INNOVATION CENTER PROGRESS REPORT

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CDSiC Innovation Center: Quarterly Report

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PURPOSE

The CDS Innovation Collaborative (CDSiC) Innovation Center prepares a publicly available quarterly progress report to provide a summary of the status of all projects and activities being conducted within the CDSiC Innovation Center's two Cores and Planning Committee during the reporting period.

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Introduction

NORC at the University of Chicago (NORC) is pleased to submit the fourteenth 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 projects and activities being conducted within the CDSiC Innovation Center in year four between April and June 2025.

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 PC CDS:** The 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 PC 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 quarterly report provides a summary of the status of all projects and activities being conducted within the CDSiC Innovation Center from April through June 2025. Over this period, the Innovation Center has focused on continuing four projects across both Cores and finalizing project work from year three of the CDSiC.

Innovation Center Cores

The Innovation Center Cores are tasked with developing and completing four projects that advance PC CDS research. Based on discussions with AHRQ and the Planning Committee, Innovation Center leadership identified projects aimed at developing new approaches for measuring PC CDS and building the evidence base for implementing and scaling PC CDS in real-world settings. The goals of these

projects are to conceptualize how artificial intelligence (AI) can be used in PC CDS, to develop a framework and inventory for patient engagement measurement, and to conduct real-world pilots of PC CDS technologies.

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

- Level I 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 II projects involve a medium amount of effort and one mode of research or real-world assessment.
- Level III projects are shorter-term and may be proof-of-concept ideas or pilots.

Core 1 is undertaking two Level III projects and Core 2 is undertaking two Level II projects.

Core 1: Measurement and Value of PC CDS

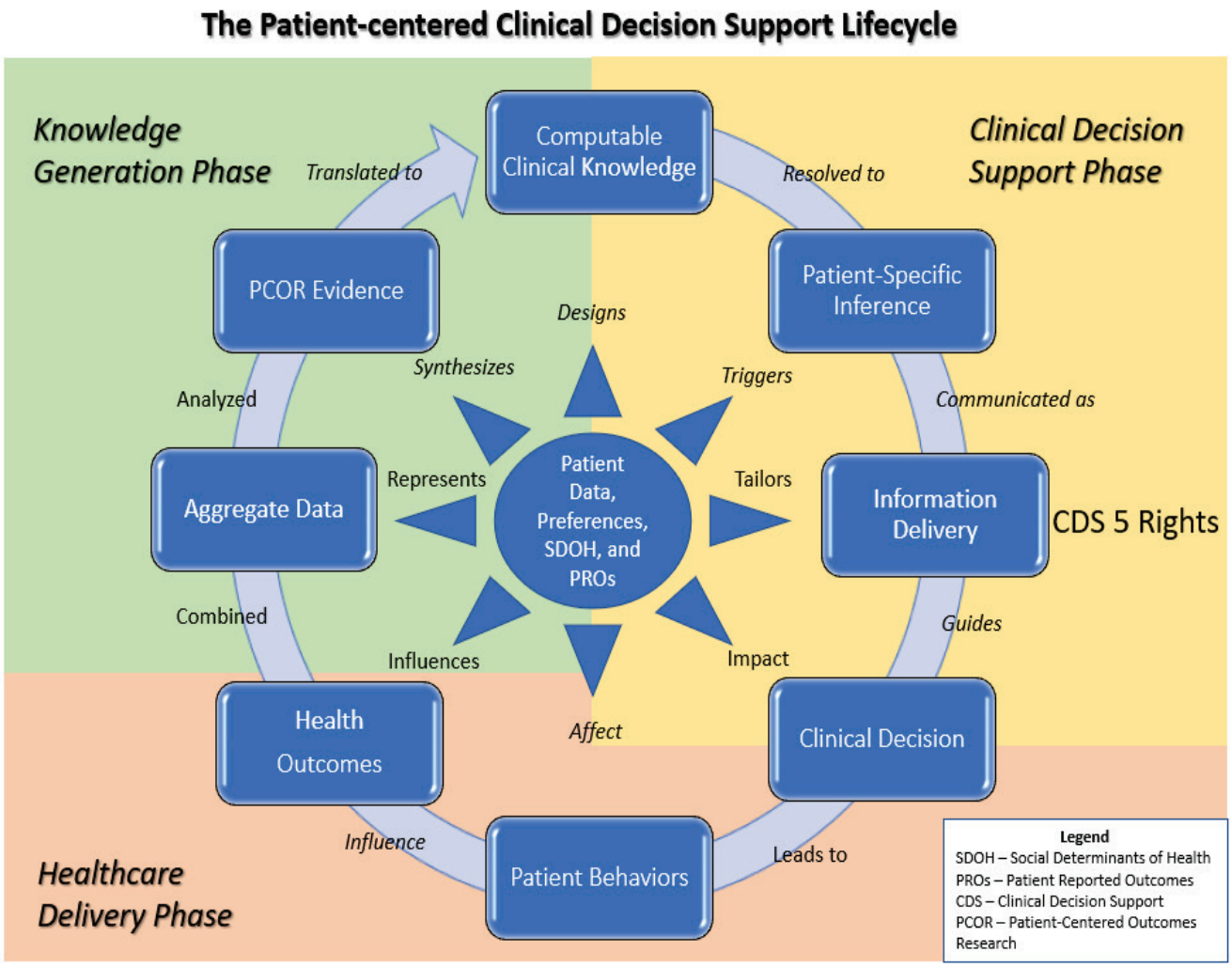
Significant gaps exist in the tools, techniques, and standards required to accurately measure and monitor the performance of PC CDS across the design, development, implementation, and use lifecycle.[1] To address these gaps, Core 1 has undertaken two projects: 1) identifying measures across the PC CDS lifecycle to measure successful patient engagement with PC CDS technologies, and 2) detailing the current landscape of use cases for AI in PC CDS to establish a foundation for future performance measurement efforts. In addition, Core 1 continued disseminating findings from the prior year's project on a measurement framework for PC CDS performance.

