

Clinical Decision Support Innovation Collaborative 2023-2024 (Year 3) Period of Performance Report

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PURPOSE

The Clinical Decision Support Innovation Collaborative (CDSiC) aims to improve patient health outcomes by serving as a proving ground to design, develop, disseminate, implement, use, measure, and evaluate evidence-based, shareable, interoperable, and publicly available patient-centered clinical decision support. This Period of Performance Report summarizes CDSiC’s third year of activities, outputs, and outcomes spanning September 2023 through September 2024.

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Executive Summary

The field of clinical decision support (CDS) is advancing rapidly with a focus on integrating patient-centered information with evidence-based practice guidance. The Agency for Healthcare Research and Quality (AHRQ) initiated efforts in 2016 to enhance CDS and funded the CDS Innovation Collaborative (CDSiC) in 2021. The CDSiC aims to improve patient health outcomes by serving as a proving ground to design, develop, implement, use, measure, evaluate, and disseminate evidence-based, shareable, interoperable, and publicly available patient-centered clinical decision support (PC CDS).

During the first two years of the project (September 2021 – September 2023), the CDSiC established an infrastructure built on three distinct centers—the Operations Center, the Stakeholder Community and Outreach Center, and the Innovation Center—while engaging over 100 stakeholders (that include patients, clinicians, researchers, health information technology [IT] and CDS developers, informaticians, payers, and policymakers), synthesizing 1,200 resources, and developing 30-plus guidance documents. The CDSiC's third year (September 2023 – September 2024), or Year 3, built on this momentum by expanding stakeholder engagement, shifting to field-based work, and effectively disseminating products to wider audiences. During Year 3, the CDSiC also aimed to tackle several priority topics, such as exploring artificial intelligence (AI) for PC CDS, capturing patient preferences, improving measurement and reporting, addressing social determinants of health (SDOH), and assessing the value proposition for PC CDS.

In this report, we present an overview of CDSiC activities, outputs, and outcomes during the third year and summarize lessons learned. The intended audience for this report includes PC CDS developers, researchers, informaticians, policymakers, patients/caregivers, and other stakeholders working to advance the evidence base and practice of PC CDS, as well as those interested in learning about and tracking CDSiC key activities, accomplishments, and lessons learned.

Methods

To track CDSiC progress and accomplishments, the NORC team leveraged the CDSiC performance assessment framework that includes three domains:

- **Activities:** The actions carried out in the day-to-day implementation of the CDSiC, including maintenance of the established CDSiC infrastructure and ongoing activities of the CDSiC's centers, committees, and Workgroups.
- **Outputs:** The products of CDSiC activities, including reports, resources, and dissemination efforts to share this work.
- **Outcomes:** Engagement of the CDS stakeholder community to expand the reach and adoption of CDSiC outputs, as well as broader awareness of PC CDS.

The team used this framework to collect and synthesize data to summarize CDSiC progress to date. Data sources for the CDSiC performance assessment included website, newsletter, and social media analytics; program administrative documents and meeting attendance rosters; feedback from CDSiC 2024 Annual Meeting attendees; and qualitative stakeholder feedback (e.g., emails, social media posts).

Results

During the project's third year, the CDSiC team continued to operate the CDSiC's three centers and engaged over 100 CDS stakeholders in discussions around the current state, future promise, and challenges of PC CDS. In doing so, the CDSiC convened and sustained the CDSiC's 23-member Steering Committee and four Stakeholder Center Workgroups comprising 32 members representing diverse experiences and viewpoints. Additionally, the Innovation Center, comprised of two Cores focused on measurement and implementation projects, pushed existing limits to develop new PC CDS concepts and technologies. The CDSiC team also synthesized over 1,200 peer-reviewed and gray literature resources; engaged 102 unique experts (including 34 patient partners) through 118 engagements (e.g., key informant interviews [KIIs], focus groups, and technical expert panels); and developed over 21 resources with concrete recommendations and guidance to advance the scalability, quality, and effectiveness of PC CDS. Finally, the CDSiC disseminated PC CDS resources and CDSiC outputs through various channels, including scientific journals, conference presentations, newsletters, Leadership Viewpoint pieces, and the [CDSiC website](#). The CDSiC's third-year accomplishments are summarized on the next page.

The CDSiC’s Accomplishments (September 2023 – September 2024)

CDSiC ACTIVITIES

The CDSiC engaged stakeholders from the patient-centered clinical decision support (PC CDS) community across its three Centers.

The CDSiC community represented a **diverse group of stakeholders**, including Patients and Patient Representatives | Caregivers | Informaticians | Medical and Academic Institutions | Researchers | Standards Developers | Clinicians | CDS Content Developers | EHR Developers | Federal Agencies and Policymakers | Health System Representatives.

23 

Steering Committee members engaged in providing strategic guidance through participation in **5** meetings.

32 

Workgroup members who provided thought leadership through **24** Workgroup meetings.

7 

Planning Committee members who provided strategic input on developing real-world implementation projects.

The CDSiC team synthesized over

1,200 

peer-reviewed and grey literature resources.

The CDSiC team had

118 

engagements with PC CDS experts through project activities such as key informant interviews.

CDSiC OUTPUTS

The CDSiC team developed **15 products and projects** under the Stakeholder Center and Innovation Center, as well as **21 resources and 6 conference presentations** to increase awareness of PC CDS.

11 

Unique PC CDS products developed by four CDSiC Workgroups.

6 

Innovation Center deliverables across **4** unique PC CDS implementation projects, including **2** peer-reviewed manuscripts.

7 

AHRQ CDSiC Insider Newsletters, **2** leadership viewpoint pieces, and **4** companion products published by the Operations Center.

6 

Conference presentations and **5** additional accepted.

CDSiC REACH AND ENGAGEMENT

The Operations Center has publicly disseminated information about PC CDS and the CDSiC to the CDS community.

Social Media

3,215,040+

combined Twitter/X Impressions.



CDSiC Newsletter

602 

subscribers.

CDSiC Website

34,000+ views by

6,900 

unique visitors between October 1, 2023 and July 31, 2024.

Lessons Learned

During Year 3, the CDSiC continued to support AHRQ in designing, developing, adopting, implementing, evaluating, and disseminating the use of PC CDS while continually reflecting on processes, achievements, and challenges. Key lessons learned include:

Product Development and Pilot Project Implementation

Foster collaboration across the Stakeholder Center and Innovation Center so the whole is greater than the sum of the parts. Maintaining alignment and cross-pollination across the Stakeholder Center and Innovation Center helped ensure that the Workgroups and Innovation Center worked collaboratively to inform each other's work by sharing resources; create outputs that build on previous and ongoing work; and ultimately advance CDSiC goals for PC CDS and shared decision making. This collaboration helped improve efficiency, reduce redundancy, and enhance the overall quality and cohesiveness of CDSiC resources.

Continue to monitor the evolving PC CDS landscape. Staying informed about recent policy and technical developments in the PC CDS landscape helped the CDSiC contextualize and leverage the innovative work of other PC CDS experts. The CDSiC project team kept abreast of relevant publications and topics such as AI, Fast Healthcare Interoperability Resources (FHIR), and PC CDS standards. By monitoring the evolving landscape, the CDSiC expanded products to address emerging areas such as AI, real-world implementation of PC CDS, incorporating SDOH information, and assessing the value proposition for PC CDS.

Carefully engage and select potential pilot sites. Innovation Center activities highlighted the importance of carefully selecting pilot sites and better understanding health system capabilities to participate in pilot projects. To engage health system sites, the CDSiC aligned projects with health system priorities, increasing their willingness to invest time and resources. Overall, the CDSiC team had to be flexible and adaptable to accommodate the varying priorities and constraints of the selected health system partners, which helped to overcome challenges and ensure smooth pilot execution.

Stakeholder Engagement

Grow the breadth and diversity of the CDSiC community through product development and dissemination beyond existing networks. We learned that engaging a wider group of experts, patients, and patient advocates through focus groups, roundtables, and KIs significantly increased awareness of CDSiC efforts and resources. The CDSiC team learned that participation in discrete qualitative activities can lead to increased engagement and involvement with the CDSiC community, as several key informants, for example, then participated virtually in the CDSiC Annual Meeting. During Year 3, we also leveraged broader expertise through outreach to the networks of Steering Committee members and Workgroup leads. They suggested stakeholders to engage with, resulting in more diverse perspectives. This year, we expanded stakeholder engagements across the CDSiC, reaching to a total of 118, up from 93 last year. Notably, we engaged 102 unique individuals over the past year. Additionally, most experts engaged in Year 3 Workgroup activities were new (with an ~11% repeat rate), and there was increased input from patient, payer, and industry stakeholders. Additionally, the CDSiC presented work

beyond the CDSiC community to widen dissemination, including at Health Level Seven (HL7) and American Medical Informatics Association (AMIA) CDS workgroups.

Engage patient partners meaningfully and intentionally. Advancing the field of PC CDS requires that patients be involved in all stages of the PC CDS lifecycle. In Year 3, the CDSiC team prioritized the inclusion of patient voices in PC CDS outputs to incorporate their needs, values, and preferences in a meaningful way in product development. As a result, we engaged twice as many (n=26) patient partners compared to the project's first two years (n=10) for Workgroup products. Other patient engagement efforts included featuring a dedicated panel discussion at the CDSiC Annual Meeting, a poster for a CDSiC product at the Patient Insight Congress, and developing a collaborative blog post with patient partners.

Strategies for Operating a Successful Collaborative With Diverse Stakeholders

The CDSiC team identified the following important lessons for supporting this multi-stakeholder collaborative:

Ensure tight project management, adhere to timelines given the volume of products, and practice effective engagement of Workgroup leads and Workgroups. Effective and agile project management were critical to developing 11 Workgroup products in Year 3. The CDSiC team employed several tactics to ensure high-quality products were delivered on time, including maintaining detailed timelines and conducting regular internal check-ins; consultations and asynchronous reviews with Workgroup leads; seeking asynchronous feedback from Workgroup members; and working closely with AHRQ to coordinate product review and finalization. Consistent interaction and engagement created a forum to discuss findings and results; gather feedback from Workgroup leads and members; resolve issues; and keep all parties actively involved in shaping final PC CDS products.

Deploy multifaceted strategies for sustained CDSiC stakeholder engagement. As in previous years, consistently engaging Workgroup members proved challenging due to the voluntary nature of their involvement, competing demands, and limited availability. Throughout Year 3, the CDSiC team used strategies to improve engagement, including sending discussion questions before meetings to facilitate constructive feedback during meetings, providing updates, and seeking asynchronous feedback on products between meetings. The CDSiC team also worked to promote and sustain long-term engagement with Steering Committee members, the majority of whom have been involved since the project's launch in 2021. The CDSiC team successfully employed engagement strategies, including incorporating external presentations into Steering Committee meetings and facilitating members to share their CDS-related work for feedback from fellow members.

Conclusion

Dedicated to advancing PC CDS through innovation and collaboration, the CDSiC in Year 3 produced 11 public-facing products and six deliverables across four projects. The CDSiC engaged 102 unique experts through a total of 118 engagements (e.g., interviews, roundtables, and co-design sessions) and disseminated findings widely via scientific journals, conferences, and the CDSiC website.

By creating accessible resources and serving as a hub for innovation, the CDSiC continues to catalyze new PC CDS developments. To that end, the CDSiC explored critical topics such as the integration of SDOH data, transparent AI use to scale PC CDS, and expanding PC CDS beyond initial trials to establish robust implementation practices.

Looking ahead, the CDSiC remains dedicated to staying at the forefront of PC CDS innovation. By fostering ongoing engagement with patients, clinicians, researchers, developers, payers, and federal agencies, the CDSiC aims to identify more opportunities to advance PC CDS and address gaps in the evidence base. The goal is to continue refining practical resources and guidance for PC CDS and to facilitate widespread adoption of these tools to enhance patient health outcomes across health care settings.

1. Introduction

The Clinical Decision Support Innovation Collaborative (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. This report presents an overview of the activities, outputs, and impact from the third year (September 2023 – September 2024) of the CDSiC.

1.1 Background and Context

The field of CDS continues to advance rapidly, and technology has empowered consumers to engage more actively in their health care. However, to deliver on the promise of higher quality care and improved health outcomes, CDS must provide patients, caregivers, and care teams with the right information, in the right formats, through the right channels, at the right times.^{1,2} PC CDS encompasses a spectrum of decision-making tools that significantly incorporate patient-centered factors related to knowledge, data, delivery, and use. Knowledge refers to the use of comparative effectiveness research (CER) or patient-centered outcomes research (PCOR) findings. Data focuses on the incorporation of patient-generated health data, patient preferences, social determinants of health (SDOH), and other patient-specific information. Delivery refers to directly engaging patients and/or caregivers across different care settings. Finally, use focuses on facilitating bi-directional information exchange in support of patient-centered care, including shared decision making.³

In 2016, the Agency for Healthcare Research and Quality (AHRQ), through the PCOR Trust Fund, launched a multicomponent Initiative to advance the implementation of PCOR into practice through CDS.⁴ This included funding a learning network, targeted CDS research, the CDS Connect platform,⁵ the CEPI Evidence Discovery And Retrieval application programming interface (CEDAR API) for accessing AHRQ resources,⁶ and conducting an evaluation of the overall Initiative.⁷ The knowledge gained from this Initiative highlighted the need for more evidence and resources to help translate PC CDS into practice. The AHRQ-funded CDSiC builds on AHRQ's prior work to serve as a hub for stakeholder engagement to advance the field of PC CDS.⁸

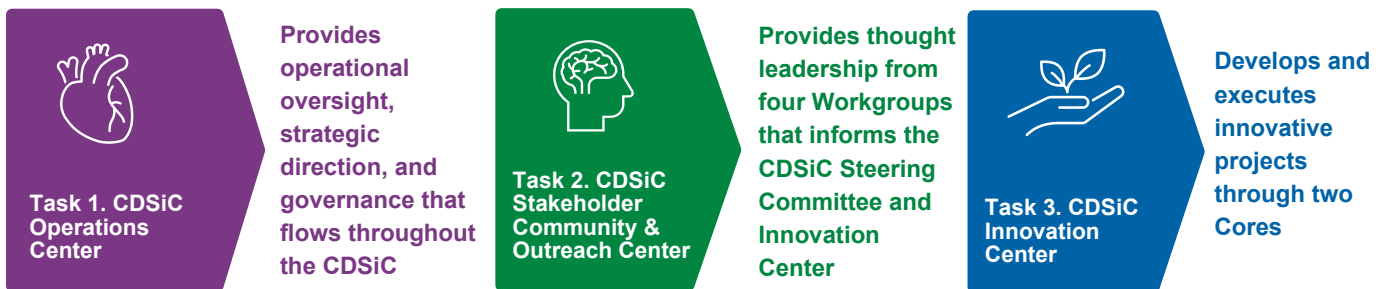
1.2 Purpose of the CDSiC

Launched in 2021, the CDSiC is a diverse community of stakeholders at the forefront of using technology to better support care teams, patients, and caregivers. Stakeholders include clinicians, PC CDS researchers, PC CDS content developers, electronic health record (EHR) developers, app developers, device and wearable manufacturers, health information technology (IT) standards developers, policymakers, patients/caregivers, and payers. The CDSiC aims to better understand what makes CDS patient-centered by serving as a proving ground of innovation for PC CDS concepts and creating resources to support the design, development, testing, implementation, tracking, measurement, and dissemination of PC CDS in the real world. The CDSiC aspires to shape the future of PC CDS by identifying gaps and opportunities to achieve a world in which patients, caregivers, and care teams receive evidence-based information to support shared decision making.

1.3 Design of the CDSiC

The CDSiC in Year 3 continued to be organized into four tasks: 1) governance and operations, 2) stakeholder collaboration, 3) PC CDS research initiatives, and 4) overall CDSiC project management. The CDSiC is strategically organized into three centers—the Operations Center, the Stakeholder Community and Outreach Center, and the Innovation Center—that emphasize patient-centeredness (Exhibit 1).

