network traffic management.
- Expanded documentation and configuration management of Repository processes for developing new features, applying security patches, updating components, and content management.
- Established 125 Repository and Community accounts.

Authoring Tool

The [CDS Authoring Tool](#) is a user-friendly web application for creating standards-based CDS logic using Health Level Seven (HL7) Clinical Quality Language (CQL) and the HL7 FHIR[®] data model, logic that can then be integrated within electronic health record systems.

An Authoring Tool account allows users whose expertise does not include software development to easily author CDS logic that features inclusion and exclusion criteria, sub-populations, conditional recommendations, and custom modifiers. Because of the Authoring Tool's integration with the National Library of Medicine's Value Set Authoring Center, authors can define clinical elements using value sets and standard terminologies. Experienced authors may also import externally authored CQL, specify run-time parameters, and test their logic using synthetic data. Exporting valid CQL using the FHIR[®] Release 2, 3, 4, or 4B data models is as simple as clicking a button.

This year's Authoring Tool accomplishments included:

- Added a feature allowing authors to preview generated CQL logic.
- Expanded test results view to show results inline with CQL.
- Improved code maintainability and reusability through React refactoring.
- Implemented a variety of enhancements and bug fixes to improve user experience.
- Performed major upgrades, including Mongo DB, CQL Translation Service, and CQL Execution.
- Streamlined Docker build to reduce build times.
- Enhanced continuous integration and delivery processes.
- Established 130 accounts, with 20% requested for use in university health informatics coursework.

Open-Source Tools

CDS Connect developed a number of open-source tools.

[CQL Services](#) is an open-source application enabling users to expose CQL-authored logic over custom and CDS Hooks-based web services.

The [CQL Testing Framework](#) is an open-source library allowing developers to create and execute detailed test cases for CQL libraries.

The [Pain Management Summary Application](#) is a Substitutable Medical Applications, Reusable Technologies (SMART) on FHIR® application enabling clinicians and patients to view all individual patient data that might be relevant to managing that patient's pain.

Freely available on [GitHub](#), these tools complement the Authoring Tool capabilities and encourage implementation.

This year's Open-Source Tool's accomplishments included:

- Updated Pain Management summary to reflect changes in logic and terminology.
- Simplified installation and dependency management of all tools by adding support for npm, the package manager for Javascript.
- Updated dependency libraries as needed.

CDS Artifacts

The Repository has continued to grow. Highlighting the work of MITRE and the greater CDS community, artifacts span a variety of functions (alerts, risk assessments, order sets, event-condition-action rules, smart documentation forms, data summaries, multimodal formats, and calculators) and represent different degrees of implementation.

From narrative summaries to implementation guides up through the results of piloting the artifact in a health system, the Repository showcases how evidence-based research can and is being incorporated into clinical practice.

An annual review process keeps the actively maintained artifacts intended for clinical use current, reflecting the most up-to-date clinical evidence. MITRE completed an annual review and update of their eight Implementation Guides (IG) and associated artifacts:

- [Healthy Diet and Physical Activity for CVD Prevention in Adults with Cardiovascular Risk Factors](#)
- [Factors to Consider in Managing Chronic Pain: A Pain Management Summary](#)
- Statin Therapy for the Primary Prevention of CVD in Adults ([clinician-facing](#) and [patient-facing](#) artifacts)
- [Statin Therapy for the Prevention and Treatment of CVD: An eCQM-derived CDS](#)
- Prediabetes and Type 2 Diabetes ([screening](#) and [counseling](#) artifacts)
- [U.S. Preventive Services Task Force Aspirin Therapy for the Primary Prevention of Cardiovascular Disease](#)

Recommendations and Lessons Learned

Beyond continuing to align with interoperable health standards such as FHIR® and CQL, CDS Connect recommends CDS projects and the broader CDS Community focus future efforts to:

- Expand the use of the platform and Authoring Tool by promoting awareness and adoption by institutions of higher learning and other learning communities.
- Promote the importance of adopting a patient- and caregiver-centered approach to CDS development.
- Engage with organizations leveraging digital tools such as CDS, value sets, health standards, and electronic clinical quality measures (eCQM) to improve the quality of healthcare delivery.
- Support CDS developers and address the needs of those implementing pilot projects.
- Introduce artifact metadata fields to encourage CDS developer and artifact authors to reflect on both the Food and Drug Administration guidance on CDS software, and the role(s) artificial intelligence technologies may have played in their work.
- Consider incorporating machine learning and artificial intelligence that improves the user experience of artifact authors and site visitors alike.
- Explore opportunities to leverage artificial intelligence tools and synthetic patient data to test and pilot patient outcomes prior to CDS implementation.
- Assess the impact of emerging technologies on the development, publishing and piloting of CDS artifacts.

Next Steps

Over the next year, the MITRE team will continue to prepare for transition, as AHRQ explores sustainability models. If interested in learning more, please sign up for AHRQ's newsletter at <https://www.ahrq.gov/news/newsletters/e-newsletter/index.html> or request to be added to the CDS Connect Update Email list at <https://cds.ahrq.gov/contact-us>.

Resources



For more information on the CDS Connect project:

<https://cds.ahrq.gov/cdsconnect>



To view CDS artifacts in the Repository:

<https://cds.ahrq.gov/cdsconnect/repository>



To view all the Open Source tools:

<https://github.com/AHRQ-CDS>



To sign up for a CDS Connect account:

<https://cds.ahrq.gov/cdsconnect/signup>



To view the Authoring Tool:

<https://cds.ahrq.gov/authoring/>



To try the Pain Management Summary App:

<https://apps.smarthealthit.org/app/cds-connect/>