1. Identifying Patient Engagement Measures for PC CDS

In prior years of the CDSiC, several Stakeholder and Innovation Center products examined measurement of patient engagement in PC CDS, finding that it remains limited and largely focused on the process of engagement versus engagement quality or outcomes.[2,3,4,5] To address these gaps and better understand the impact of patient engagement in PC CDS, it is necessary to develop more advanced, comprehensive, and standardized measures of patient engagement.

This project aims to explore existing patient engagement measures and identify gaps and opportunities to improve measurement. The Core 1 team mapped these measures to the PC CDS Lifecycle (Exhibit 1) developed in year one, to enable PC CDS developers, researchers, implementers, evaluators, and other stakeholders to assess successful patient engagement in different phases of the technology.[6] The PC CDS Lifecycle Framework defines the different phases, sequences and interactions of activities within the design, development, implementation, use, and evaluation of PC CDS. The lifecycle is separated into three separate phases: the knowledge generation phase (i.e., the development of evidence-based guidelines from patient-centered outcomes research [PCOR]), the clinical decision support phase (i.e., the transformation of evidence from research into computable logic for patients), and the healthcare delivery phase (i.e., the clinical decision-making process among patients, caregivers, and clinicians).

Exhibit 1. The Patient-centered Clinical Decision Support Lifecycle Framework



In Q2 2025, the Core 1 team revised and drafted a report and inventory collating patient engagement measures across the PC CDS lifecycle. The goals were to describe the activities where patients are engaged and measures of patient engagement in those activities within each phase, identify where measures are currently lacking, and describe the challenges and opportunities to advance patient engagement measurement.

The inventory, containing 395 measures of patient engagement, synthesizes findings from the literature and key informant interviews. The inventory contains a user guide, which describes the purpose of the inventory, how it can be used, and considerations for its use. Additionally, the Core 1 team added a codebook that provides an in-depth description of each variable (e.g., PC CDS lifecycle phase, steps where patients are engaged), and its values.