Exhibit 1. The CDSiC's Three Centers



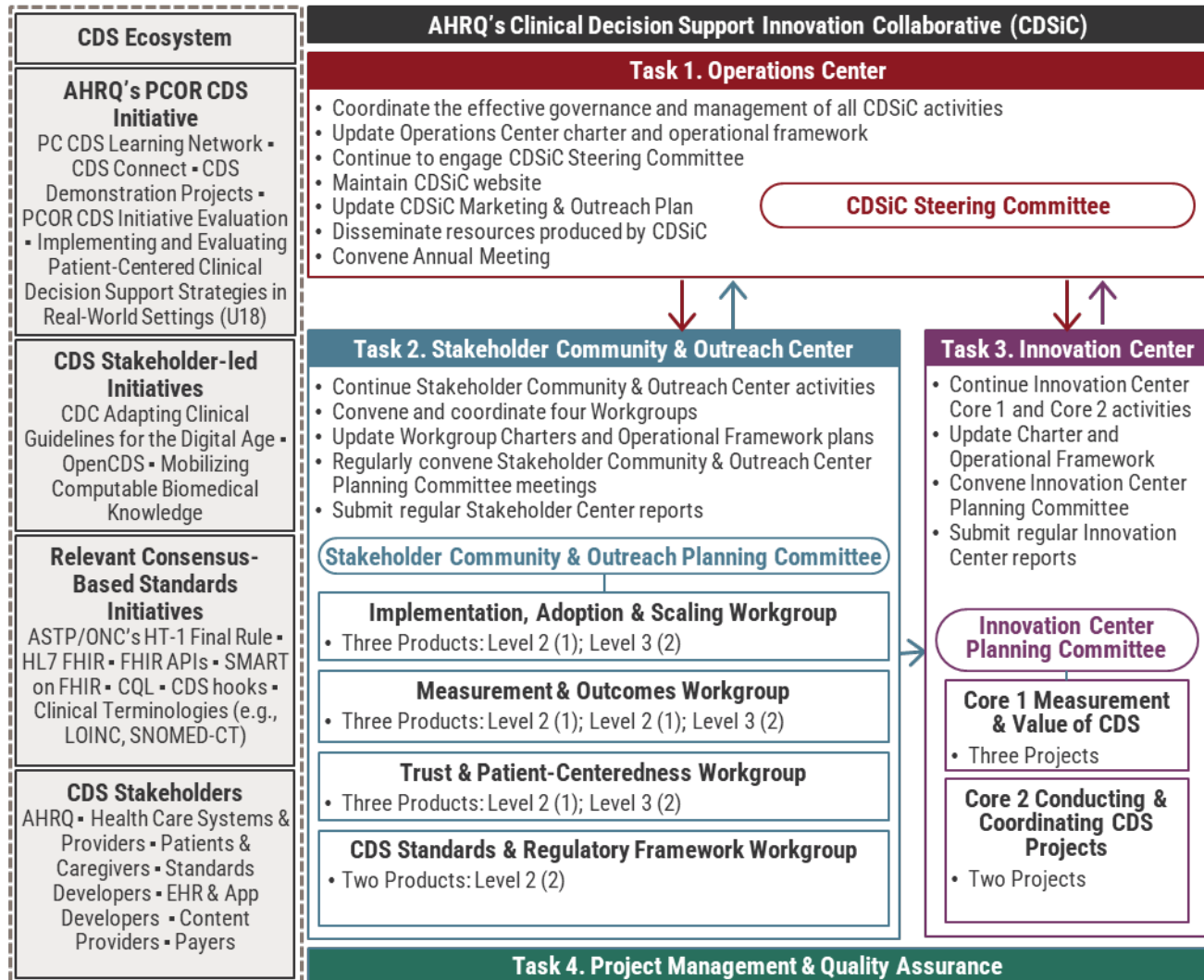
- The Operations Center is the heart of the CDSiC and is instrumental in shaping the CDSiC's strategic direction, disseminating findings, and advancing the field of PC CDS. The Operations Center also houses a Steering Committee of nationally recognized multidisciplinary experts who advise and inform the CDSiC's vision.
- The Stakeholder Community and Outreach Center (Stakeholder Center) provides thought leadership for the CDSiC, drawing from the expertise of a range of stakeholders, including patients, clinicians, researchers, health IT and CDS developers, informaticians, payers, and policymakers. These stakeholders are organized in four topic-focused Workgroups that were updated in Year 3 to include: 1) Implementation, Adoption, and Scaling of CDS; 2) Measurement and Outcomes of CDS; 3) Trust and Patient-Centeredness; and 4) CDS Standards and Regulatory Frameworks. These Workgroups develop products such as environmental scans, research agendas, and frameworks that advance the field of PC CDS.
- The Innovation Center is the CDSiC's research and development hub that facilitates real-world application of CDSiC tools, learnings, and insights. The Innovation Center has two Cores: 1) the Measurement and Value of CDS Core and 2) the Conducting and Coordinating CDS Projects Core.

1.4 Collaboration and Alignment Across Centers

Through coordinated activities, the centers seek to strategically advance and innovate PC CDS in a manner reflecting stakeholder needs and priorities. CDSiC products and activities were designed so Workgroup and Core activities contribute to the larger objective of advancing PC CDS to facilitate shared decision making and patient-centered care. In doing so, the impact of the whole (i.e., CDSiC) was envisioned to be greater than the impact of the constituent parts (i.e., each Workgroup and Core). While the day-to-day operations and governance of each center function somewhat independently, they

are ultimately linked, forming an integrated, collaborative network of tasks and deliverables. Exhibit 2 illustrates the CDSiC’s technical approach to governance and synergy across all components.

Exhibit 2. Overview of CDSiC Organizational Structure



Abbreviations: API, Application Programming Interface; CDS, Clinical Decision Support; CQL, Clinical Quality Language; EHR, Electronic Health Record; FHIR, Fast Healthcare Interoperability Resources; HL7, Health Level Seven; LOINC, Logical Observation Identifiers Names and Codes; ASTP/ONC, The Office of the National Coordinator for Health Information Technology; PCOR, Patient-Centered Outcomes Research; SNOMED-CT, Systemized Nomenclature of Medicine – Clinical Terms

1.5 Goals for the CDSiC’s Third Year (2023 – 2024)

In the first two years, the CDSiC established an operational infrastructure, engaged CDS stakeholders, established and convened a Steering Committee and four Workgroups, and developed and disseminated several resources. Details of previous CDSiC accomplishments during first two years of operation have been published previously.⁹ In 2023-24, the CDSiC continued to support AHRQ in developing, adopting, implementing, and evaluating the use of PC CDS through the following goals:

- Build on the foundation and momentum of the CDSiC’s first two years (2021 – 2023).
- Effective ongoing management and collaboration among the three CDSiC centers.
- Sustain and broaden stakeholder engagement.
- Conduct more meaningful patient engagement.
- Move to more field-based PC CDS implementation.
- Ensure effective dissemination of CDSiC products to date.

The CDSiC’s third year was informed by the first CDSiC Annual Meeting in May 2023, which was attended by 73 CDS stakeholders, with approximately 90% in-person and 10% virtual. During the meeting, numerous opportunities to advance delivery of PC CDS were identified, including creating meaningful feedback loops for patient-contributed data, developing new workflows for incorporation of patient preferences and goals into decision making, expanding the evidence base of PC CDS, and adapting the CDS five rights (the right information, people, formats, channels, and timing of CDS) for the patient perspective. Participants also suggested developing resources to support collection and use of SDOH data in PC CDS, gathering patient and physician perspectives on the use of AI, and identifying opportunities to scale PC CDS within and across health systems. These identified opportunities shaped the strategic focus for CDSiC’s third year.

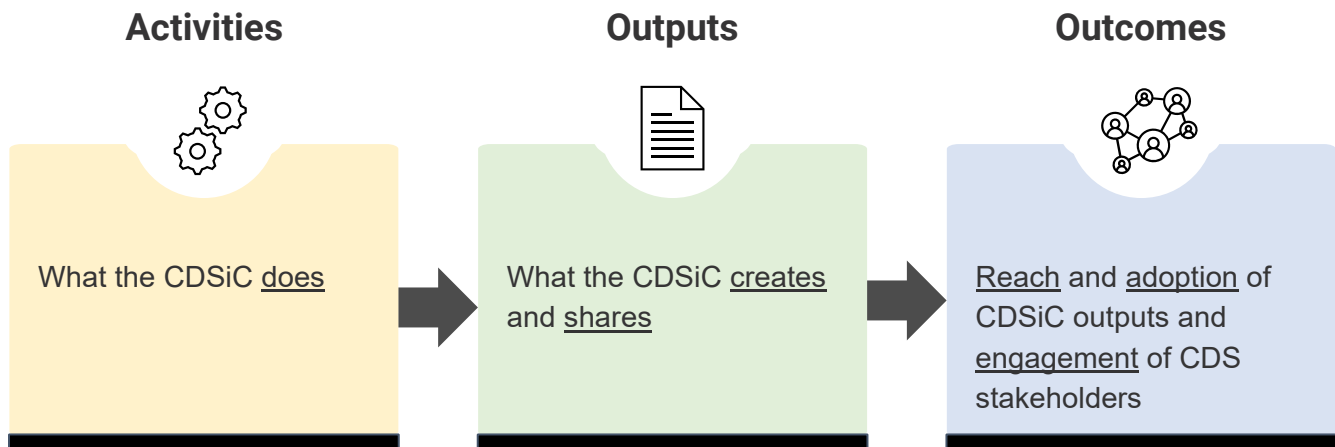
1.6 Roadmap of Report

This report summarizes and reflects on CDSiC activities and accomplishments during Year 3. Section 2, *Methods*, summarizes the performance assessment framework used to develop and organize the report, as well as the report’s data sources. Section 3, *Results*, presents CDSiC activities and accomplishments, organized across the CDSiC’s three centers. Section 4, *Discussion*, describes the lessons learned from the third year of the CDSiC, including the CDSiC’s strategies for successfully engaging and collaborating with a broad range of stakeholders contributing diverse perspectives on CDS.

The intended audience for this report includes PC CDS developers, researchers, informaticians policymakers, patients/caregivers, and others involved in advancing both the evidence base and practice of PC CDS and who are interested in learning about and tracking CDSiC’s key activities, accomplishments, and lessons learned.

2. Methods

To track the CDSiC’s progress and accomplishments, a performance assessment framework was developed in the first year of the project using a program evaluation approach.¹⁰ The framework includes three sequential domains, illustrated in the logic model in Exhibit 3. The performance assessment framework was reviewed and updated by project leadership and the Steering Committee in 2023. The updated performance assessment framework is provided in Appendix A.

Exhibit 3. Logic Model Used to Develop the CDSiC Performance Assessment Framework

Activities refer to the actions carried out in the day-to-day implementation of the CDSiC, including the maintenance of CDSiC infrastructure and sustainment of the CDSiC’s centers and committees. Outputs refer to products of CDSiC activities, including written reports and resources as well as dissemination to share this work. Outcomes refer to the engagement of the CDS stakeholder community and the reach and adoption of CDSiC outputs, as well as the broader awareness of PC CDS.

The project team routinely collected data as a byproduct of project activities. Data sources for the CDSiC performance assessment included website, newsletter, and social media analytics; program administrative documents and meeting attendance rosters; feedback from 2024 CDSiC Annual Meeting attendees; and qualitative feedback from stakeholders (e.g., emails, social media posts).

The CDSiC performance assessment framework serves as an organizing structure for this Period of Performance Report. In the following sections, we describe CDSiC activities during Year 3, as well as products developed through CDSiC activities (i.e., outputs), and the reach and adoption of these outputs (i.e., outcomes), based on the data available at the time of publication.

3. Results

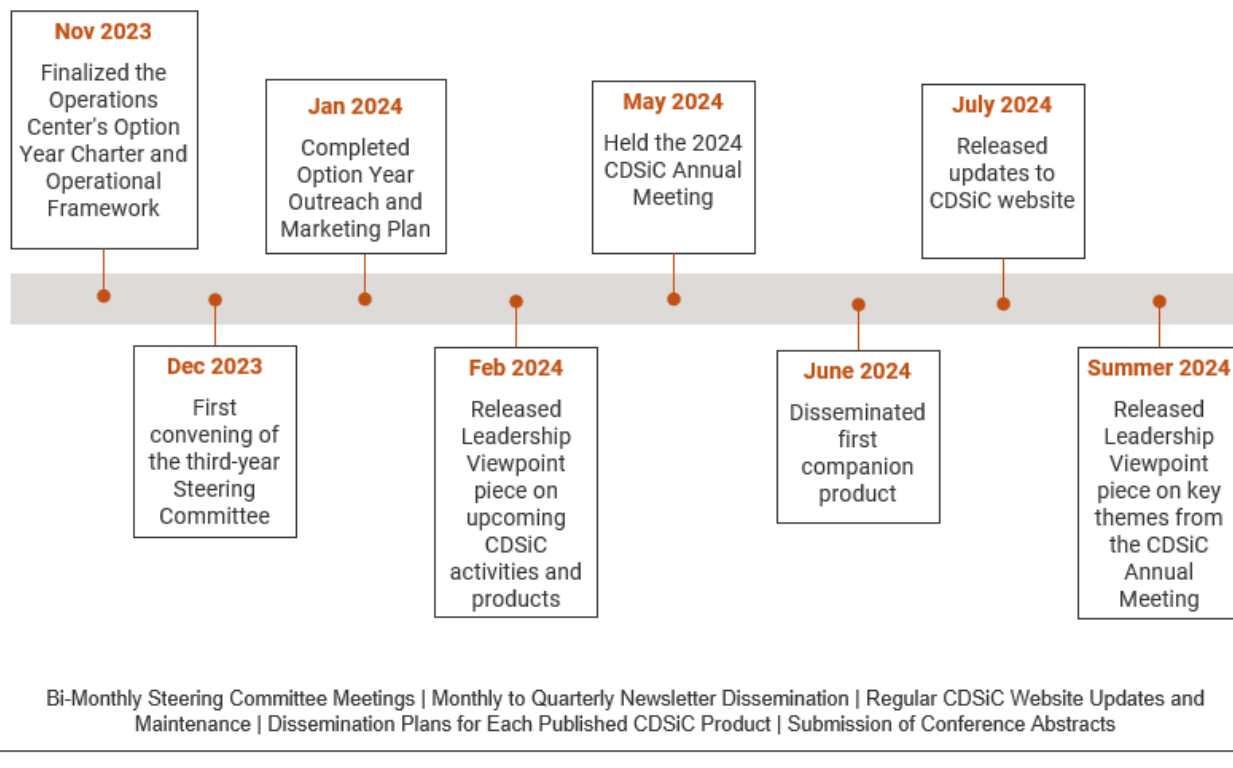
The collective activities of the CDSiC are guided by the project’s Vision and Mission statements,¹¹ which describe what the CDSiC hopes to achieve (Vision) and what the CDSiC will do to achieve this vision (Mission). The Vision and Mission statements were reviewed with the Steering Committee in 2023-24, and there was broad agreement that no updates were needed.

CDSiC activities and accomplishments in Year 3 are presented below. The activities, outputs, and outcomes are presented below by task (i.e., the three centers—Operations, Stakeholder, and Innovation), followed by a description of outcomes that transcend tasks and reflect the totality of the CDSiC initiative.

3.1 Task 1: Operations Center

In 2023-24, the Operations Center continued to support essential daily CDSiC activities and play a crucial role in shaping the CDSiC’s strategic direction, raising awareness of CDSiC efforts and disseminating findings, and advancing the field of PC CDS. Operations Center activities are described below, followed by the outputs and outcomes stemming from these activities. Section 3.1.3 summarizes challenges experienced over the course of this work and strategies for resolution. Exhibit 4 provides key milestones and major ongoing activities of the Operations Center between October 2023 and September 2024.

Exhibit 4. Overview of Operations Center Activities and Timeline



3.1.1 Operations Center Infrastructure and Activities

Since its launch in October 2021, the Operations Center has served as the operational foundation of CDSiC activities and has led Steering Committee engagement, the Annual Meeting, and dissemination activities. In the project’s third year, the Operations Center updated its Charter and Operational Framework (finalized November 2023), revised the CDSiC Outreach and Marketing Plan (finalized January 2024), and maintained a CDSiC SharePoint site. The Operations Center also supported and sustained the CDSiC’s Steering Committee and held quarterly meetings. These activities are described in more detail below.

Charter and Operational Framework

CDSiC leadership developed the Operations Center Charter to formally initiate the third-year work of the Operations Center.¹² This Charter outlines the Operations Center’s purpose and objectives, as well as the outputs and projected outcomes of center activities, potential challenges, relevant stakeholders involved in center work, and decision-making frameworks. CDSiC leadership also produced an updated Operations Center Operational Framework to establish the center’s structure, functions, goals, and processes related to center core activities, including dissemination, stakeholder coordination, and strategic planning, in the project’s third year.¹³ The Operations Center Charter and Operational Framework are both available for reference on the CDSiC’s SharePoint and public CDSiC website.

Charter and Operational Framework Produced

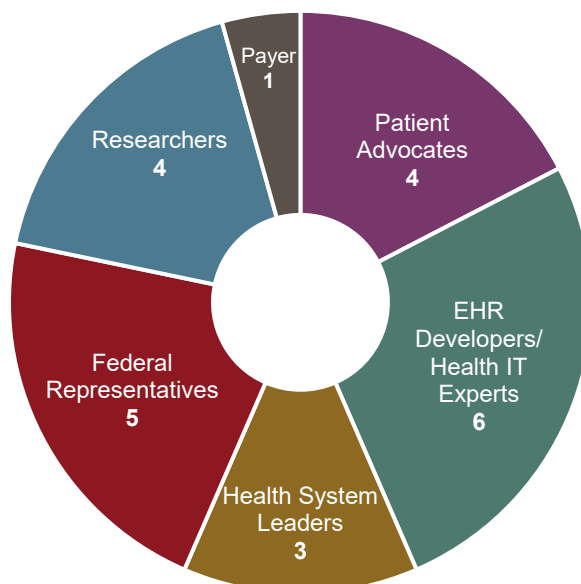
- Operations Center Charter
- Operations Center Operational Framework

Steering Committee

The CDSiC is guided by a 23-member Steering Committee that serves to advise, support, and guide the project’s activities and strategic vision. The Steering Committee was first formed in November 2021, soon after the project’s launch. In preparation for the project’s third year, in September 2023, the CDSiC team conducted outreach to existing Steering Committee members to confirm their willingness to participate for another year. Most Steering Committee members chose to continue their involvement. CDSiC leadership also invited two stakeholders, who previously served as Workgroup leads, to join the Steering Committee.

The Steering Committee is comprised of experts representing a range of disciplines and stakeholder groups, including patient advocates, EHR developers and health IT experts, payers, health system leaders, researchers, and federal representatives (Exhibit 5).

Exhibit 5. Composition of the CDSiC Steering Committee



Since October 2023, CDSiC leadership has organized five Steering Committee meetings, with the first Steering Committee meeting of Year 3 held in December 2023. Each two-hour, virtual Steering Committee meeting serves as an opportunity to share critical project updates, receive feedback on CDSiC activities, and feature presentations relevant to the CDS community. The meetings were well attended, with an average of 18 Steering Committee members attending each meeting. Exhibit 6 provides a description of Steering Committee meeting topics and attendance.

Exhibit 6. Steering Committee Meetings, Topics, and Attendance

Meeting Date	Meeting Topics	Steering Committee Member Attendance
December 6, 2023	<ul style="list-style-type: none"> • Review of Steering Committee roles and responsibilities • Discussion of proposed Year 3 Workgroup and Innovation Center products • Preview of Year 3 dissemination approach • Update on 2024 CDSiC Annual Meeting planning 	18
February 6, 2024	<ul style="list-style-type: none"> • Steering Committee member presentations on how EHR vendors are collecting and incorporating patient preferences in PC CDS • Discussion of proposed 2024 CDSiC Annual Meeting sessions and speakers • Updates on Year 3 dissemination activities • Stakeholder Center and Innovation Center progress updates 	17
March 26, 2024	<ul style="list-style-type: none"> • External stakeholder presentation on the use of SDOH data in CDS • External stakeholder presentation on payer involvement in PC CDS • Review and discussion of the CDSiC performance assessment framework • Update on 2024 CDSiC Annual Meeting planning activities 	21
<i>Note: A Steering Committee meeting was not held in May 2024 due to the 2024 CDSiC Annual Meeting.</i>		
July 17, 2024	<ul style="list-style-type: none"> • External stakeholder presentation on efforts to use AI to support clinical decision making • Recap and discussion of 2024 CDSiC Annual Meeting • Review and discussion of potential future topics for the Stakeholder Center and Innovation Center to explore 	17
September 18, 2024	<ul style="list-style-type: none"> • Review of Year 3 accomplishments • Preview of Year 4 activities 	19

CDSiC Outreach and Marketing Plan

The CDSiC’s marketing and outreach activities are guided by a multifaceted, comprehensive, and strategic Outreach and Marketing Plan that was approved by AHRQ’s Office of Communications (OC) in January 2024. The key objectives of the plan are to: 1) increase the visibility of the CDSiC; 2) position the effort as a trusted information source that increases uptake of CDSiC products and findings; and 3) enable bidirectional engagement of diverse stakeholders. The plan identifies and describes key target audiences—including clinicians and health care system stakeholders, researchers, CDS and health IT developers, patients, families and advocates, payers, and policymakers—as well as provides details about the processes and mechanisms guiding outreach and marketing efforts.

