

INNOVATION CENTER PROGRESS REPORT

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CDSiC Innovation Center Quarterly Report

Presented by:

Prashila Dullabh, Dean Sittig,
Aziz Boxwala, Adam Wright,
Edna Shenvi, Elise Russo, and
Courtney Zott
NORC at the University
of Chicago
4350 East-West Highway
Suite 800
Bethesda, MD 20814

Presented to:

Ed Lomotan and James Swiger
Agency for Healthcare Research
and Quality
5600 Fishers Lane, Room 06B03
Rockville, MD 20857

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Introduction

NORC at the University of Chicago (NORC) is pleased to submit the second quarterly report to the Agency for Healthcare Research and Quality (AHRQ) on the Clinical Decision Support Innovation Collaborative (CDSiC) Innovation Center. This quarterly report provides a summary of the status of all projects and activities being conducted within the CDSiC Innovation Center.

The CDSiC aims to advance the design, development, dissemination, implementation, use, measurement, and evaluation of evidence-based, shareable, interoperable, and publicly available patient-centered clinical decision support (PC CDS) to improve health outcomes of all patients by creating a proving ground of innovation. Products put forth by the CDSiC will provide innovative solutions that promote the adoption of PC CDS to facilitate whole-person, evidence-based care and improve patients' health and care experience. Ultimately, the CDSiC aims to create a world where patients, caregivers, and clinicians have the information needed to make decisions that improve health and well-being for all individuals.

The CDSiC Innovation Center is the real-world test bed of the CDSiC, leading the development and application of CDSiC tools, learnings, and insights. The Innovation Center consists of a Planning Committee and two Cores:

- **Core 1. Measurement and Value of CDS:** This purpose of this Core is to standardize the measurement of all aspects of PC CDS and demonstrate PC CDS utility through the implementation of safe and effective PC CDS.
- **Core 2. Conducting and Coordinating CDS Projects:** The purpose of this Core is to test PC CDS projects in real-world settings to ascertain best practices for implementation and monitoring to ease last mile implementation challenges.

Status Report

This status report provides updates on progress of the activities of the Innovation Center from April to June 2022¹, including finalizing project concepts, commencing project work, and facilitating a Planning Committee. The report also describes upcoming activities.

Planning Committee

The Innovation Center has established a Planning Committee comprised of seven thought leaders in the field of CDS. The Planning Committee is central to the operations of the Innovation Center and will provide strategic input for all Innovation Center Core activities.

The Planning Committee kicked off on April 7, 2022. During the kickoff meeting, members were oriented to CDSiC and the Innovation Center and were asked for input on the projects being conducted

¹ More detailed background on the CDSiC, the Innovation Center, and Innovation Center activities from January to March 2022 can be found in the first quarterly report.

by the Cores (detailed further below). The Committee will meet once every three months to provide input on the overall strategic direction of Core projects and ensure alignment across the objectives of the CDSiC Steering Committee, CDSiC Stakeholder Center Planning Committee and Workgroups, and AHRQ. Future meetings are scheduled for July 28, 2022; October 18, 2022; and January 9, 2023. The Committee will also review materials related to Core projects and help to raise awareness of Core activities within the broader CDS community.

Innovation Center Cores

The Innovation Center Cores are tasked with developing and completing three projects in the first two years of the CDSiC that advance PC CDS research. Based on discussions with AHRQ and the Planning Committee, Innovation Center leadership identified and finalized three projects aimed at addressing gaps in measuring and monitoring PC CDS performance. The overarching goals of these projects are to develop a comprehensive performance measurement framework along with measurement and monitoring prototypes to help patients, clinicians, and CDS developers understand real-world implementation and measurement considerations for PC CDS and any unintended consequences.

The projects vary in terms of expected length of time to complete based on scope, falling into one of three Levels.

- Level 1 projects are the largest in scope, involving significant effort and multiple modes of research or real-world assessments with the expectation of tangible results.
- Level 2 projects involve a medium amount of effort and one mode of research or real-world assessment.
- Level 3 projects are shorter-term and may be proof-of-concept ideas or pilots.