Deliverables Submitted in Q2:

- Core 1 submitted the second draft of the Patient Engagement Measures for PC CDS report that describes the background, methods, findings, and discussion of the project, and the first draft of the accompanying Inventory of measures on April 4, 2025.
- Core 1 submitted the finalized Patient Engagement Measures for PC CDS Inventory with an accompanying user guide and codebook on May 29, 2025.

Dissemination Activities in Q2:

- Core 1 presented the Inventory of Patient Engagement Measures for PC CDS to Planning Committee members on June 9, 2025. The team provided minutes following the meeting.

2. Examining Use Cases for Generative AI in PC CDS

The use of AI in PC CDS tools has potential implications for PC CDS technology, patients/caregivers, and clinicians. In particular, generative AI (GenAI), which can create new content from textual and media input,[7] has strong capabilities to synthesize large amounts of data for PC CDS through various mediums (e.g., unstructured data in electronic health records [EHRs], clinical visit recordings, patient-generated health data [PGHD]).[8] Because of the rapid growth of GenAI and concerns with its transparency and regulatory oversight, there is need to clarify how it is being implemented in the PC CDS landscape.

The aim of this project is to create a consolidated resource that documents current use cases of GenAI-supported PC CDS and its implications and considerations for practice and research. The Core 1 team will emphasize the implications of GenAI-supported PC CDS for patients/caregivers, as the current literature focuses on implications for clinicians and healthcare leaders using traditional CDS.[9,10,11,12]

In Q2 2025, the Core 1 team submitted a perspective piece about use cases for GenAI-supported PC CDS to a peer-reviewed journal. The manuscript focuses on the use of GenAI in PC CDS for patients/caregivers and/or clinicians and its implications for practice and research, as well as areas to advance the technology. The team is revising the manuscript after receiving feedback from journal reviewers.

Deliverables Submitted in Q2:

- Core 1 submitted a Perspective manuscript on GenAI-supported PC CDS to a peer-reviewed journal and received reviewer feedback.

Dissemination Activities in Q2:

- Core 1 received an acceptance on an abstract to AcademyHealth's 2025 Annual Research Meeting (ARM). The team drafted and submitted the poster the conference, titled, "The Use of AI in Patient-Centered Clinical Decision Support: Implications for Practice and Research."

- Core 1 submitted a panel abstract to the American Medical Informatics Association (AMIA) 2025 Annual Meeting that will focus on the use cases for GenAI-supported PC CDS and implications for practice and research.

3. PC CDS Performance Measurement Framework *[Continued from the Prior Year]*

In prior years, Core 1 developed a framework for measuring PC CDS performance that CDS developers, clinician informaticians, clinical leaders, and others could use to assess PC CDS across the lifecycle. The framework is informed by traditional CDS and health information technology literature as well as key informant interviews with experts in the field of PC CDS. It includes several domains and subdomains of measurement to assess PC CDS performance that are extensible to different health care settings, patient populations, and PC CDS developers.

In Q2 2025, the Core 1 team successfully published a manuscript that describes the framework in the Journal of Medical Informatics Research (JMIR). The manuscript is titled, "A New Performance Measurement Framework for Realizing Patient-Centered Clinical Decision Support: Qualitative Development Study."[13]

Dissemination Activities in Q2:

- Core 1 published an original research manuscript on the PC CDS Performance Measurement Framework in a peer-reviewed journal on April 30, 2025.

4. Real-World Performance Measurement of PC CDS *[Continued from the Prior Year]*

In the previous year, the Core 1 team conducted a cross-cutting qualitative assessment examining how the PC CDS Performance Measurement Framework measures are used in 20 real-world AHRQ-funded PC CDS projects. From this assessment, the team identified key measurement trends, gaps, and challenges, as well as potential opportunities for advancing PC CDS performance measurement.

In Q2 2025, the Core 1 team began drafting a manuscript for a peer-reviewed journal detailing the assessment findings, including discussions on common measurement areas in real-world PC CDS projects and measurement challenges and opportunities described by project investigators.