Activities in Year 3 built on the success of the project’s first two years. Initial activities in Year 3 focused on repackaging currently available products by developing a suite of companion products. These companion products are described in detail in Section 3.2.2. As new products became available for promotion, the team coordinated closely with AHRQ’s Office of Communications on each product dissemination campaign. Exhibit 7 summarizes the channels and formats used for outreach and marketing throughout the project’s third year.

Exhibit 7. Summary of Channels and Formats Used for CDSiC Outreach and Marketing

Channels <i>How Content Arrives to the Audience</i>	Formats <i>What Form the Content Takes</i>
<ul style="list-style-type: none"> • AHRQ CDSiC website • CDSiC SharePoint • Newsletters <ul style="list-style-type: none"> – AHRQ Digital Healthcare Research electronic newsletter with 130,000 subscribers – AHRQ CDSiC Insider Newsletter distributed bimonthly to over 580 subscribers • Social media including @AHRQNews and other stakeholder accounts on LinkedIn and Facebook • Amplifier networks <ul style="list-style-type: none"> – Steering Committee – Workgroup leadership and members – Innovation Center Planning Committee – AcademyHealth – NORC Health Implementation Science Center • Events and conferences <ul style="list-style-type: none"> – AMIA Annual Symposium – Mobilizing Computable Biomedical Knowledge (MCBK) North America Meeting – CDSiC Annual Meeting – ONC Tech Forum webinars – AcademyHealth Annual Research Meeting – Society for Medical Decision Making Annual Meeting 	<ul style="list-style-type: none"> • Published reports • Conference panels • Conference posters • Leadership Viewpoint piece • Peer-reviewed manuscript • Infographic • Chart book • Factsheet

Channels <i>How Content Arrives to the Audience</i>	Formats <i>What Form the Content Takes</i>
<ul style="list-style-type: none"> • Technical Working Group Meetings <ul style="list-style-type: none"> - HL7 CDS Workgroup - AMIA CDS Workgroup • External Outlets <ul style="list-style-type: none"> - The National Patient Advocate Foundation’s Patient Voices Blog • Journals <ul style="list-style-type: none"> - <i>Journal of American Medical Informatics Association (JAMIA)</i> - <i>JAMIA Open</i> - <i>Learning Health Sciences</i> - <i>Applied Clinical Informatics</i> 	

SharePoint Development

The CDSiC SharePoint site, launched in August 2022, continues to serve as a platform for collaborative document editing for the Workgroups, Steering Committee, and Innovation Center. A total of 136 individuals, including all Workgroup, Steering Committee, and Innovation Center members and NORC and AcademyHealth project staff, have access to the SharePoint and permission to edit relevant documents posted there.

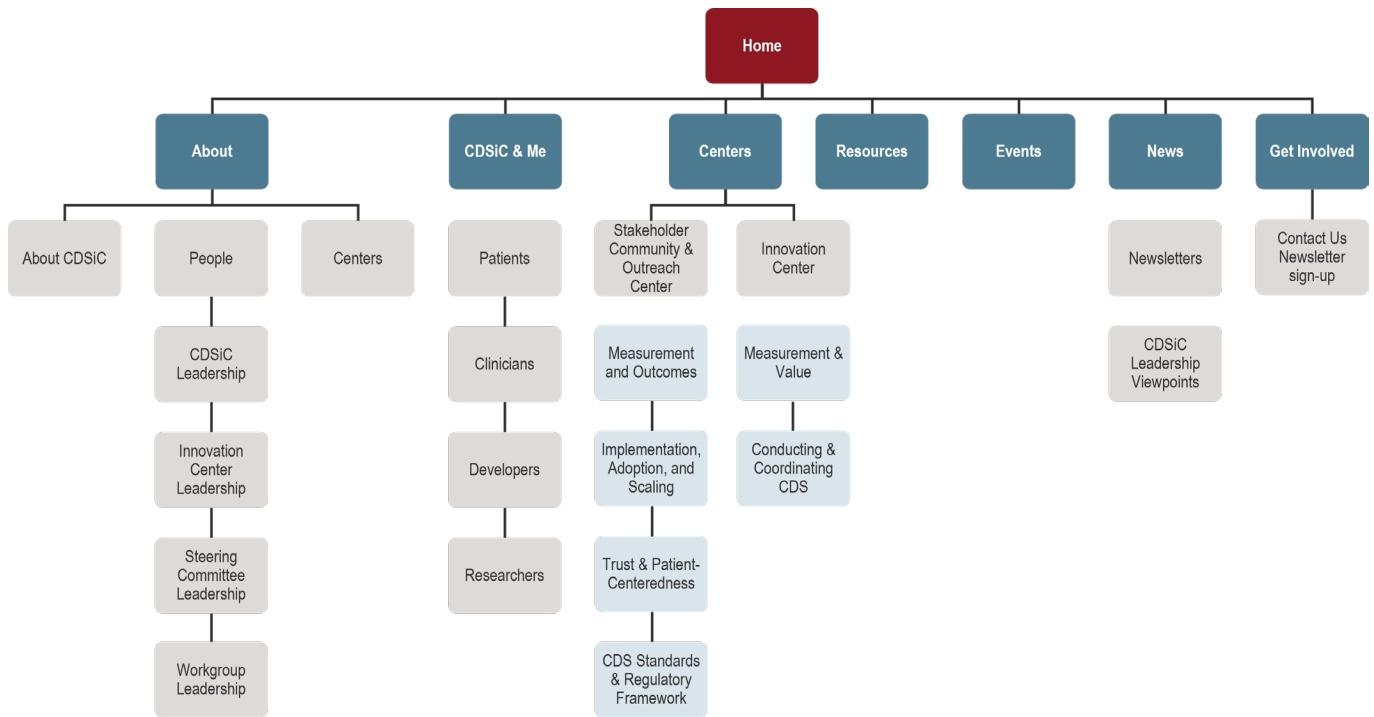
The SharePoint site is organized into three distinct spaces focused on the work of the Steering Committee, Stakeholder Center, and Innovation Center. It enables CDSiC members to efficiently find the content most relevant to their efforts, including meeting materials, reports, and products.

CDSiC members actively use the SharePoint site to review and refine project materials. Documents added to the SharePoint site for collaboration include meeting materials for all three centers, presentation slides for each of the 2024 CDSiC Annual Meeting’s nine sessions, draft iterations of all Innovation Center projects and Workgroup products, and drafts of each CDSiC center’s charter.

Website Maintenance

The [CDSiC project website](#) has undergone several enhancements to optimize its visual appearance, functionality, and resource library navigation. The project website continues to feature information on the project’s aims, leadership, and structure; pages describing the CDSiC’s relevance to patients, clinicians, developers, payers, and researchers; descriptions of the purpose and activities of each of the project’s centers; Leadership Viewpoint pieces and project resources; announcements of upcoming events and other news; and a “Get Involved” page that encourages individuals to sign up for the AHRQ CDSiC Insider newsletter or reach out to the project team. Exhibit 8 depicts the current site map of the CDSiC website.

Exhibit 8. Site Map of CDSiC Website



There have been several updates to the website during this period. Exhibit 9 provides a description of these updates.

Exhibit 9. Website Updates

Enhancement	Description
Tagging taxonomy	<ul style="list-style-type: none"> 20 terms that describe the topic of the product and 10 terms that indicate the type of product available on the website. Each new product posted to the website is given at least five descriptive tags and one product type tag. The five Leadership Viewpoint pieces, seven manuscripts, 19 progress reports, and 20 Stakeholder Workgroup products in the resource library have been tagged using this taxonomy of terms.
Resource library sorting and filtering engagements	<ul style="list-style-type: none"> Users can filter resources on the website by publication date, title, and topic area. They can also search for resources using a keyword search.
Homepage	<ul style="list-style-type: none"> Updated to be more inviting and dynamic. This page has an interactive scrolling “hero” banner that features up to four new products. The homepage is now editable by all content editors, enabling us to update the resources featured on the page regularly as new resources are published.

Enhancement	Description
“Get Involved” pop-up invitation	<ul style="list-style-type: none"> There is a pop-up invitation when a new visitor navigates to the website, inviting them to sign up for the AHRQ CDSiC Insider newsletter.
Newsletters page	<ul style="list-style-type: none"> A Newsletters page has been added to the website containing all past issues of the AHRQ CDSiC Insider newsletter.
Stakeholder Community & Outreach Center and Innovation Center Landing Pages	<ul style="list-style-type: none"> An accordion feature has been added to both landing pages to allow users to collapse and expand resources by Workgroup, year, and resource type. This feature is editable by all content editors.

Resources in the website library include finalized CDSiC products and reports, peer-reviewed manuscripts produced by the CDSiC, center charters and operational frameworks, infographics, and vignettes. Exhibit 10 provides the count of different types of resources on the CDSiC website as of July 9, 2024. Resources will continue to be added to the website as they are finalized.

Exhibit 10. CDSiC Website Resources by Type

Resource Type	Number
Links to Peer-Reviewed Manuscript	7
Vignettes and Leadership Viewpoints	6
CDSiC Charters and Operational Frameworks	22
Stakeholder Center Workgroup Products	20
Stakeholder Center Quarterly Reports	9

3.1.2 Operations Center Outputs and Outcomes

This section provides an overview of Operations Center outputs, such as the 2024 Annual Meeting, the AHRQ CDSiC Insider newsletter, companion products, social media posts, and Leadership Viewpoint pieces, as well as the reach of these outputs and associated engagement of the CDS community.

CDSiC Annual Meeting

The second CDSiC Annual Meeting took place May 14, 2024, at AHRQ headquarters in Rockville, Maryland. The meeting served as an opportunity for stakeholders to learn about the CDSiC’s innovative work to advance the field PC CDS and participate in critical discussions to determine the most effective future directions for the project. The meeting was organized around the theme of “Building on a Strong Foundation to Reach New Heights: How can we chart a path forward for PC CDS?” It featured nine

sessions on a range of relevant topics, including the use of AI in PC CDS, efforts to measure and improve PC CDS, and patient advocate perspectives on the current and future work of the CDSiC.

A total of 85 attendees joined the Annual Meeting, most in person and some virtually. In addition to plenary sessions, attendees also participated in an in-depth discussion session where they explored return on investment (ROI) for PC CDS. Exhibit 11 below describes each Annual Meeting session.

Exhibit 11. Annual Meeting Sessions

Session Type	Session Topic
Opening Plenary	Grounding presentation that welcomed meeting participants and provided an overview of the CDSiC's third-year focus, accomplishments since the 2023 Annual Meeting, and the meeting's goals
Exploration of the Use of AI in PC CDS	Moderated panel on the CDSiC's AI-focused efforts
Keynote Presentation	Keynote presentation by Dr. Catina O'Leary of Health Literacy Media
Updates from Food and Drug Administration (FDA) and ASTP/ONC	Presentations on federal agency updates relevant to PC CDS, including highlights of the new Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing (HTI-1) Final Rule from ASTP/ONC and an overview of the latest FDA guidance applicable to health care AI tools
Remarks from Dr. Robert Valdez	Brief remarks from AHRQ Director Dr. Robert Valdez
Measuring and Improving PC CDS	A series of presentations highlighting CDSiC work on a range of cutting-edge topics, including the real-world performance measurement of PC CDS, patient preference measurement tools, and override reasons for PC CDS recommendations
Patient Roundtable Discussion	A moderated roundtable discussion on PC CDS with patients and patient advocates
Examining ROI for PC CDS	An interactive session that began with a brief presentation on CDSiC efforts to examine ROI for PC CDS, followed by a moderated in-depth discussion with all participants about opportunities and approaches to demonstrate ROI for PC CDS
Closing Remarks	Brief remarks closing the Annual Meeting

All Annual Meeting attendees received a brief, nine-question meeting evaluation survey. The survey received 22 responses for a response rate of 31%. Key takeaways from the survey are listed in Exhibit 12.

Exhibit 12. Key Takeaways from Annual Meeting Evaluation Survey Results

Overall Satisfaction	Relevance	Most Impactful Session
<ul style="list-style-type: none"> • 90% of respondents indicated they were “very satisfied” with the meeting session topics 	<ul style="list-style-type: none"> • 82% of respondents indicated that the meeting was “very relevant” to them 	<ul style="list-style-type: none"> • Examining ROI for PC CDS was selected as the most impactful session

Following the Annual Meeting, the CDSiC leadership team reviewed meeting notes and identified key themes that emerged from discussions, including advancing PC CDS through real-world projects, exploring new topics to promote meaningful patient engagement, building a value proposition for PC CDS, and understanding how PC CDS can leverage AI and maintain trust. These themes were summarized in a [Leadership Viewpoint piece](#) posted on the CDSiC website on September 18, 2024.

In addition to the Leadership Viewpoint piece, the CDSiC team developed a manuscript on the first CDSiC Annual Meeting, which took place in May 2023. The article shared seven key opportunities to advance PC CDS that emerged from discussions at the first CDSiC Annual Meeting: 1) establish feedback loops between patients and clinicians; 2) develop new workflows; 3) expand the evidence base; 4) adapt the CDS Five Rights for the patient perspective; 5) advance health equity; 6) explore perceptions on the use of AI; and 7) encourage widespread use and scalability of PC CDS. As of August 2024, the article is under review for publication in *JAMIA Open*.

The AHRQ CDSiC Insider Newsletter

The CDSiC newsletter, titled the AHRQ CDSiC Insider, serves as a mechanism for the CDSiC team to share project updates, as well as news relevant to the broader CDS community, including recent publications, upcoming conferences, and webinar opportunities. Since launching in June 2022, 20 newsletters have been disseminated. Popular content (content with higher click rates) often includes CDSiC-developed resources, such as infographics, manuscripts, and product announcements. In the project’s third year, the newsletter retained most subscribers with a net gain of 45 subscribers, bringing the newsletter circulation to 587. Subscribers largely include individuals who signed up initially using AHRQ’s Conference Management Application (CMA) webform, as well as individuals who joined the distribution list via the CDSiC website’s [“Get Involved”](#) form. Additionally, in December 2023, the CDSiC team collaborated with AHRQ to disseminate a CDSiC-focused edition of the AHRQ Digital Healthcare Research newsletter. Exhibit 13 lists each newsletter released in 2023-24, featured topics, and open rates (the percentage of successfully delivered newsletters that were opened by recipients). These open rates consistently met or exceeded the health care industry open rate of 34.6%.¹⁴

Exhibit 13. CDSiC Newsletter Topics and Open Rates

Month	Topics	Open Rate
October 2023	CDSiC's new efforts in 2023-24; announcement of CDS Standards and Regulatory Frameworks Workgroup's Improving Interoperability of Patient Apps with the Health IT Ecosystem and Advancing Standardized Representations for Patient Preferences to Support PC CDS products; CDSiC work featured at 2023 AMIA Annual Symposium; AHRQ Challenge Competition to advance CDS Connect; ASTP/ONC tech forum on CDS; new Stakeholder Center Quarterly Report	40%
November 2023	Announcement of Trust and Patient-Centeredness Workgroup's Methods for Involving End-Users in PC CDS Co-Design product; announcement of Scaling, Measurement, and Dissemination Workgroup's PC CDS Performance Measurement Inventory User Guide; CDSiC work featured at 2023 AMIA Annual Symposium; AHRQ Challenge Competition to advance CDS Connect; ASTP/ONC tech forum on CDS; new CDS-relevant publications	42%
December 2023	<i>AHRQ Digital Healthcare Research Newsletter</i> Overview of the CDSiC and review of CDSiC products that support stakeholders in understanding the foundations of PC CDS development, engaging patients throughout the PC CDS lifecycle, developing patient-facing PC CDS tools, and identifying measures to assess PC CDS impact	13%
February 2024	Announcement of CDSiC Base Period of Performance report; CDSiC leadership publication in <i>Applied Clinical Informatics</i> ; AHRQ-funded research published in <i>JAMIA Open</i> ; CDSiC work featured at 2023 AMIA Annual Symposium; Stakeholder Center and Innovation Center quarterly reports; AHRQ participation in the Healthcare Information and Management Systems 2024 Conference; AHRQ Challenge Competition to advance CDS Connect	59%
April 2024	Leadership Viewpoint on upcoming CDSiC products and projects; AHRQ notice of intent to publish funding opportunity for research on PC CDS	32%
June 2024	Announcement of the Overview of Standards for PC CDS factsheet; 2024 CDSiC Annual Meeting update; AHRQ's notice of request for information on CDS Connect; CDSiC work featured at AcademyHealth's Annual Research Meeting	37%
July 2024	Announcement of Measurement and Outcomes Workgroup's Inventory of Patient Preference Measurement Tools for PC CDS product; CDSiC leadership publication in <i>JAMIA</i> ; AHRQ funding opportunity for research on PC CDS; AHRQ's notice of request for information on CDS Connect	38%
August 2024	Announcement of Implementation, Adoption, and Scaling Workgroup's Landscape Assessment on the Use of Artificial Intelligence to Scale PC CDS product, CDS Standards and Regulatory Frameworks Workgroup's An Initial Taxonomy of Override Reasons for Patient-Centered Clinical Decision Support Recommendations, and Measurement and Outcomes Workgroup's Patient Prioritization of Measurement Areas for Patient-Centered Clinical Decision Support; AHRQ funding opportunity for research on PC CDS; update on the 2024 Mobilizing Computable Biomedical Knowledge (MCBK) Global Meeting; new CDS-relevant publications	41%

Companion Products

Companion products are micro-products that support the dissemination of an official CDSiC deliverable. Since a key objective for the project's third year was to increase the uptake of CDSiC outputs, the CDSiC team developed a suite of companion products to break down complex concepts into bite-size, shareable pieces tailored to specific audiences. Over the course of the project year, the following companion products were developed:

CDS Standards and Regulatory Frameworks Environmental Scan Factsheet

Derived from the Environmental Scan report¹⁵ developed by the CDS Standards and Regulatory Frameworks Workgroup, *An Overview of Standards for Patient-Centered Clinical Decision Support*¹⁶ is a two-page factsheet that summarizes the current state of available standards for the eight stages of the PC CDS technical landscape and identifies opportunities for further advancement. The factsheet was published on June 17, 2024, and distributed in the following day's edition of the AHRQ CDSiC Insider newsletter.