Core 1 is undertaking one Level 1 project and Core 2 is undertaking one Level 2 and one Level 3 project. The projects are being conducted concurrently and in an iterative manner, with findings from each project being incorporated as relevant into the others to enhance and refine outputs.

Core 1: Measurement and Value of CDS

Significant gaps exist in the tools, techniques, and standards required to accurately measure and monitor the performance of various forms of PC CDS across the design, development, implementation, and use spectrum.^{viii} To begin with, Core 1 is undertaking the development of a comprehensive PC CDS measurement framework.

To guide development of the framework, Innovation Center leadership merged and expanded upon the CDS five rightsⁱ and the analytic framework for action (AFA) developed by the PC CDS Learning networkⁱⁱ to create a new, more comprehensive model that outlines a three-phase life cycle of PC CDS.² The goal of this new, expanded model is to highlight the myriad of steps in the PC CDS lifecycle that must be adequately negotiated by all participants in the healthcare delivery system, including

² A detailed description of the model can be found in the Q1 report.

patients and their caregivers, to achieve the desired changes in behavior and the resulting improvements in personal health and lifestyle, societal health and happiness, and economic outcomes. During Q2, Innovation Center leadership continued to refine the model by clarifying steps and specifying their applicability to patient data, preferences, social determinants of health, and patient-reported outcomes. The updated model is shown in Exhibit 1.

Exhibit 1. Updated Patient-Centered Clinical Decision Support Life Cycle



As a first step in developing the framework, Core 1 completed a literature review of existing CDS and PC CDS measurement and evaluation frameworks, and illustrative measures. A total of 62 papers were identified through the scan. Abstracted data included phases of the PC CDS life cycle and measure domains, subdomains, and illustrative measurements covered in each paper.

Through this process, common measurement areas emerged for evaluating the implementation and impact of PC CDS tools, and gaps were uncovered regarding availability of measures within the PC CDS Life Cycle Diagram. Supplemental literature scans will be conducted to address gap areas, and findings from the literature review will be used to develop a foundational conceptual structure for the framework.

Core 1 also began coordinating key informant interviews with CDS artifact developers, implementers, health systems and EHR and application developers to understand existing CDS measurement

capabilities and future opportunities. In addition to semi-structured discussion, interviews will involve demonstrations of developers' tools to ascertain what kind of measurement frameworks are used and how measures are implemented in the real world. Findings from the interviews will be used to expand upon the conceptual structure and provide more specific guidance on operationalizing the performance measurement framework.

Ultimately, the framework will provide a basis for consistent measurement and evaluation (e.g., identification of best practices; return on investment analyses; or assessment of the number of interventions needed to affect change) of PC CDS design, development, implementation, use, and evaluation. The aim is for the framework to be extensible and adaptable to different health care settings, patient populations, and CDS developers. The ultimate goal is to develop methods to evaluate the effort involved in implementation, the performance and impact of PC CDS, and the factors affecting performance, which should encourage wider adoption of PC CDS.

Core 2: Conducting and Coordinating CDS Projects

Clinical dashboards provide real-time feedback to healthcare providers and leaders, as opposed to a retrospective summary of care activities. Data visualization techniques can lead to a more effective decision-making process by reducing cognitive load and improving comprehension of patient data. However, there are several considerations that can impact their performance, such as data sources and availability, the design of visualizations, level of user experience and expertise, individual cognitive factors, or device being used (i.e., PC or mobile device).ⁱⁱⁱ

Core 2 is developing two dashboards intended to operationalize the fundamental PC CDS measurement framework being developed by Core 1. The dashboards will seek to create easy-to-use, succinct views of the key measures developed for each of the facets of the framework.

Project 1: PRO Performance Measurement Dashboard. The first dashboard will be an interactive PC CDS clinical performance dashboard focusing on patient-reported outcomes (PROs). The dashboard will be modeled on an existing prototype CDS dashboard that is under development at Vanderbilt University that captures information from PRO-driven PC CDS, including depression screenings, fall risk assessments, and more. As a first step in developing the dashboard, Core 2 began conducting a literature review of existing PC CDS dashboards and measures. The search identified 22 papers. Findings from the literature review will be used to identify promising and effective utilization and performance measures, how best to present the measures, and how the measures might be interpreted by CDS implementers, patients, and their caregivers. Dashboard requirements include visualizing PRO utilization, responses, and links to PC CDS interventions; filtering to type of PC CDS or CDS, stratification by provider type, patient characteristics, and more; and extent of adoption of measure domains from the Core 1 performance measurement framework and specific measurement definitions from relevant CDSiC Workgroups.