Core 2: Conducting and Coordinating PC CDS Projects

PC CDS tools have the potential to improve patient safety and quality of care by remotely monitoring patients' conditions and symptoms. Remote monitoring is particularly pertinent for chronic conditions such as hypertension that impact a large patient population and can contribute to more serious conditions like early onset cardiovascular disease and, if pregnant, complications during or after delivery. Mobile health technology, which utilizes smartphones, tablets, or personal computer in the management of chronic disease, has been shown to be effective for patients that must adhere to medication regimens or monitoring over extended periods of time.[14, 15] Due to the burden of hypertension and the efficacy of mobile health, Core 2 has undertaken two projects: 1) implementation

and evaluation of a PC CDS prototype to support hypertension medication adherence; and 2) implementation and evaluation of a PC CDS prototype for postpartum hypertension.

1. Implementation and Evaluation of a PC CDS Prototype to Support Hypertension Medication Adherence

In this project, the Core 2 team will expand on the prior year's project to implement and evaluate a text-messaging application (app) to help patients monitor and improve adherence to hypertension medications. The app leverages an AI-based tool to text patients who have uncontrolled blood pressure to ensure that a) patients continue taking their medications as prescribed, and b) the medications have the desired effect. In the prior year, the Core 2 team integrated the app with an EHR system at a pilot site using Substitutable Medical Applications and Reusable Technologies (SMART) on Fast Healthcare Interoperability Resources (FHIR®)[16] to allow clinicians to monitor patients' medication use between visits and intervene if necessary. They then assessed the integration process to understand the feasibility and usability of the app in a lab simulation environment. This year, the Core 2 team will enhance the app to collect blood pressure data from patients and will implement the app with patients in a primary care setting.

Pilot Implementation. In Q2 2025, the Core 2 team worked closely with the pilot site to monitor patient usage and app performance during the live pilot (February 1, 2025 - June 30, 2025). They finished enrolling 21 patients into the text messaging program in mid-April. Discussions during this period centered around resolving technical issues with the app and sharing preliminary feedback from the ongoing assessment.

Assessment. The Core 1 and Core 2 teams continued the pilot assessment on the app's technical feasibility, performance, and usability in a real-world setting. The team conducted key informant interviews with patients at the midpoint of the pilot to assess interim usability and acceptability. They also conducted interviews with the clinical care team to assess their workflows for the app and its use in clinical decision-making. They began preparing for patient interviews at endpoint, including drafting discussion guides and the post-interview questionnaire. In addition, they began discussing app usage metrics on a monthly basis, including the number of clinician interactions, number of patient responses, types of patient responses, and patient response times.

Dissemination Activities in Q2:

- Core 2 presented updates on the project to Planning Committee members on June 9, 2025. The team provided minutes following the meeting.

2. Implementation and Evaluation of a PC CDS Prototype to Support Postpartum Hypertension

In this project, the Core 2 team will build on an earlier prototype to monitor blood pressure for patients with postpartum hypertension. The app sends SMS text messages to patients with a web-based questionnaire that allows them to report their daily blood pressure readings and hypertensive symptom data post-delivery. It also leverages SMART on FHIR standards to safely store data and includes an EHR-integrated dashboard for clinicians to monitor their patients' symptoms. Clinicians can view flags

in the dashboard next to any abnormal readings, allowing for prompt intervention for patients. In 2023, the app was pilot tested at Yale New Haven Health System and demonstrated preliminary effectiveness in promoting patient self-management of postpartum hypertension.[17] This year, the Core 2 team will conduct another pilot at a different site and enroll a larger sample of patients.

App Integration. In Q2 2025, the Core 2 team and Elimu Informatics completed the security review of the Hypertensive Disorders of Pregnancy Monitoring (HDPM) App.

In Q2 2025, the Core 2 team began meeting with Emory's technical team three times a week to streamline app integration. Discussions centered on streamlining the technical integration of the HDPM app into Emory's EHR by finalizing the backend build, flowsheet build, workbench report build, and security details.