Patient Preferences Taxonomy Infographic

To increase awareness of the Outcomes and Objectives Workgroup's 2023 report, Taxonomy of Patient Preferences,¹⁷ among clinicians and health care providers, the CDSiC team developed an infographic¹⁸ outlining the six domains of patient preference information most relevant to PC CDS and four key considerations for collecting and incorporating patient preferences within PC CDS. The visual theme of a camera highlighted the need to bring the patient into focus by better understanding patient preferences. The infographic was published on the CDSiC website on September 20, 2024 and will be distributed via the AHRQ CDSiC Insider newsletter in October 2024.

Co-Design Chart Book

The goal of the *Involving End-users in Co-design of Patient-Centered Clinical Decision Support*¹⁹ chart book is to share information with CDS developers so they can better identify and use methods of co-design to advance PC CDS. In just 13 visually appealing pages, the chart book provides an overview of key takeaways from the Trust and Patient-Centeredness Workgroup's Methods for Involving End-Users in PC CDS Co-Design report.²⁰ The chart book was also published on the CDSiC website on September 20, 2024 and will be distributed via the CDSiC Insider newsletter in October 2024.

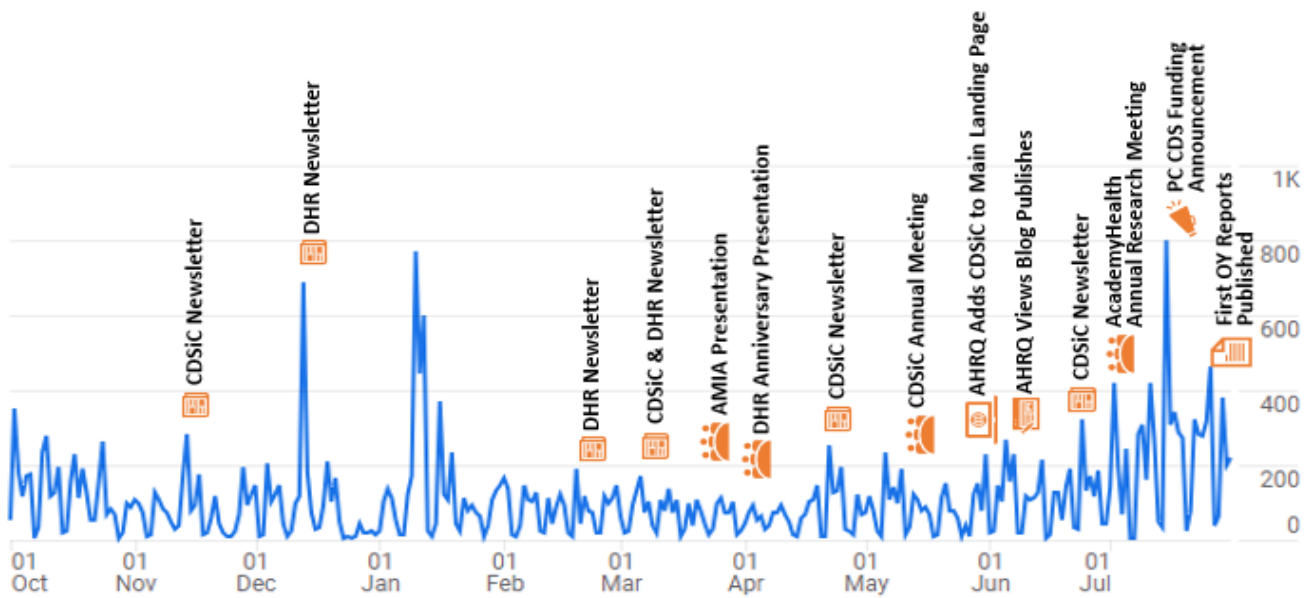
Patient Voices Blog Post

To support the goal of increased engagement with patient audiences, the CDSiC team worked with patient advocate members of the Steering Committee to develop a high-level introduction to PC CDS, the role it can play in supporting patient-centered care, and why it is relevant to patients. The blog will be submitted to the National Patient Advocate Foundation's (NPAF's) Patient Voices Blog for publication in fall 2024. The NPAF-hosted blog provides educational resources to help patients advocate for themselves and make informed, personalized health care decisions.

CDSiC Website Reach

From October 1, 2023, through July 31, 2024, the CDSiC website has been viewed more than 34,000 times by about 6,900 unique visitors. Traffic peaks (as shown in Exhibit 14) correspond with dissemination activities such as AHRQ CDSiC Insider newsletter distribution, meeting presentations, and ARHQ website updates. The CDS Standards and Regulatory Frameworks Workgroup’s Environmental Scan, the first Workgroup product released by the CDSiC, has been downloaded by 332 unique users. Additionally, 15 people have submitted “Get Involved” forms to date.

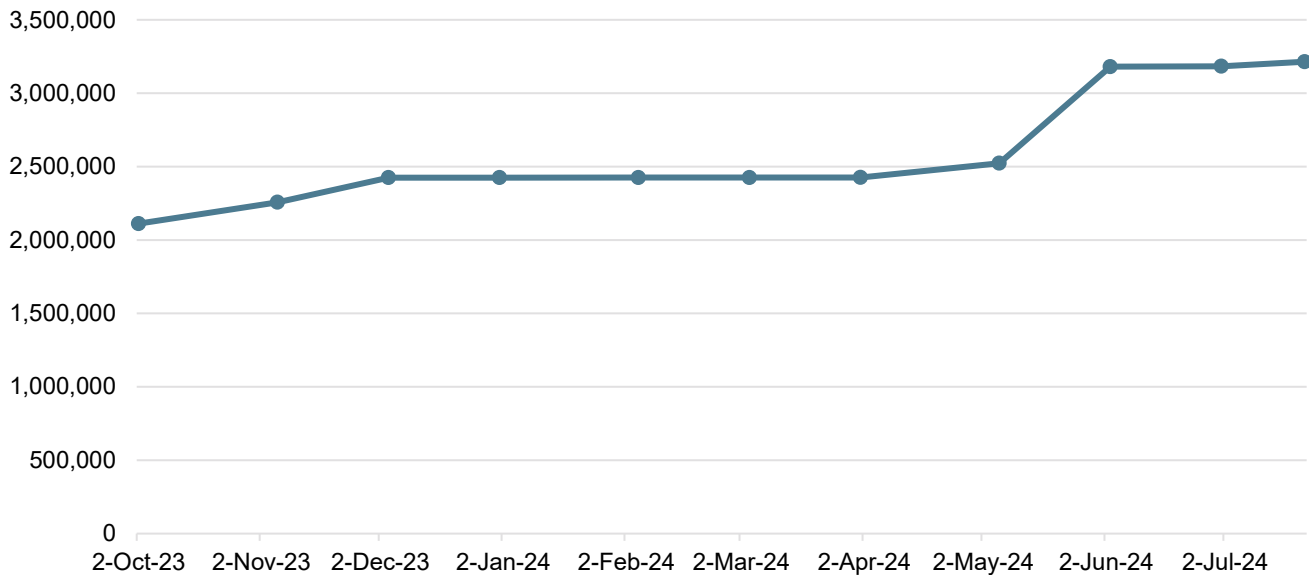
Exhibit 14. CDSiC Website Views, Oct. 1, 2023 – July 31, 2024



Social Media Posts

As outlined in the Outreach and Marketing Plan, social media is an important channel for dissemination. A snapshot of cumulative Twitter/X impressions for posts that leveraged the #CDSiC hashtag from October 1, 2023, to July 31, 2024, is shown in Exhibit 15.

Exhibit 15. Cumulative CDSiC Hashtag Twitter/X Impressions by Weekⁱ



For Workgroup products released by the CDSiC in fall 2023, the team prepared focused dissemination plans for submission to AHRQ. These packages included five tweets and one LinkedIn post, with one social media image for each. Once these packages were approved and the product shared by @AHRQNews, these packages were also shared with other CDSiC stakeholders such as Workgroup and Steering Committee members to encourage amplification.

ⁱ Twitter/X impressions are tracked via Symplur’s Healthcare Hashtag Project, a free open platform that tracks key metrics related to registered hashtags, which are based on the use of the registered CDSiC hashtag (AHRQ does not track impressions using hashtags). Symplur’s impressions are calculated by taking the number of times an account has tweeted multiplied by the account’s number of followers repeated for all accounts, which are then added. Please note that the impressions listed are not unique.

The increase in Twitter/X impressions from October 1 to November 20 represents CDSiC amplification of AHRQ tweets as they promoted the final 2023 Workgroup products. The uptick in impressions in May is a result of the 2024 CDSiC Annual Meeting. We anticipate a steady increase beginning in August as 2024 Workgroup products are released. LinkedIn has also been an important channel, reaching a combined total of more than 50,000 followers across the accounts of AHRQ, NORC, AcademyHealth, and other key members of the CDSiC stakeholder community that actively post about CDSiC efforts.ⁱⁱ Social media activity related to the CDSiC is most active during CDSiC events or when a new CDSiC publication is released. For example, several Annual Meeting participants shared key takeaways via Twitter/X, including overwhelmingly positive feedback. Exhibit 16 shares an example of social media messaging used to disseminate CDSiC products through Twitter/X.

Exhibit 16. CDSiC-Focused Post on AHRQ’s LinkedIn Account



Twitter/X Posts about the 2024 CDSiC Annual Meeting

- *“Really love how @AcademyHealth & @ImpSciNORC coordinated an accessible #cdsic meeting for those unable to be here physically. Ensuring all of our voices are heard and shared!”*
– *CDSiC Steering Committee Member*
- *“Different roles of AI in healthcare delivery may be creating confusion to both patients and clinicians. PAIGE as presented by @adamatw shows a great example of AI as a part of the care delivery team. #CDSiC”*
– *CDSiC Workgroup Co-Lead*

LinkedIn Comment about CDSiC Product on Co-Design Methods:

- *“Happy to be a part of this important project with all of you and share key strategies to include patient input from co-creation through dissemination!”*
– *CDSiC Steering Committee and Workgroup Member*

Social Media Activity from the 2024 CDSiC Annual Meeting

- *During the one-day meeting, #CDSiC generated about 500,000 impressions and #PCCDS generated about 230,000 impressions on Twitter/X.*
- *A CDSiC Steering Committee member tweeted about the CDSiC’s patient engagement efforts to her over 13,000 followers.*

ⁱⁱ A LinkedIn follower is comparable to a subscriber, i.e., people who have chosen to follow a LinkedIn account so they receive that account’s updates and posts. The number listed is an estimate of the total number of followers of accounts that have posted about the CDSiC.

Leadership Viewpoints

Leadership Viewpoint pieces help CDSiC leadership share their thoughts and project findings on a range of topics relevant to PC CDS, including new developments, challenges faced, and opportunities to advance the field. Two Leadership Viewpoints have been developed in the project’s third year and have been disseminated via the CDSiC website. Exhibit 17 provides more information on the focus of each Viewpoint piece.

Exhibit 17. CDSiC Leadership Viewpoint Pieces

Month	Viewpoint Title	Description	Outlet
February 2024	Building Momentum: CDSiC’s Continued Progress Toward Advancing Patient-Centered Clinical Decision Support ²¹	Provides an overview of the four overarching PC CDS themes the CDSiC is addressing in its third year and highlights the upcoming products and projects the CDSiC is undertaking that will contribute to each theme.	CDSiC website
September 2024	Charting a Path for Patient-Centered Clinical Decision Support: Key Themes from the 2024 CDSiC Annual Meeting ²²	Shares four major themes that emerged from the 2024 CDSiC Annual Meeting and describes how these themes will be used to inform the project’s future efforts.	CDSiC website

3.1.3 Challenges Experienced and Strategies for Resolution

The CDSiC Operations Center engaged in a wide range of dissemination and stakeholder engagement activities over the course of the project’s third year. However, the project team encountered some related challenges and has worked to develop strategies in response.

Sustained Steering Committee member participation. As many Steering Committee members have been involved since CDSiC’s launch in 2021, there is an ongoing need to promote member engagement and participation over the course of a long-term project. The CDSiC team identified two key strategies that can improve engagement:

- Provide Steering Committee members with opportunities to lead presentations on their own research or projects during Steering Committee meetings, which enables members to share a view into other CDS-relevant efforts and receive feedback from a group of expert stakeholders on their work.
- Invite external speakers to present at Steering Committee meetings, which provides members with cutting-edge updates from the field of PC CDS.

Coordination of product review timelines. During the first two years of the project, the CDSiC team learned that product development timelines led to multiple products and dissemination materials being sent to AHRQ OC in rapid succession. This had the potential to cause bottlenecks that could delay the dissemination of completed products. In response, the CDSiC team collaborated with AHRQ OC to develop a streamlined process to send the product and accompanying CDSiC webpage simultaneously

to AHRQ OC for copyedit review. The project team quickly adapted to these evolving processes, which helped to expedite the review and dissemination of third-year products.

Development of a dynamic, user-friendly project website. The CDSiC website is an essential resource that supports the dissemination and use of CDSiC products. However, the website houses a significant number of project resources, which can limit accessibility of important materials. In response, the CDSiC team worked closely with the CDSiC website developer, Pantheon, to implement several changes that will enhance the findability and usability of CDSiC resources:

- Implementing a tagging taxonomy that added tags on each product’s type and key topics to all CDSiC resources.
- Strengthening website search and filtering features to enable users to sort resources by date, taxonomy term, type, and keyword.
- Creating a more dynamic homepage that includes an interactive “hero” banner that can be quickly and easily updated to feature up to four new products.
- Adding a designated [Newsletters](#) page that helps users easily access previous issues of the CDSiC Insider newsletter.
- Utilizing a pop-up box that invites new visitors to the CDSiC website to sign up to receive regular updates via the AHRQ CDSiC Insider newsletter.

3.2 Task 2: Stakeholder Center

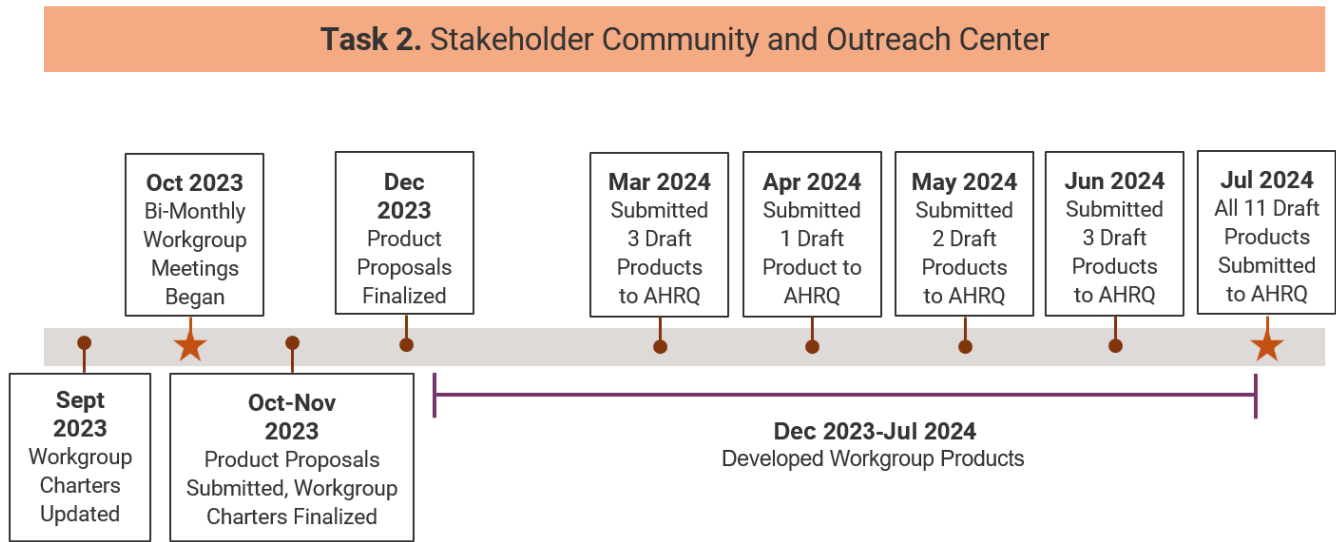
The Stakeholder Center, including the Stakeholder Center Planning Committee and four Workgroups, provides the CDSiC’s thought leadership—developing products that advance CDS for the broader community, guiding the overall work of the CDSiC (in partnership with the CDSiC Steering Committee), and offering input on projects the CDSiC Innovation Center develops. Critically, the Stakeholder Center includes various stakeholders in CDSiC activities, consistent with the mandate established by Section 6301 of the Affordable Care Act for AHRQ to engage and obtain feedback from diverse stakeholders.²³

During the third year of the CDSiC, the Stakeholder Center engaged a diverse array of CDS stakeholders to convene four Workgroups and develop 11 products to advance the field of PC CDS. Stakeholder Center activities are described below, followed by the outputs and outcomes stemming from these activities. Section 3.2.3 summarizes challenges experienced over the course of this work and strategies for resolution.

3.2.1 Stakeholder Center Infrastructure and Activities

During the reporting period, the Stakeholder Center leveraged the existing infrastructure to support the operations of four Workgroups. In total, the Workgroups developed 11 written products, including reports, resources, and tools to address gaps in the CDS landscape and build on the foundational products developed in the first two years of the CDSiC. Exhibit 18 provides an overview of Stakeholder Center activity milestones during the CDSiC’s third year. These activities are described in more detail below.