Core 2 is also participating in key informant interviews being conducted by Core 1 to gain insight into the dashboards used by CDS developers. The team will eventually conduct multiple rapid usability studies of both the measurement framework and the PC CDS clinical performance dashboard.

After these steps have concluded, the team will

- 1) Refine the prototype at Vanderbilt
- 2) Load PC CDS and PRO data from the EHR and potentially other sources into the dashboard's database.
- 3) Conduct an expert-led heuristic usability evaluation of the prototype
- 4) Conduct a guided, think-aloud usability evaluation of the prototype with representative PC CDS stakeholders, including PC CDS developers, clinicians, patients, and their caregivers

Project 2: PGHD Dashboard. The second dashboard will be a prototype that implements best practices for presentation and analysis of selected types of patient-generated health data (e.g., patient-collected, physiologic measurements) during clinical decision-making. PC CDS clinical dashboards that integrate could support informed and shared decision-making processes. PGHD, in particular continuously measured physiologic parameters such as blood pressure or glucose, presents unique issues of integration into and presentation during clinical decision-making tasks due to limited availability and use of interoperability standards, the potential volume of data, and the variable circumstances in which the data is obtained and reported. On the other hand, the use of PGHD to inform clinical decisions can improve engagement and connectedness with patients,^{iv} which can lead to better health outcomes, increase patient satisfaction, and improve self-management.^v PGHD can provide a holistic picture for continuous care.^{vi} Currently, there is a dearth of knowledge on optimal ways to integrate and visualize PGHD so that it informs care processes and integrates into provider workflows.

As a first step in developing this dashboard, the Core 2 team completed a scoping literature review of existing patient-collected, physiological measurements and visualization techniques, identifying best practices and challenges for presentation of this data. The search identified 11 total papers. Visualizations in papers were predominantly line plots and circle and bar graphs, with an assortment of other plots. Common methods for summarizing physiologic data included descriptive statistics and clinical indicators (e.g., normal/abnormal with coloring schemes). Literature review findings will be synthesized into a written report and ultimately used to ensure the prototype builds on existing PGHD presentation and analysis tools and best practices. The team will also conduct discussions with a small set of CDS developers and PGHD experts to gain a better understanding of what data exists, what data is needed, and how this data could be aggregated, interpreted, or synthesized to create more patient centered CDS interventions. The team will then develop a core set of requirements based on the literature review and key informant discussions to inform the development of the PGHD dashboard.

To develop the dashboard, the team will begin by creating pilot versions of PGHD presentation and analysis tools for selected PGHD types to refine ideas, understand the limitations of existing data and analysis methods, and gather feedback on presentation methods. If possible, the team will use PGHD collected from patients in existing projects and when not possible will use sample data collected in previous trials or synthetic data designed to mimic real-world data. In developing the PGHD dashboard, the team will explore the utility of selected data summarization analysis techniques (e.g., mean, max, min, mode, etc.) in a limited number of subjects in an in vitro pilot project. Finally, the team will conduct an expert-led heuristic usability evaluation of the prototype. The final dashboard will either be open-

source software, a SMART on FHIR app, or a software library that can be used to incorporate PGHD visualization into other apps.

Next steps

The Innovation Center will conduct the second meeting for the Planning Committee on July 28, 2022. This meeting will focus on preliminary findings from each of the literature reviews conducted for the Core projects, particularly how the findings can inform each Core's outputs. Over the next 3 months, Core 1 will complete key informant interviews and begin developing the measurement framework, and Core 2 will begin developing the PC CDS clinical performance dashboards and PGHD prototype.

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- ⁱⁱⁱ Dowding D, Merrill JA, Onorato N, Barrón Y, Rosati RJ, Russell D. The impact of home care nurses' numeracy and graph literacy on comprehension of visual display information: implications for dashboard design. *J Am Med Inform Assoc*. 2018;25(2):175-182. doi:10.1093/jamia/ocx042
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