Pilot Implementation. In Q2 2025, the Core 2 team continued biweekly meetings with the pilot health system site to plan for app rollout. These included discussions regarding finalizing a clinical workflow, developing workbench reports, and requirements for the technical development and integration of the app into the pilot's EHR, including app enhancements.

The Core 2 team also began developing and iterating upon pilot materials, including recruitment materials and patient and clinician interview guides.

Assessment. In Q2 2025, the team submitted the final Assessment Plan that provides background on the app, an overview of the pilot, and an overview of the assessment, including the research goals, research questions, proposed assessment measures and collection methods, and data analysis methods. The team plans to collect qualitative data from the technical team on their experience updating and deploying the app, the care team on the app's usability and acceptability within their workflows, and patients on the app's usability and acceptability. The CDSiC team will also collect quantitative data on app usage, blood pressure readings, and symptoms. The team will develop a final report that summarizes key findings by the end of year four.

Deliverables Submitted in Q2:

- Core 2 submitted a second draft of the Assessment Plan that details the research goals and questions, an overview of the pilot, and data collection and analysis methods for the HDPM app assessment on April 4, 2025. Following approval from AHRQ, the team submitted a finalized 508-compliant version on April 28, 2025.

Dissemination Activities in Q2:

- Core 2 presented updates on the project to Planning Committee members on June 9, 2025. The team provided minutes following the meeting.

Innovation Center Deliverables

In Exhibit 2, we outline each Core's completed deliverables to date.

Exhibit 2. Summary Table of Deliverables

Project	Status
Core 1	
AI-Based PC CDS Manuscript	In Progress
Patient Engagement Measurement Framework Report and Inventory	Complete
Core 2	
Medication Adherence Prototype	
Medication Adherence Pilot Assessment Plan	Complete
Medication Adherence Pilot Assessment Report	In Progress
Postpartum Hypertension Prototype	
Postpartum HTN Specifications and Requirements Documentation	Complete
Postpartum HTN Assessment Plan	Complete
Postpartum HTN Assessment Report	In Progress

Planning Committee

The Planning Committee met once towards the end of the Q2 reporting period on June 9, 2025. The meeting focused on presenting findings and updates of the current projects. Core 1 presented a walkthrough of the Patient Engagement Measures for PC CDS inventory. Core 2 presented assessment findings for the Quartz Medication Adherence App Pilot at Baystate Health and pilot updates and assessment plans for the HDPM App Pilot at Emory University.

- For the Patient Engagement Measurement project, Planning Committee members found that the measurement inventory was comprehensive and a helpful resource. Given this, planning committee members suggested that the Core 1 team consider options for presenting the inventory in an accessible format.
- For the Quartz Medication Adherence Pilot at Baystate Health, members discussed the difficulties of conducting end-to-end testing for a natural language processing (NLP)-driven text-messaging pilot. They provided suggestions for managing workflows and volumes of incoming patient messages as well as promoting the sustainability of the app.
- For the HDPM App Pilot at Emory University, members discussed the added value that the pilot brings by collecting symptom data from patients, noting that the use of text messaging promotes more patient engagement than the patient portal alone.

The team gave closing remarks reflecting on the Innovation Center's accomplishments, given that this was the last Planning Committee meeting of the contract.

Next Steps

This quarterly report provides updates on the Innovation Center's project activities between April and June 2025. Over the next three months, Core 1 will resubmit the Perspective manuscript on GenAI-supported PC CDS to a peer-reviewed journal. Core 2 will complete the implementation and assessment of the two PC CDS pilots. For the Medication Adherence pilot, they will end patient monitoring on June 30, 2025. They will complete data collection on the app's usability and acceptability and submit the Assessment Report to AHRQ that summarizes the findings. For the Postpartum Hypertension pilot, they will complete testing and deployment to the health system's production environment, monitor patients in the pilot for eight weeks, and complete data collection on the app's usability and acceptability.

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