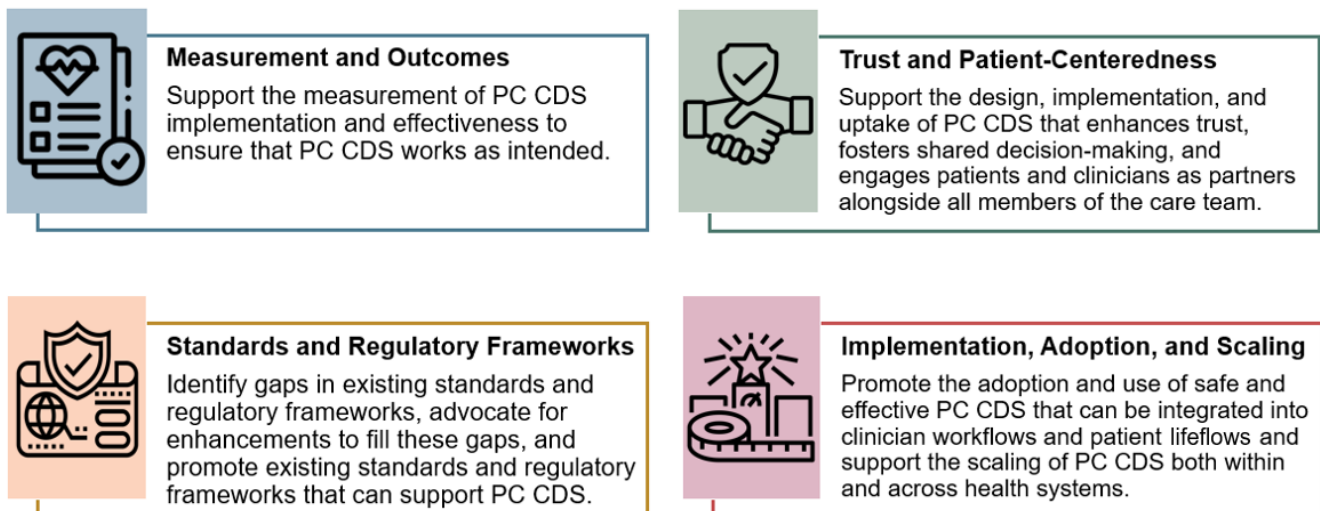
Exhibit 18. Overview of Stakeholder Center Activities and Timeline



CDSiC Stakeholder Center Workgroups

In response to learnings from previous years, the CDSiC leadership team worked with AHRQ to redefine and launch two Workgroups in 2023-24. Initially, there were two measurement-focused Workgroups: 1) CDS Outcomes and Objectives and 2) Scaling, Measurement, and Dissemination of CDS. To clarify scopes and prevent overlap among activities, the CDSiC team restructured these two measurement-focused Workgroups. The CDS Outcomes and Objectives Workgroup was renamed the Measurement and Outcomes Workgroup, and the Scaling, Measurement, and Dissemination of CDS Workgroup is now the Implementation, Adoption, and Scaling Workgroup. The two other Workgroups (Trust and Patient-Centeredness and CDS Standards and Regulatory Frameworks) established at the beginning of the CDSiC remained unchanged in scope. Each Workgroup’s focus is described in Exhibit 19.

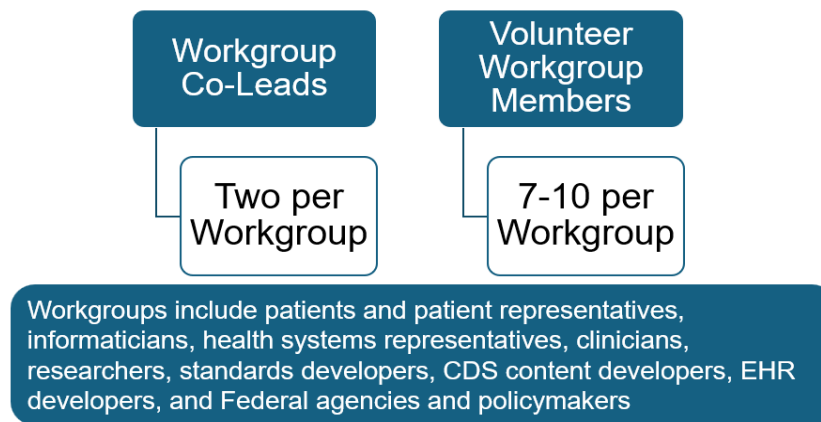
Exhibit 19. Stakeholder Center Workgroups



Workgroup Composition

Across the four Workgroups, eight Workgroup leads, and 32 Workgroup members actively participated throughout Year 3. For the two restructured Workgroups, existing members of the previous Workgroups were invited to participate in one of the restructured Workgroups based on where their expertise aligned with the Workgroup scope. Before the start of the project's third year, CDSiC leadership invited an additional 15 CDS experts and patient advocates who had previously expressed interest in participating after reviewing their resumes and receiving AHRQ approval. Workgroup composition is described in Exhibit 20.

Exhibit 20. Stakeholder Center Workgroup Composition



Charters and Operational Frameworks

In updating the Workgroup structure, CDSiC leadership updated the Stakeholder Community and Outreach Center's Operational Framework and Charter to reflect the organizational changes. The Operational Framework document describes the Stakeholder Center's structure and processes, including the composition of the Stakeholder Center Planning Committee and the Center's four Workgroups, as well as scheduling, reporting, and workflows of Stakeholder Center activities.²⁴ The Stakeholder Center charter outlines the purpose, objectives, outputs, potential challenges, and decision-making frameworks for the Stakeholder Center.²⁵ In launching the Measurement and Outcomes Workgroup and the Implementation, Scaling, and Adoption Workgroup, the CDSiC team worked with Workgroup leads to produce Workgroup charters following a similar structure to the Stakeholder Center Charter.^{26,27,28,29}

Stakeholder Center Planning Committee

Following a similar format used in the project’s first two years, the Stakeholder Center established a Planning Committee comprised of Stakeholder Center leadership, AHRQ project officers, the CDSiC project leadership, and the eight Workgroup leads. During Year 3, the Planning Committee met four times to provide input on Stakeholder Center overall strategic direction and coordination, discuss Workgroup products, and coordinate efforts to leverage product alignment. Specifically, these meetings covered topics such as Workgroup product discussions to identify areas of alignment and additional considerations, preparation for the 2024 CDSiC Annual Meeting, and reflections on Workgroup lead experience to improve processes. Exhibit 21 describes topics covered at each meeting and the number of Workgroup leads attending.

Stakeholder Center Charters and Operational Frameworks

- [Stakeholder Community and Outreach Center Charter](#)
- [Stakeholder Community and Outreach Center Operational Framework](#)
- [Implementation, Adoption, and Scaling Workgroup Charter](#)
- [Measurement and Outcomes Workgroup Charter](#)
- [CDS Standards and Regulatory Frameworks Workgroup Charter](#)
- [Trust and Patient-Centeredness Workgroup Charter](#)

Exhibit 21. Stakeholder Center Planning Committee Meeting Topics

Meeting Date	Meeting Topics
January 5, 2024	<ul style="list-style-type: none"> • Introduction of Planning Committee members • Overview of product development process and discuss Workgroup product alignment with the PC CDS lifecycle • Discussion of Workgroup products and Innovation Center activities focused on AI • Discussion of potential meeting sessions for the 2024 CDSiC Annual Meeting
February 26, 2024	<ul style="list-style-type: none"> • CDSiC Annual Meeting planning discussion • Discussion of three Workgroup products examining the use of patient preferences in PC CDS
March 18, 2024	<ul style="list-style-type: none"> • Update on activities across the centers • Discussion of Workgroup products focused on return on investment, CDS overrides, and patient health journey measures
September 16, 2024	<ul style="list-style-type: none"> • Review of Stakeholder Center accomplishments over the year • Overview of fourth-year ideas • Reflections on Workgroup experience

Workgroup and Workgroup Lead Meetings

Beginning in October 2023, each Workgroup met once every other month during the reporting period, for a total of 24 meetings across the four Workgroups. To support routine Workgroup activities and advance product development, Workgroup leads and support teams met every other week, holding approximately 100 internal meetings during the project’s third year.

Workgroup Product Proposals

For the project's third year, the CDSiC proposed a set of product topic ideas to AHRQ informed by ideas surfaced by CDSiC stakeholders (e.g., the CDSiC project team, Steering Committee members, and Workgroup members and leads) during the CDSiC's first two years. The ideas were collected from input provided during the 2023 CDSiC Annual Meeting and routine Steering Committee, Stakeholder Center Planning Committee, and Workgroup meetings. After AHRQ's review and approval of the proposed ideas, Workgroup support teams met with Workgroup leads to narrow the proposed ideas and discuss any new suggestions from Workgroup leads. Between September and December 2023, all Workgroups developed and refined product ideas, using October and December Workgroup meetings to discuss product ideas, potential methods, and potential key informants. NORC submitted formal product proposals to AHRQ for review and approval in October-November 2023. For each proposed product, Workgroups described product background and context; provided an overview of product scope, objectives, need or gap identified, and potential impact; summarized the product development process; and delineated a timeline for product development. The product proposals were finalized by December 2023.

Workgroup Product Development

Reflecting input received from CDSiC partners and other stakeholders, the CDSiC in 2023-24 focused on developing pragmatic tools and resources while building on the solid foundation of previously developed CDSiC products. In doing so, the CDSiC leveraged and extended the theoretical work established in prior Workgroup products to develop practical resources for the CDS field. To ensure that products moved from theoretical to practical, the CDSiC engaged diverse members of the CDS and patient communities to include their perspectives. Workgroup product development was supported by 12 Workgroup support team members with direction from the Stakeholder Center lead and the CDSiC leadership team.

A description of each Workgroup product, including the timeliness of the product for the field, is provided in Exhibit 22. The products varied in terms of expected length of time and level of effort to complete based on scope, falling into one of two levelsⁱⁱⁱ: Level 2 projects involve a medium amount of effort; Level 3 projects are shorter-term activities that require less effort. In the third year, the Workgroups produced 11 products at the Level 2 and Level 3 effort. Three Workgroups (Measurement and Outcomes; Implementation, Adoption, and Scaling; and Trust and Patient-Centeredness) produced three products each, including one Level 2 product and two Level 3 products. The CDS Standards and Regulatory Frameworks Workgroup produced two Level 2 products.

ⁱⁱⁱ In the first two years of the CDSiC, the project also developed Level 1 products. Level 1 products are the largest in scope, involving significant effort. These Base Period products are described in the [CDSiC Base Period of Performance Report](#).

Exhibit 22. Workgroup Product Descriptions and Relevance for the Field**Title and Description*****Implementation, Adoption, and Scaling Workgroup*****Landscape Assessment on the Use of Artificial Intelligence to Scale PC CDS (Level 3)³⁰**

Leveraging AI is a promising approach to addressing barriers to the wider adoption and impact of PC CDS. The product maps findings from real-world implementations of AI with CDS to five dimensions where AI can scale PC CDS and recommends how AI can be used to scale PC CDS in a patient-centered way.

Exploring Challenges and Opportunities for Patient Engagement, Implementation, Adoption, and Scaling Through PC CDS Case Studies (Level 3)³¹

This product describes case studies of real-life PC CDS implementation, with a focus on AHRQ-supported implementations. It derives more detailed insights into the key challenges, opportunities, and recommendations for the implementation, adoption, and scaling of PC CDS.

Opportunities to Determine Value for PC CDS (Level 2)

Favorable ROI is critical to the widespread implementation, adoption, and scaling of any health care intervention. However, there is limited literature on ROI for PC CDS, which limits widespread dissemination of PC CDS. This product catalogs opportunities and approaches for PC CDS to provide a favorable ROI, resources needed to demonstrate ROI for PC CDS, and current gaps and opportunities in formulating PC CDS ROI estimates and models.

Measurement and Outcomes Workgroup**Inventory of Patient Preference Measurement Tools for PC CDS (Level 3)³²**

In 2023, the CDSiC developed the *Taxonomy of Patient Preferences*, which identified and described six domains of patient preferences relevant to PC CDS. This product builds on this work to identify, aggregate, and describe measures/instruments to collect and assess patient preferences in a filterable inventory, and describe considerations when using the identified tools as well as considerations and gaps in measuring patient preferences broadly.

Patient Prioritization of Measurement Areas for PC CDS (Level 3)³³

The Workgroup consulted patient advocates to prioritize measurement areas that reflect what should be considered standard in measuring a patient health journey for PC CDS. Using 15 patient health journey measurement areas previously identified by the CDSiC, this product summarizes findings from a multi-step prioritization activity performed by patient advocates to determine outcomes that are most important to patients.

PC CDS Planning and Reporting Tool User Guide (Level 2)³⁴

In 2023, the CDSiC developed the *PC CDS Planning, Implementation, and Reporting Tool* to support consistent reporting of PC CDS interventions in the literature. The Measurement and Outcomes Workgroup streamlined and refined the tool and an accompanying user guide for improved usability and accessibility, which will enable broader adoption of the tool.

CDS Standards and Regulatory Frameworks Workgroup**An Initial Taxonomy of Override Reasons for Patient-Centered Clinical Decision Support (PC CDS) Recommendations (Level 2)³⁵**

The Workgroup developed a written taxonomy of PC CDS override reasons, encompassing override reasons for both clinicians as well as patients/caregivers. The taxonomy serves as a foundation for creating standard override terminology, which will support advancement in analysis of PC CDS overrides.

Title and Description

Prioritizing Patient Preferences for Standardization to Support PC CDS (Level 2)³⁶

Some domains of patient preferences are more routinely collected and standardized in PC CDS tools compared to others. This report summarizes findings from a multi-stakeholder roundtable to prioritize patient-centric data for PC CDS and provides actionable next steps for the standards development community to move patient preferences standardization forward.

Trust and Patient-Centeredness Workgroup

Patient and Caregiver Perspectives on Generative Artificial Intelligence in PC CDS (Level 3)³⁷

With health care on the cusp of an AI revolution, this product describes patient and caregiver views on the use of AI for CDS to better understand how AI use in PC CDS may impact patient trust in providers and clinical information. The report describes patient and caregiver perspectives on AI and provides a list of considerations for the development of AI-enabled PC CDS tools that support trust and patient-centeredness.

Capturing Patient Preferences for PC CDS Within Clinician Workflows and Patient Lifeflows (Level 3)³⁸

To further advance the capture and use of patient preference information for PC CDS, this product identifies ways to reduce data collection burden on patients and clinicians. The report features swimlane diagrams to show where patient preference data can be collected and integrated within PC CDS workflows and patient lifeflows for specific use cases. The report provides key considerations to optimize collection and use of patient preferences as well as short- and long-term opportunities to advance the incorporation of such data in PC CDS.

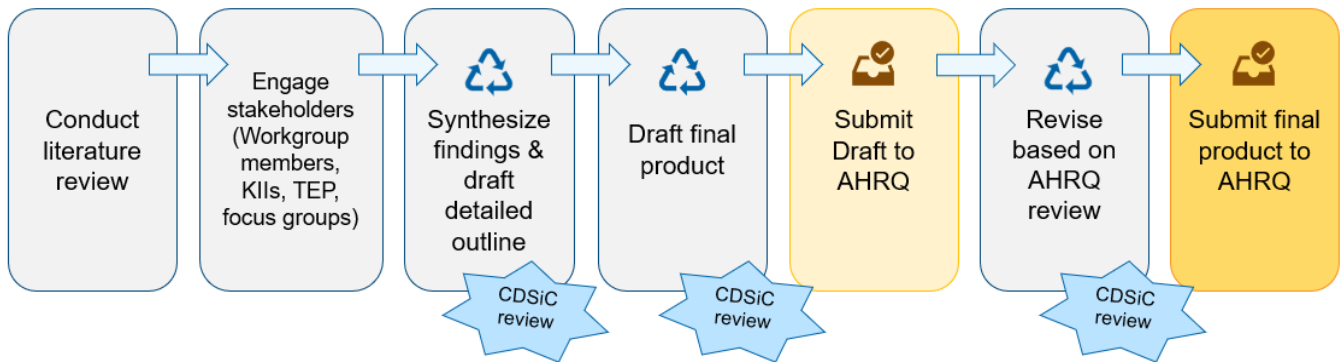
Action Plan to Collect and Use Social Determinants of Health Data in PC CDS (Level 2)³⁹

The action plan outlines key challenges and current efforts in using SDOH data for PC CDS as well as potential short-term and long-term opportunities to address challenges, speaking to five key needs that must be addressed to incorporate SDOH factors across the PC CDS lifecycle. This product will facilitate a shared understanding of critical gaps in addressing SDOH factors with PC CDS.

The Workgroup support teams and Stakeholder Center lead met internally every other week to support product development. These meetings provided a forum to share product development updates, discuss synergies across products, and share lessons learned applicable to all Workgroups. Each Workgroup support team also met weekly to discuss Workgroup-specific tasks and activities related to product development.

Although the product development process varied for each product, the process generally involved targeted literature searches, stakeholder input and feedback (e.g., through Workgroup engagement, key informant interviews [KIIs], focus groups, and/or other qualitative data collection methods), and analysis and synthesis. Each Workgroup product underwent a rigorous internal review process by the CDSiC leadership team at the outline and draft stages to ensure that the products are high-quality written deliverables that provide substantive contributions to the CDS field. Exhibit 23 depicts the process for product development.

Exhibit 23. Workgroup Product Development Process



Workgroup members contributed to product development both during scheduled Workgroup meetings and asynchronously through a variety of mechanisms, including by providing email feedback and working on draft outlines and products posted on the CDSiC SharePoint site.

Workgroups collectively screened 958 resources and synthesized 287 (note: count not de-duplicated) peer-reviewed and gray literature resources across seven products. Exhibit 24 describes the literature synthesized for each product that included a literature review in the development process.

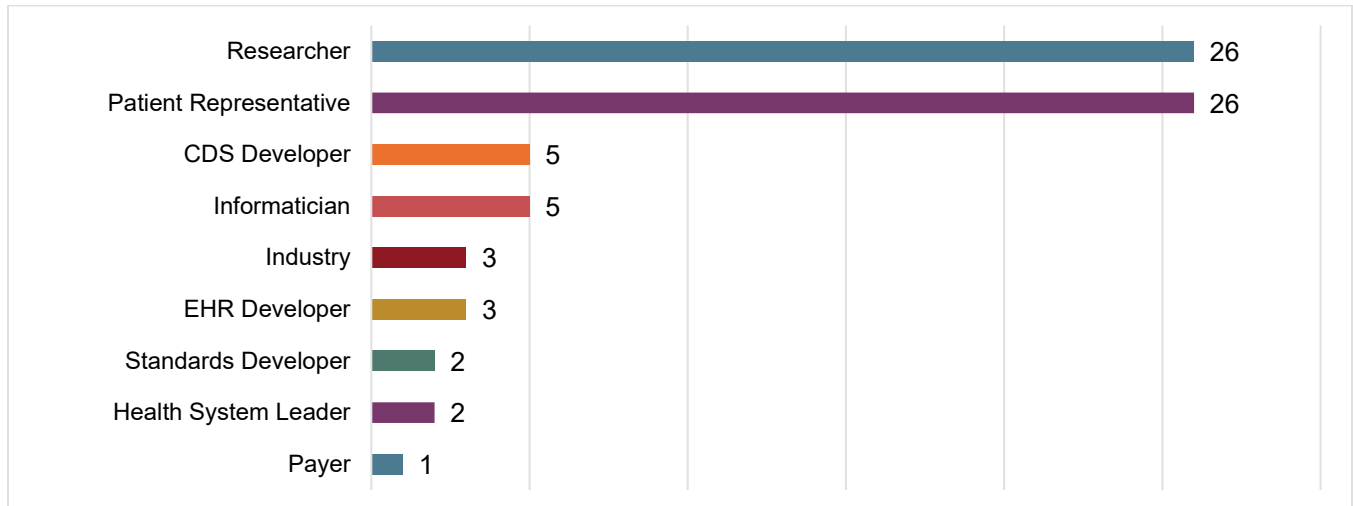
Exhibit 24. Literature Synthesized for Workgroup Products

Workgroup Product	Literature Synthesized
CDS Standards and Regulatory Frameworks: An Initial Taxonomy of Override Reasons for PC CDS Recommendations (Level 2)	30 peer-reviewed publications
Measurement and Outcomes: Inventory of Patient Preference Measurement Tools for PC CDS (Level 2)	44 peer-reviewed and grey literature resources
Implementation, Adoption, and Scaling: Landscape Assessment on the Use of Artificial Intelligence to Scale PC CDS (Level 3)	39 peer-reviewed and grey literature resources
Implementation, Adoption, and Scaling: Exploring Challenges and Opportunities for Patient Engagement, Implementation, Adoption, and Scaling Through PC CDS Case Studies (Level 3)	32 peer-reviewed and grey literature resources
Implementation, Adoption, and Scaling: Opportunities to Determine Value for PC CDS (Level 2)	39 peer-reviewed publications and grey literature resources
Trust and Patient-Centeredness: Capturing Patient Preferences for PC CDS Within Clinician Workflows and Patient Lifeflows (Level 3)	63 peer-reviewed publications and grey literature resources
Trust and Patient-Centeredness: Action Plan to Collect and Use Social Determinants of Health Data in PC CDS (Level 2)	55 peer-reviewed publications and grey literature resources

Across the 11 products, Workgroups engaged partners in several qualitative data collection formats, including KIIs (seven products), roundtables or panels (two products), prioritization activities (one product), small group discussions (two products), and a formative evaluation with user testing (one product). Exhibit 25 describes the perspectives represented of the 73 experts engaged via 79 KIIs,

roundtables/panels, small group discussions, and user testing sessions. Notably, compared to previous years, the number of patient representatives engaged by Workgroups in the CDSiC’s third year doubled, due to increased CDSiC efforts to identify new patient voices (in collaboration with existing patient partners) to inform product development.

Exhibit 25. Number of Partners Engaged in Qualitative Data Collection Activities, by Stakeholder Type



3.2.2 Stakeholder Center Outputs and Outcomes

Dissemination of products developed in the base period, as well as companion products, continued into the third year of the CDSiC. Additionally, during the reporting period, the four Workgroups collectively completed 11 products for AHRQ, and the Operations Center developed four companion products. As of July 19, 2024, four of the third-year products were published. Information about the reach of each product published by the CDSiC as of July 31, 2024, including those developed in the base period, is provided in Exhibit 26.

Exhibit 26. Published Stakeholder Center Products and Reach

Title and Description	Publication Date	Reach
<i>Measurement and Outcomes Workgroup</i>		
<u>Taxonomy of Patient Preferences</u> ⁴⁰	May 2023	653 views
<u>Integration of Patient-Centered Clinical Decision Support Into Shared Decision Making</u> ⁴¹	September 2023	379 views
<u>Patient-Focused Outcome Measures for Patient-Centered Clinical Decision Support</u> ⁴²	September 2023	406 views
<u>Inventory of Patient Preference Measurement Tools for PC CDS Report</u> ⁴³	June 2024	321 views

Title and Description	Publication Date	Reach
<u>Patient Prioritization of Measurement Areas for Patient-Centered Clinical Decision Support</u> ⁴⁴	July 2024	63 views
<i>Implementation, Adoption, and Scaling CDS Workgroup</i>		
<u>Approaches to Measuring Patient-Centered CDS Workflow and Lifeflow Impact</u> ⁴⁵	July 2023	461 views
<u>PC CDS Performance Measurement Inventory User Guide</u> ⁴⁶	August 2023	360 views
<u>PC CDS Planning, Implementation, and Reporting User Guide</u> ⁴⁷	August 2023	360 views
<u>Landscape Assessment on the Use of Artificial Intelligence to Scale PC CDS</u> ⁴⁸	July 2024	119 views
<i>CDS Standards and Regulatory Frameworks Workgroup</i>		
<u>Environmental Scan</u> ⁴⁹	January 2023	362 views
<u>Environmental Scan Companion Product An Overview of Standards for Patient-Centered Clinical Decision Support</u> ⁵⁰	June 2024	216 views
<u>Advancing Standardized Representations for Patient Preferences to Support Patient-Centered Clinical Decision Support</u> ⁵¹	August 2023	388 views
<u>Improving Interoperability of Patient Apps with the Health IT Ecosystem</u> ⁵²	August 2023	341 views
<u>An Initial Taxonomy of Override Reasons for Patient-Centered Clinical Decision Support (PC CDS) Recommendations</u> ⁵³	July 2024	132 views
<i>Trust and Patient-Centeredness Workgroup</i>		
<u>Improving the Source Credibility of Patient-Centered Clinical Decision Support Tools</u> ⁵⁴	July 2023	192 views
<u>Methods for Involving End Users in PC CDS Codesign</u> ⁵⁵	August 2023	465 views
<u>An Introductory Handbook for Patient Engagement Throughout the Patient-Centered Clinical Decision Support Lifecycle</u> ⁵⁶	September 2023	351 views
<u>Patient and Caregiver Perspectives on Generative Artificial Intelligence in Patient-Centered Clinical Decision Support</u> ⁵⁷	July 2024	290 views

The views and number of unique downloads reported in this table are tracked using Google Analytics.

The CDSiC team presented findings from Workgroup products developed in the base period at several conferences during the current reporting period, including two presentations at the 2023 AMIA Annual Symposium, two presentations at the 2024 AcademyHealth Annual Research Meeting, and one presentation at the 2024 Patient Insight Congress. The CDSiC team also presented findings from these

products at other venues, including the ASTP/ONC Tech Form Workgroup and professional meetings with the HL7 CDS workgroup and the AMIA CDS workgroup. Additionally, the CDSiC team prepared and submitted five abstracts about Workgroup products completed during the reporting period for presentation at fall 2024 conferences, including the AMIA Annual Symposium, Mobilizing Computable Clinical Knowledge (MCBK) 2024 Meeting, and the Society for Medical Decision Making (SMDM) 2024 Annual Meeting. Exhibit 27 summarizes these presentations.

Exhibit 27. Stakeholder Center Conference and Professional Meeting Presentations

Workgroup	Title	Description	Setting, Date
Base Period Products			
Trust and Patient-Centeredness Workgroup	Co-design in the Context of CDS	Webinar	ASTP/ONC Tech Forum Workshop: The Future of Clinical Decision Support, September 27, 2023
CDS Outcomes and Objectives Workgroup & CDS Standards and Regulatory Frameworks Workgroup	Integrating Patient Preferences in Patient-Centered Clinical Decision Support: Where Are We Now and Where Do We Go Next?	Panel	2023 AMIA Annual Symposium, November 2023
Center-Wide	Using a Stakeholder Driven-Process to Advance Patient-Centered Clinical Decision Support: Visual Framework for Clinical Decision Support Innovation Collaborative (CDSiC) Efforts	Poster Presentation	2023 AMIA Annual Symposium, November 2023
CDS Standards and Regulatory Frameworks Workgroup	CDSiC CDS Standards and Regulatory Frameworks Workgroup Products	Professional Meeting	HL7 CDS workgroup, November 2023
Trust and Patient-Centeredness Workgroup	Methods for Co-Designing Patient-Centered Clinical Decision Support with Patients and Caregivers	Poster Presentation	2024 Patient Insight Congress, April 2024
Scaling, Measurement, and Dissemination Workgroup	How to Measure the Impact of Patient-Centered Clinical Decision Support (PC CDS) on Patient Lifeflow and Clinical Workflow	Poster Presentation	2024 AcademyHealth Annual Research Meeting, June 2024
CDS Standards and Regulatory Frameworks Workgroup	Improving Interoperability of Patient Apps with the Health IT Ecosystem	Poster Presentation	2024 AcademyHealth Annual Research Meeting, June 2024
Third Year Products			
CDS Standards and Regulatory Frameworks Workgroup	CDSiC CDS Standards and Regulatory Frameworks Workgroup Products	Professional Meeting	AMIA CDS Workgroup, March 2024

Workgroup	Title	Description	Setting, Date
Cross-Workgroup	Leveraging Large Language Models and Other Artificial Intelligence Methods to Advance Patient-Centered Clinical Decision Support	Panel (Accepted)	AMIA 2024 Annual Symposium, November 2024
Implementation, Adoption, and Scaling Workgroup	Making the Case for Patient-Centered Clinical Decision Support: Exploring Approaches for Projecting and Demonstrating Return on Investment	Podium (Accepted)	AMIA 2024 Annual Symposium, November 2024

Qualitative Feedback Received about Outputs

While dissemination of Year 3 Workgroup products is still underway, the team received qualitative feedback on these new products throughout the development process from both Workgroup members and key informants. Sources of qualitative input on products include Workgroup meetings, the 2024 CDSiC Annual Meeting, key informant qualitative data collection activities, and LinkedIn posts. Thus far, the feedback points to the potential value of these products to the PC CDS field (Exhibit 28).

Exhibit 28. Feedback Received on Workgroup Products to Date

Workgroup Product	Source	Description of Feedback
Standards and Regulatory Frameworks Workgroup: <i>Prioritizing Patient Preferences for Standardization to Support PC CDS</i>	Workgroup Member	<ul style="list-style-type: none"> Described the report as a great synopsis of the roundtable discussion.
Measurement and Outcomes Workgroup: <i>PC CDS Implementation and Reporting Tool</i>	Key Informant Interviews	<ul style="list-style-type: none"> Field testers noted the tool is a very impressive and comprehensive approach for how to go about effectively deploying PC CDS and it covers most of the key aspects of what could be part of a PC CDS journey report.
Implementation, Adoption, and Scaling: <i>Opportunities to Determine Value for PC CDS</i>	2024 CDSiC Annual Meeting	<ul style="list-style-type: none"> The product generated robust discussion among meeting participants, who expressed interest in the product and reinforced the value of conceptualizing ROI for PC CDS.
Trust and Patient-Centeredness Workgroup: <i>Capturing Patient Preferences for PC CDS Within Clinician Workflows and Patient Lifeflows</i>	Key Informant Interviews	<ul style="list-style-type: none"> One informant expressed the desire to share the swimlane diagrams representing timepoints and methods for capturing patient preferences with their students and trainees.
Measurement and Outcomes Workgroup: <i>Inventory of Patient Preference Measurement Tools for PC CDS Report</i>	LinkedIn	<ul style="list-style-type: none"> Several individuals reshared the report on LinkedIn with accompanying comments including, “Great insight!”, “Good to know!”, and “Insightful!”.

Workgroup Product	Source	Description of Feedback
Trust and Patient-Centeredness Workgroup: <i>Patient and Caregiver Perspectives on Generative Artificial Intelligence in Patient-Centered Clinical Decision Support</i>	LinkedIn	<ul style="list-style-type: none"> Professor Thomas Rocco, Jr. at the University of Rochester Medical shared the report in the public LinkedIn group <i>The Artificial Intelligence Investors Group: Robotics, Machine Learning, NLP, Computer Vision & IoT</i> with the comment that the report was “worth perusing.” He tagged Harlan Krumholz (Director of Yale University’s Center for Outcomes Research & Evaluation), Larry Becker (Member of PCORI Board of Governors), and Christopher Cannon (Professor at Harvard University and Brigham and Women’s Hospital).
Standards and Regulatory Frameworks Workgroup: <i>An Initial Taxonomy for Patient-Centered Clinical Decision Support Recommendations</i>	LinkedIn	<ul style="list-style-type: none"> The AHRQ LinkedIn post was reposted by four individuals including Dr. Robert Valdez, Director of AHRQ, who stated “Clinical decision support makers - here are some tips for a better product.”

3.2.3 Challenges Experienced and Strategies for Resolution

The CDSiC has engaged with enthusiastic expert stakeholders through the Stakeholder Center Workgroups. However, the project team has also needed to develop strategies to adapt to several challenges.

Sustained Workgroup member engagement and participation. Due to the voluntary nature of Workgroup member involvement, not all Workgroup members engage equally with the ongoing product development process. It can occasionally be challenging to get widespread feedback and input from Workgroup members due to competing demands and limited bandwidth. Throughout the reporting period, the CDSiC team identified several strategies that can improve engagement:

- Develop discussion questions for Workgroup meetings to focus feedback on critical areas and intersperse discrete questions throughout presentation slides.
- Allow Workgroup members to present on their projects or initiatives during Workgroup meetings so that they also feel that they are benefiting from the meetings.
- During the initial phases of product development, meet monthly with Workgroup members to get more substantial feedback earlier and make meetings more productive; as products are finalized meetings can be bimonthly.

Addressing the needs of different stakeholders and varying perspectives. With several Workgroup members providing input on product content and development, differences in suggestions or desired directions sometimes arose. To navigate conflicting feedback, Workgroup leads and support teams adopted the following strategies:

- Focus discussions on substantive areas to advance product development and guide conversations so that Workgroup member input was within the product’s scope.

- Provide direction by synthesizing Workgroup member feedback, determining next steps, and communicating how Workgroup member feedback was incorporated into products.
- Balance a pragmatic approach with scientific rigor in developing products, ensuring that approaches addressed concerns of Workgroup members to create both rigorous and practical products.

Timeline management. To develop two to three products per Workgroup, the CDSiC team needed to work efficiently to translate product proposals into final products on a rapid timeline. To develop high-quality products within the designated timeline, the CDSiC team employed the following strategies:

- Strong project management with detailed timelines and routine check-ins between Workgroup leads, the Stakeholder Center lead, and support teams (either weekly or every other week) to keep product development on track and mitigate issues as they arose.
- Workgroup leads and support teams focused on the utility of the product to the end user as the “north star” to support uptake of products from the start of development, reducing the need to later rework product content for dissemination.
- Workgroup support teams met internally on a weekly basis to share resources and lessons learned and discuss strategies for advancing product timelines.
- Additionally, clearly defining the product scope early in the product development process and managing the potential of “scope creep” in discussions with Workgroup leads and members to reduce exploration of tangential topics that could impact timeline adherence.



3.3 Task 3: Innovation Center

The Innovation Center is the research and development hub for the CDSiC and focuses on facilitating real-world PC CDS measurement and testing projects, improving CDS usability and acceptability via improved design and implementation, and translating PCOR into clinical practice using CDS to improve patient and clinician decision making. The activities of the Innovation Center are described below, followed by the outputs and outcomes stemming from these activities. Section 3.3.3 summarizes challenges experienced over the course of this work and strategies for resolution.

3.3.1 Innovation Center Infrastructure and Activities

During the project’s third year, the Innovation Center continued operating a Planning Committee and two Cores (Exhibit 29) that engaged stakeholders, including clinicians, informaticians, researchers, payers, and patients, in designing and conducting projects that address key challenges to widespread use of PC CDS. The Cores were tasked with developing and completing four projects that advance PC CDS research during this period.

Exhibit 29. The Innovation Center Cores

	<p>Core 1. Measurement and Value of CDS</p> <ul style="list-style-type: none"> 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. 		<p>Core 2. Conducting and Coordinating CDS Projects</p> <ul style="list-style-type: none"> 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.
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Planning Committee

The Innovation Center Planning Committee provides input on the overall strategic direction and coordination of the Innovation Center Cores, while coordinating with the overall CDSiC, integrating input from the Stakeholder Center Workgroups, the Steering Committee, and AHRQ. The Planning Committee is comprised of seven thought leaders in the CDS field, including health system leaders, CDS developers, informatics researchers, clinicians, and patient partners. The Planning Committee met three times during 2023-24.

The Planning Committee held its first third-year meeting on October 12, 2023, to discuss and solicit strategic input on project ideas for the upcoming year. At the February and June 2024 meetings, the CDSiC project team provided progress updates, demonstrations, and requested feedback on Core 1 and Core 2 projects. Planning Committee meeting dates, topics, and attendance are summarized in Exhibit 30 below.

Exhibit 30. Innovation Center Planning Committee Meetings, Topics, and Attendance

Meeting Date	Meeting Topic	Planning Committee Member Attendance
October 12, 2023	Present project ideas for third year and solicit strategic input on direction from Planning Committee members	7
February 7, 2024	Update on Core 1 and Core 2 project progress, including demonstrations for Core 2 prototypes, with feedback from Planning Committee members	7
June 26, 2024	Update on Core 1 and Core 2 project progress, with input on future directions and steps for projects from Planning Committee members	2

Charter and Operational Framework

The work of the Innovation Center is guided by its Operational Framework, developed by CDSiC leadership and the Innovation Center Planning Committee and updated for the third year.⁵⁸ The Operational Framework describes the Innovation Center's structure and day-to-day processes, including the composition of the Planning Committee, the processes for coordinating across the Cores, and the mechanisms for scheduling, tracking Core activities and progress, and reporting. The Innovation Center was formally initiated with the ratification of its Charter.⁵⁹ The charter describes the purpose, objectives, outputs, and outcomes, as well as potential challenges and decision-making frameworks for the Innovation Center.

Innovation Center Project Proposals

The Innovation Center Cores are tasked with developing and completing four projects of varying levels (i.e., Level 1, 2, or 3) that advance PC CDS research. Level 1 projects are the largest in scope, involving significant effort; Level 2 projects involve a medium amount of effort; Level 3 projects are shorter-term activities. Based on discussions with AHRQ and the Planning Committee, Innovation Center leadership identified four projects aimed at both addressing gaps in measuring and monitoring PC CDS performance and developing real-world, forward-looking PC CDS tools to advance the field:

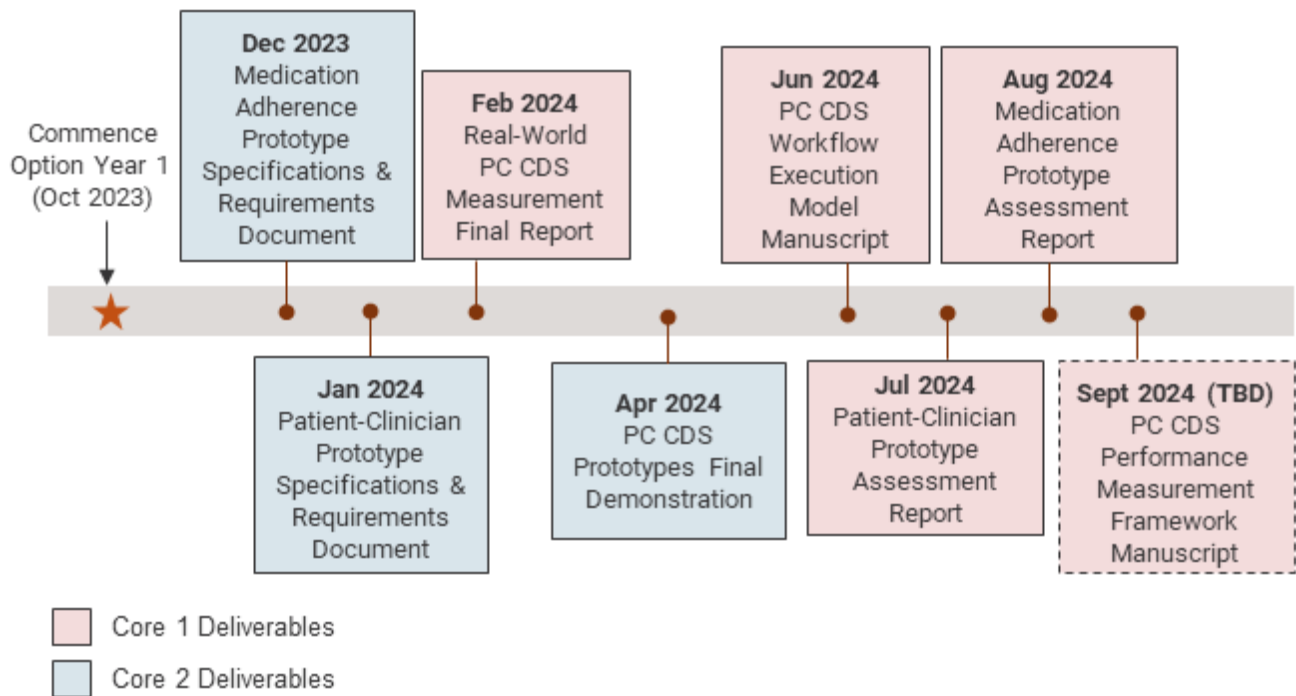
- 1) Core 1: Cross-Cutting Assessment of Real-World Experience in PC CDS Measurement (Level 2)
- 2) Core 1: Assessment of Core 2's Prototypes (Level 2)
- 3) Core 2: Design, Development, and Deployment of a Chatbot Prototype to Support Medication Adherence (Level 1)
- 4) Core 2: Design and Development of a Chatbot Prototype to Support Patient-Clinician Communication (Level 1)

The overarching goals of these projects were to examine the current state of PC CDS performance measurement and opportunities for advancement and to examine the use of AI to support PC CDS.

The four projects for Core 1 and Core 2 ultimately produced six deliverables between October 2023 and August 2024. Additionally, Core 1 produced two manuscripts based on Innovation Center deliverables, one that has been published and one that is under review. Exhibit 31 shows the timeline for each deliverable.

Third Year Charters and Operational Frameworks Produced

- [Innovation Center Operational Framework](#)
- [Innovation Center Charter](#)

Exhibit 31. Timeline of Innovation Center Deliverables

Innovation Center Project Development

Core 1 delivered two Level 2 projects by 1) conducting a qualitative assessment of real-world PC CDS performance measurement and 2) conducting formative assessments of Core 2's prototype PC CDS tools.

Assessment of Real-World PC CDS Measurement. In years one and two of the CDSiC, the Innovation Center developed a new, comprehensive PC CDS performance measurement framework that includes key domains, subdomains, and levels of measurement that CDS developers and others should consider when assessing PC CDS interventions. The goal of this framework is to provide a basis for consistent measurement of PC CDS design, development, implementation, and use across the structure, process, and outcome spectrum. For the third-year project, the Core 1 team tested the framework by examining how AHRQ-funded projects measured the performance of real-world PC CDS interventions. The three aims of the cross-cutting assessment were to: 1) validate the PC CDS performance measurement framework; 2) gather researcher perceptions about the limitations and challenges of using the performance measures in AHRQ-funded PC CDS projects; and 3) use information gathered to develop an action plan for advancing the development and use of PC CDS performance measures. This project resulted in one deliverable (Real-World Experience in PC CDS Measurement Final Report) and one manuscript that is currently under review (PC CDS Performance Measurement Framework manuscript). More details on each of these are described in greater detail in Section 3.4.2 Innovation Center Outputs.

Assessment of Core 2's Prototypes. To build understanding of PC CDS performance measurement, Core 1 leveraged the PC CDS performance measurement framework to conduct two assessments of Core 2's prototype tools. For the assessment of the medication adherence chatbot prototype, the Core 1 team assessed the technical feasibility of integrating the app into a health system EHR as well as the

usability and patient-centeredness of the prototype. For the assessment of the patient-clinician communication prototype, the Core 1 team assessed patient perspectives on usability and clinician perspectives on utility and accuracy. This project resulted in two deliverables: Medication Adherence Prototype Assessment Report and Patient-Clinician Communication Prototype Assessment Report.

Core 2 delivered two Level 1 projects by 1) designing, developing, and deploying a medication adherence prototype, and 2) designing and developing a patient-clinician communication prototype. Both projects aim to explore the use of AI in PC CDS tools by facilitating the collection and use of patient-reported data for health care decision making.

Medication Adherence Prototype. The medication adherence prototype known as “Quartz” leverages an AI-based tool to text patients with uncontrolled blood pressure levels to check in on adherence to hypertension medications. The app collects patient-reported information on levels of adherence (using a peer-reviewed Likert scale question) and barriers to taking medications. The app will display the patient interaction in the EHR so that clinicians can monitor their patients’ medication use between visits and intervene if necessary. The team used patient co-design techniques to inform the conversation scenarios and personalization features that matter to patients. The team developed the app using natural language processing solutions that did not rely on AI to answer patient questions but could understand free text responses from patients. This project resulted in two deliverables: Medication Adherence Prototype Specifications and Requirements Document and the PC CDS Prototype Final Demonstration.

About the Core 2 PC CDS Prototypes

- The **Medication Adherence Prototype** is a text-messaging application (app) called “Quartz” to help patients improve adherence to medications for hypertension. The app leverages natural language processing (NLP) to text patients who have been identified as having uncontrolled blood pressure to ensure that 1) patients begin and continue taking their medications as prescribed, and 2) the medications have the desired effect.
- The **Patient-Clinician Communication Prototype** is an interactive LLMs-powered chatbot called “Patient Artificial Intelligence Guided E-messages” (PAIGE) that will serve as an intermediary between patients and clinicians via the patient portal. The aim is to improve accuracy and efficiency in patient-clinician communication by using a chatbot to field and summarize information from patients about their symptoms for clinicians to make care decisions.

Patient-Clinician Communication Prototype. The patient-clinician communication prototype, known as Patient Artificial Intelligence Guided E-messages (“PAIGE”), leverages a patient portal tool that helps patients communicate symptoms and concerns to their clinicians. Through a partnership with Vanderbilt University Medical Center (VUMC®), the Core 2 team extracted a sample of VUMC patient-clinician portal messages and used it to fine-tune large language models (LLMs) to ask similar clarifying questions on the clinician’s behalf. The patient responses are summarized and combined with relevant medical information from the EHR to help clinicians make an informed decision. The team co-designed the tool with both patients and clinicians to understand their needs when communicating on patient portals and identify any concerns in the initial prototype. This project resulted in two deliverables:

Patient-Clinician Communication Prototype Design Considerations and Requirements Document and the PC CDS Prototype Final Demonstration.

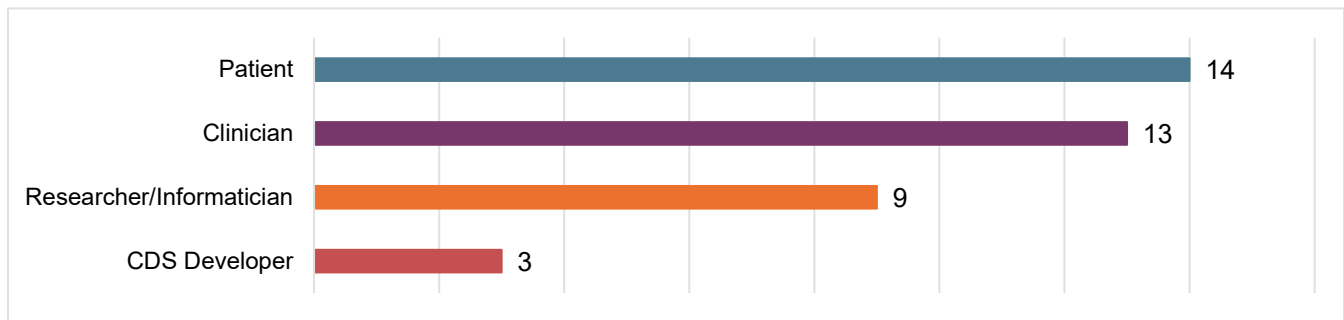
While some common strategies were employed to develop these deliverables, methods ultimately differed based on scope and goals. Each deliverable involved varying levels of stakeholder engagement via Planning Committee meetings, KIIs, surveys, co-design sessions, and usability testing. Brief summaries of the methods employed for each deliverable are provided in Exhibit 32.

Exhibit 32. Research Methods Employed for Innovation Center Deliverables

Innovation Center Deliverable	Research Methods Employed
Real-World Experience in PC CDS Measurement Final Report	The team synthesized 40 peer-reviewed and gray literature resources for 20 AHRQ-funded PC CDS projects in a targeted literature review . The team then conducted KIIs with nine principal investigators representing projects that used different technologies and addressed different health conditions. Findings from the literature review and KIIs were synthesized into an action plan for PC CDS performance measurement. The findings and action plan were reviewed by the Innovation Center Planning Committee.
Medication Adherence Prototype Specifications and Requirements Document	The team reviewed literature, consulted with stakeholders, sought feedback from the Innovation Center Planning Committee , and engaged in extensive discussions with Innovation Center leadership .
Medication Adherence Prototype Assessment Report	The team conducted KIIs with three members of the technical integration team to assess the feasibility of the integration and two clinicians to assess the fit with workflow. The team then conducted think-aloud tests with three patients and administered a post-test questionnaire to assess users' perceptions.
Patient-Clinician Communication Chatbot Prototype Design Considerations and Requirements Document	The team reviewed literature, consulted with stakeholders, sought feedback from the Innovation Center Planning Committee , and engaged in extensive discussions with Innovation Center leadership .
Patient-Clinician Chatbot Prototype Assessment Report	The team conducted usability testing sessions with five patient advocates in which patients tested the chatbot with hypothetical questions, provided feedback on the interactions, and participated in a usability survey. The team calculated response times and reading levels of the interactions to assess ease of use. The team then administered a survey instrument to five clinicians to assess the appropriateness, relevance, and accuracy of the hypothetical patient interactions from the usability testing sessions.
PC CDS Prototype Final Demonstration	To design and develop the prototype, the medication adherence team conducted co-design sessions with three patient advocates to solicit feedback on the chatbot's conversation scenarios. The patient-clinician communication team conducted co-design sessions with two patient advocates and six clinicians to gather feedback on the overall design of the chatbot and the flow of questions and responses.

Exhibit 33 provides further detail about the stakeholder types that participated in KIIs, surveys, think-aloud tests, co-design sessions, and usability testing sessions for the Core 1 and Core 2 deliverables described previously. In total, the team engaged 39 stakeholders for PC CDS measurement and development.

Exhibit 33. Number of Innovation Center Stakeholders Engaged by Stakeholder Type



3.3.2 Innovation Center Outputs

In completing the four projects, the Innovation Center developed six separate deliverables for AHRQ. The team also developed two peer-reviewed journal manuscripts based on projects completed during the base years, which are both public-facing resources (Exhibit 34).

Exhibit 34. Innovation Center Deliverables

Core	Deliverable Title	Description
Core 1	<i>Project 1: Assessment of Real-World Experience in PC CDS Measurement</i>	
	Real-World Experience in PC CDS Measurement Final Report	This report describes common areas of measurement and gaps in measurement per the PC CDS performance measurement framework, as well as the challenges measuring certain PC CDS domains. It also identifies six action steps to improve PC CDS performance measurement in the near and long term.
	<i>Project 2: Assessment of Core 2's Prototypes</i>	
	Medication Adherence Prototype Assessment Report	This report details findings from the formative assessment of the Quartz app. The assessment examined the technical feasibility of integrating the app into a health system EHR, as well as patient perspectives on usability and patient-centeredness, through key informant interviews with app developers, health system IT staff, clinicians, and patients. Findings from the assessment were used to refine the prototype.
	Patient-Clinician Chatbot Prototype Assessment Report	This report details findings from the formative assessment of the PAIGE chatbot prototype. The assessment involved usability testing sessions with patients to understand ease of use and utility. A survey instrument was administered to clinicians for perspectives on appropriateness, relevance, and accuracy. Quantitative analyses were conducted to understand the complexity of the patient-chatbot interactions. Findings from the assessment were used to refine the prototype.

Core	Deliverable Title	Description
	Base Year Manuscripts	
	PC CDS Workflow Execution Model Manuscript	This manuscript details PC CDS workflow execution models for three illustrative use cases: 1) collection and use of PROs; 2) collection and use of PGHD other than PROs; and 3) encouraging or facilitating a shared decision making discussion. The paper also highlights new considerations for PC CDS policies and procedures that healthcare systems, clinicians, EHR developers, app developers, and others need to develop to support new and evolving workflows.
	PC CDS Performance Measurement Framework Manuscript	This framework details the measure domains and subdomains that CDS developers, clinical informaticians, clinical leaders, and others should use to assess PC CDS performance across the PC CDS lifecycle. The ultimate goal of the framework is to develop a consistent approach to evaluating 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	Project 1: Medication Adherence Chatbot Prototype	
	Medication Adherence Prototype Specifications and Requirements Document	This document describes the overall design, including functional specifications and design requirements, of the Quartz text messaging app for medication adherence. The document includes sections on the technical approach to developing the app, including the software applications and AI used and the technical components. The document also outlines the conversation scenarios supported by the app. Finally, the document includes a proposed strategy for co-designing the app with patients.
	PC CDS Prototype Demonstration*	After the refinements from the co-design process were made, a demonstration was given to AHRQ show the capabilities and functionalities. The demonstration involved a pre-recorded video of a cellphone receiving and responding to text messages from Quartz for each supported conversation scenario.
	Project 2: Patient-Clinician Chatbot Prototype	
	Patient-Clinician Chatbot Prototype Design Considerations and Requirements Document	This document describes the overall design of the PAIGE chatbot prototype. The document outlines the potential use cases and describes the technical approach, including the technical components and use of AI. It also describes design considerations for the chatbot’s approach to communication.
PC CDS Prototype Demonstration*	After a functioning prototype was developed, a demonstration was given to AHRQ to show PAIGE’s capabilities and functionalities. The demonstration involved a pre-recorded video of a static version of PAIGE in the patient portal and example conversations regarding a urinary tract infection based on different large language models. A live version of PAIGE using ChatGPT as the LLM was also demonstrated with hypothetical clinical questions.	

*Note: The two PC CDS Prototype Demonstrations were presented together and are considered one deliverable

To date, the Innovation Center has published three manuscripts and has one manuscript (PC CDS Performance Measurement Framework) under review at a journal. Reach of the currently published manuscripts as of July 31, 2024, is detailed in Exhibit 35.

Exhibit 35. Reach of Innovation Center Peer-Reviewed Articles to Date

Title	Publication Date	Journal	Reach
“Patient-centered clinical decision support challenges and opportunities identified from workflow execution models” ⁶⁰	June 22, 2024	JAMIA	The manuscript was viewed 1,299 times and was downloaded 647 times . JAMIA promoted the publication on Twitter/X, where it received 376 views, 1 like, and 1 repost, ⁶¹ and LinkedIn, where it received 16 likes and 2 reposts. ⁶² The article is in the top 25% in the Altmetric Attention Score for research output.
“Visualization of Patient-Generated Health Data: A Scoping Review of Dashboard Designs” ⁶³	October 2023	<i>Applied Clinical Informatics (ACI)</i>	ACI promoted the publication on Twitter/X where it received 168 views, 1 like, and 1 repost. ⁶⁴
“A lifecycle framework illustrates eight stages necessary for realizing the benefits of patient-centered clinical decision support” ⁶⁵	July 2023	JAMIA	The manuscript was viewed 3,139 times and was downloaded 615 times . AMIA promoted the publication on Twitter/X, where it received 1.6K views, 14 likes, 4 Bookmarks and 6 reposts, ⁶⁶ and LinkedIn, where it received 55 likes, 13 reposts, and 2 comments. ⁶⁷ The article is in the top 25% of all research outputs scored by Altmetric.

In addition, one poster was presented at the MCBK North America Chapter Meeting in February 2024, and three abstracts were accepted for presentation at the 2024 AMIA Annual Symposium (Exhibit 36), which will take place in San Francisco in November 2024.

Exhibit 36. Completed and Planned Innovation Center Conference Presentations

Project	Presentation Title	Description
Completed Presentation		
Cross-Cutting Assessment of Real-World Experience in PC CDS Measurement	Real-World Measurement Experience to Mobilize Computable Biomedical Knowledge for Patient-Centered Clinical Decision Support	Poster presentation on common areas, gaps, challenges, and opportunities for PC CDS measurement

Project	Presentation Title	Description
Planned Presentations		
Core 2 Prototypes	Leveraging Large Language Models and Other Artificial Intelligence Methods to Advance Patient-Centered Clinical Decision Support	Panel presentation on the opportunity for utilizing AI, including LLMs, to aid patient-centered clinical decision making, as well as important knowledge gaps, challenges, and limitations
Cross-Cutting Assessment of Real-World Experience in PC CDS Measurement	Validating a Performance Measurement Framework through Real-World Experience in PC CDS Measurement	Poster presentation on common areas, gaps, challenges, and opportunities for PC CDS measurement
Patient-Clinician Communication Prototype	Development of a Prototype for Patient Artificial Intelligence Guided E-messages (PAIGE)	Poster presentation on findings from a feasibility assessment involving clinicians

Qualitative Feedback Received About Outputs

The team received feedback from social media, email, and audience question and answer (Q&A) sessions at the 2024 CDSiC Annual Meeting following dissemination of certain project deliverables. Exhibit 37 describes feedback received on each publicly disseminated deliverable.

Exhibit 37. Qualitative Feedback on Innovation Center Deliverables as of July 31, 2024

Project	Source of Feedback	Description of Feedback
PC CDS Lifecycle Framework Manuscript	JAMIA	<ul style="list-style-type: none"> The paper was cited in a 2023 <i>JAMIA</i> commentary aimed at highlighting papers related to the implementation of decision support, including CDS that uses AI-based approaches.⁶⁸
Medication Adherence Prototype	CDSiC 2024 Annual Meeting Audience Q&A	<ul style="list-style-type: none"> Meeting participants were interested in the level of pre-coding for the AI used for the chatbot and the degree to which the AI understands patient responses. Participants described their own positive experiences with chatbots, noting that they improved efficiency of interactions with their care team.
Patient-Clinician Communication Prototype	CDSiC 2024 Annual Meeting Audience Q&A	<ul style="list-style-type: none"> Meeting participants discussed challenges with using chatbots to communicate with patients. They discussed how patients often provide incomplete answers either because they are ignoring the chatbot’s question or because virtual communication deters elaboration. Participants described their own positive experiences with chatbots, noting that they improved efficiency of interactions with their care team.

Project	Source of Feedback	Description of Feedback
Real-World Experience in PC CDS Measurement	CDSiC 2024 Annual Meeting Audience Q&A	<ul style="list-style-type: none"> Meeting participants discussed scalability as an important area of measurement that could be incorporated in the PC CDS performance measurement framework.

3.3.3 Challenges Experienced and Strategies for Resolution

As the CDSiC research and development hub, the Innovation Center worked on the cutting edge of PC CDS. At the same time, the innovative nature of the work posed both challenges and opportunities.

Engagement of pilot sites. The Core 2 team had difficulty identifying a pilot site to deploy the medication adherence app within the initial timeframe, resulting in modest project delays. Health system candidates were concerned about resources to deploy the program and, if successful, sustaining the pilot beyond the third-year funding period. To navigate these challenges, the team employed the following strategies:

- Leveraged an existing network of health care organizations with previous experience working with the project team to implement new technologies. These organizations were more familiar with and had existing infrastructure to support the process steps and requirements.
- The team identified sites that have EHR capacity i.e., have deployed SMART on FHIR apps previously and experience collecting and integrating patient-reported data.

Navigating the emerging AI landscape and role in PC CDS. For the Core 2 prototypes, the team had to ensure that AI was being used safely and responsibly. Several challenges included finding ways to increase transparency and obtain patient consent to use AI, ensuring clinicians remained in the loop with AI-assisted decision making, and developing ways to evaluate the appropriate AI use. To address these challenges, the team implemented the following strategies:

- Used an incremental approach to design and develop the chatbot prototypes, including meeting every two weeks as a team to discuss project progress and reviewing each other’s work.
- Activities were informed by Task 2 Trust and Patient-Centeredness Workgroup findings on patients’ perceptions of AI use as well as feedback from Innovation Center Planning Committee and CDSiC Steering Committee members. As a bedrock rule, the team decided not to use AI to provide medical advice or information to patients, but rather to collect patient information to share with clinicians.
- The team engaged patients from the CDSiC’s network of patient advocates and representatives in co-design processes to ensure AI was being used in an appropriate and patient-centered manner.

3.4 Cross-CDSiC Outcomes

The CDSiC structure and activities were designed to foster alignment and collaboration among various centers. This cross-center collaboration has been crucial for the effective design and scoping of CDSiC products, ensuring that they meet the diverse needs of the PC CDS community. By actively identifying additional avenues and organizations to share CDSiC work and solicit feedback, we aimed to enhance the relevance and impact of our products. Our commitment to timeliness ensures that products and projects are delivered promptly, addressing the evolving demands of the PC CDS field. Moreover, each new product builds on prior CDSiC work, creating a cohesive and progressive body of knowledge that continually advances the field of CDS. This section below describes outcomes that cut across all of our activities and reflect the broader adoption of CDSiC outputs by CDS stakeholders and wider awareness of PC CDS overall, including citations referencing PC CDS and hashtags related to PC CDS and the CDSiC.

3.4.1 Collaboration with Other CDS Focused Groups

To spread awareness of the Workgroups' completed products and to gather feedback on products under development, the CDSiC team presented to the HL7 CDS workgroup and the AMIA CDS workgroup. At both these meetings, attendees expressed interest and enthusiasm in the products and provided thoughtful questions and considerations for the newer products under development.

3.4.2 Publications on PC CDS and Adoption by CDS Stakeholders

As of September 20, 2024, 19 manuscripts in the National Library of Medicine's PubMed search engine⁶⁹ referenced either "Patient-centered clinical decision support," "Patient-centered CDS," or "PC CDS." Eighteen of these were published within the last six years (2018-2024), and seven were published by the team as part of the CDSiC or prior AHRQ PC CDS Initiatives (Appendix B).^{70,71,72,73,74,75}

To date, manuscripts on PC CDS written by the CDSiC project team have been cited by several external manuscripts. The cumulative Altmetric score, which represents a weighted count of the amount of attention picked up for a research output, to date for all published articles is 130.

3.4.3 Social Media and Search Engine Trends

From May 15, 2023 to July 31, 2024, #PCCDS and #CDSiC have cumulative X (formerly known as Twitter) impressions of 1,183,330 and 3,215,040 respectively, highlighting the increase in awareness on the topic of PC CDS and the CDSiC. On average, the PC CDS topic has had a worldwide relative interest of 51.24 since 2021 as per Google Trends. This means that, on average, the interest in the PC CDS topic has reached 51.2% of peak interest (100 is peak popularity) during the given timeframe.

4. Discussion

In the third year of the CDSiC, the team maintained the operational infrastructure for the CDSiC's three centers and engaged over 100 CDS stakeholders in discussions around the current state and future promise of PC CDS. In doing so, the CDSiC developed over 21 new resources for a total of 51 resources for the CDS community that provide concrete recommendations and guidance for advancing the scalability, quality, and effectiveness of PC CDS.

The CDSiC's efforts in the base years yielded several lessons learned about implementing a large-scale collaboration to advance PC CDS. Lessons learned in the base years and implemented in the third year include ensuring coordination across Workgroups and the Innovation Center, strategic planning, staying updated on PC CDS developments, and engaging patients meaningfully. We also emphasized maintaining stakeholder engagement, managing timelines effectively, and being adaptive to real-world constraints like COVID-19.

4.1 Lessons Learned

In the third year of the CDSiC, the team embraced a continuous learning process, regularly reflecting on its processes, achievements, and challenges, allowing for the identification of effective strategies to advance PC CDS. This approach has supported the identification and implementation of effective strategies to advance PC CDS. Whenever a need for improvement was identified, the team addressed it, embodying a spirit of continuous improvement. Key lessons learned include:

Product Development and Pilot Project Implementation

Foster collaboration across the Stakeholder Center and Innovation Center so the whole is greater than the sum of the parts. Maintaining alignment and cross-pollination across the Stakeholder and Innovation Centers was essential to ensure that the Workgroups and Innovation Center team worked collaboratively to inform each other's work, created outputs that would build on previous and ongoing work, and ultimately furthered the CDSiC's goals to advance PC CDS and shared decision making.

This year, the Stakeholder Center and Innovation Center collaborated on several products. Specifically:

- The Trust and Patient Centeredness Workgroup leveraged the two Innovation Center pilots, Quartz and PAIGE, to develop use cases for their product on perspectives on AI.
- The Measurement and Outcomes Workgroup used data from KIs conducted for the Innovation Center's PC CDS Real World Measurement report.
- The Implementation, Adoption, and Scaling Workgroup leveraged the Innovation Center's AHRQ projects inventory of PC CDS pilots for a case studies product.
- In addition, some Workgroup products developed in previous years directly informed the development of subsequent products. For example, the taxonomy of patient preferences relevant to PC CDS and approaches to measure PC CDS were used as a model by the Trust and Patient-Centeredness Workgroup to develop swimlane diagrams on how to capture different patient preferences within lifeflows and workflows.

The Stakeholder Center and Innovation Center support teams also shared information on literature and potential key informants and experts who expressed interest in participating in additional CDSiC activities and/or were pertinent to a particular product. This collaboration helped improve efficiency, reduced redundancy, and enhanced the overall quality and cohesiveness of the resulting PC CDS resources.

Continue to monitor the evolving PC CDS landscape. Staying informed about recent policy and technical developments in the PC CDS landscape helped the CDSiC contextualize and leverage the innovative work of other experts in the PC CDS field. The CDSiC project team kept abreast of relevant publications for PC CDS and topics such as AI, FHIR, and PC CDS standards. By monitoring the evolving landscape, the CDSiC expanded products to address emerging areas such as AI, real-world implementation of PC CDS, incorporating SDOH, and assessing the value proposition for PC CDS.

Carefully engage and select potential pilot sites. Innovation Center activities highlighted the importance of carefully selecting pilot sites and better understanding health system capacity to participate in a pilot project. Delays encountered with the Quartz pilot underscored the necessity of selecting health system partners that have the time and resources to participate. Such partnerships facilitate sustainability planning beyond initial phases, ensuring long-term adoption through effective funding strategies and scalable initiatives driven by validated outcomes.

The CDSiC engaged with health system sites in the project that aligned with their priorities, thereby increasing their willingness to invest time and resources. Once a pilot site was identified, the team ensured that the health systems had a clear understanding of expectations, including detailed information on the project's goals, timelines, and level of involvement required from their teams. It was crucial to engage senior leadership within the health systems. Their support and commitment were essential for the success and sustainability of the pilot projects. At the implementation stage, there was a need to work with clinical and implementation teams on workflow integration, resource allocation, and institutional review board requirements. Overall, the CDSiC team had to be flexible and adaptable to accommodate the varying priorities and constraints of different health system partners, which helped to overcome challenges and ensure smooth project execution.

Stakeholder Engagement

Grow the breadth and diversity of the CDSiC community through product development and dissemination of products outside of existing networks. We learned that engaging a wider group of experts, patients, and patient advocates through focus groups, roundtables, and KIIIs significantly increased awareness of the CDSiC's efforts and resources. The CDSiC learned that participation in discrete qualitative activities can lead to continuous engagement and involvement with the CDSiC community, as several key informants then participated virtually in the 2024 CDSiC Annual Meeting. During Year 3, we also leveraged broader expertise through outreach to the networks of Steering Committee members and Workgroup leads. They suggested stakeholders to engage, resulting in more diverse perspectives. This year, we expanded stakeholder engagements across the CDSiC, completing a total of 118, up from 93 last year. Notably, we engaged 102 unique individuals over the past year. Additionally, most experts engaged in Year 3 Workgroup activities were new (with an ~11% repeat rate), and there was increased input from patient, payer, and industry stakeholders. Additionally, the CDSiC

presented work beyond the CDSiC community to widen dissemination, including at HL7 and AMIA CDS Workgroups. Additionally, the *Methods for Co-Designing Patient-Centered Clinical Decision Support with Patients and Caregivers* was presented at the Patient Insight Congress in Atlanta during the Trust, Equity, and Engagement in Research poster session. The audiences at these forums expressed enthusiasm and interest in the products and CDSiC.

Such engagement strategies led to a noticeable uptick in sign-ups for the CDSiC newsletter and more inquiries about joining Workgroups. For example, following focus groups and roundtables, we received a substantial number of "Get Involved" form submissions. This lesson underscores the value of inclusive engagement strategies in enhancing the quality and relevance of CDSiC work and amplifying impact. Actively involving a diverse array of stakeholders generated greater interest and participation in CDSiC activities, fostering a more collaborative and dynamic environment for advancing PC CDS.

Engage patient partners meaningfully and intentionally. Advancing the field of PC CDS requires that patients be involved in all stages of the PC CDS lifecycle. In Year 3, the CDSiC team prioritized including patient voices in PC CDS outputs to incorporate their needs, values, and preferences in a meaningful way. As a result, we engaged over twice as many patient partners (n=26 for Workgroup qualitative activities) as we engaged in the project's first two years. Other patient engagement efforts included a dedicated panel discussion at the CDSiC Annual Meeting, a poster highlighting a CDSiC product at the Patient Insight Congress, and writing a collaborative blog post with patient partners.

During Year 3, the CDSiC engaged 34 unique patient partners across the Stakeholder Center and Innovation Center via KIIs, focus groups, and roundtables, as well as co-design sessions for the Quartz and PAIGE pilots. The poster on methods for co-designing PC CDS presented at the Patient Insight Congress was particularly useful to patient partners, who noted the product's exploration of how co-design approaches can encourage patient and caregiver input in research and testing of PC CDS interventions. During the CDSiC's 2024 Annual Meeting, we also featured a patient representative panel discussion. Furthermore, the CDSiC partnered with patient advocates to co-author a patient blog post for the National Patient Advocate Foundation.

Strategies for Operating a Successful Collaborative With Diverse Stakeholders

The CDSiC team identified the following important lessons for supporting this multi-stakeholder collaborative:

Ensure tight project management, adherence to timelines given the volume of products, and effective engagement from Workgroup co-leads and Workgroups. Developing 11 products across the four Workgroups in one year required the CDSiC team to efficiently develop product proposals into final outputs within tight deadlines using a mix of qualitative and quantitative methods. Effective and agile project management enhanced flexibility and responsiveness, and enabled the team to quickly adapt to changes, deliver incremental improvements, and maintain momentum toward achieving project goals. The CDSiC team employed several tactics to ensure high-quality products were delivered on time, including maintaining detailed timelines and conducting regular internal check-ins; consultations and asynchronous reviews with Workgroup leads; seeking asynchronous feedback from Workgroup members; and working closely with AHRQ to coordinate review and finalization of products.

Consistent interaction and engagement created a forum to discuss findings and results; gather feedback from Workgroup leads and members; resolve issues; and keep all parties actively involved in shaping final products. The strict timeline adherence was crucial, given the volume of products and the need for ongoing feedback from Workgroup leads and members. The consistent engagement of Workgroup leads was achieved through a regular meeting schedule, which enabled substantive discussion on key areas for each product, fostered strong working relationships among the Workgroup leads and support teams, and created a collaborative and accountable environment. The support teams remained agile in addressing and resolving issues promptly while focusing on the end-user utility of products from the outset to minimize the need for later revisions. The Stakeholder Center internal meetings every other week for Workgroup support teams allowed them to exchange resources, share insights, and discuss methods for keeping product development on track.

Finally, the CDSiC worked closely with AHRQ throughout the product development process and efficiently managed project officer review and feedback, AHRQ OC review, and finalization of 11 products in a streamlined manner. These approaches emphasized the importance of efficient project management and proactive engagement with Workgroup leads and members and AHRQ to develop high-quality products.

Deploy multifaceted strategies for sustained CDSiC stakeholder engagement. Similar to previous years, consistently engaging Workgroup members proved challenging due to the voluntary nature of their involvement, competing demands, and limited availability. Throughout the reporting period, the CDSiC team used strategies to improve engagement, including sending discussion questions before meetings to facilitate constructive feedback during meetings, providing updates, and seeking asynchronous feedback on products during off months. The Workgroup support teams also identified strategies for implementation in the coming years, such as allowing Workgroup members to present their projects or initiatives during meetings to ensure they benefit from these sessions and meeting more frequently during the initial phases of product development.

The CDSiC team also worked to promote and sustain long-term engagement with Steering Committee members who have been involved since the project's launch in 2021. The CDSiC team successfully employed strategies, including incorporating external presentations into Steering Committee meetings and facilitating members to share their CDS-related work for feedback from fellow members. To achieve sustained engagement, the CDSiC team used multifaceted strategies to sustain and improve Workgroup and Steering Committee member engagement.

4.2 Conclusion

The CDSiC is deeply committed to advancing and driving innovation in PC CDS through development, testing, implementation, tracking, and measurement. The CDSiC actively engages diverse stakeholders, particularly patient representatives, to establish a collaborative network focused on the advancement of evidence-based, shareable, interoperable, and publicly available PC CDS.

In Year 3, the CDSiC maintained a Steering Committee, four Workgroups that collectively produced 11 public-facing products, and two Innovation Center Cores that developed six deliverables through four

projects. These efforts expanded the boundaries of PC CDS by introducing new concepts and technologies. The CDSiC involved 102 unique experts through a total of 118 engagements (e.g., Klls, focus groups, and technical expert panels), and disseminated PC CDS resources and outputs via scientific journals, conference presentations, newsletters, Leadership Viewpoint pieces, social media, and the CDSiC website.

By creating publicly accessible resources and serving as an innovation hub, the CDSiC fosters new PC CDS concepts and encourages adoption of PC CDS. During Year 3, the CDSiC explored important and emerging topics such as collection and use of SDOH data, using AI to scale PC CDS while ensuring transparency and building trust, and scaling PC CDS beyond pilot projects to demonstrate value and expand the evidence base for implementation best practices.

Looking ahead, the CDSiC remains dedicated to staying at the forefront of PC CDS innovation. By fostering ongoing engagement with patients, clinicians, researchers, developers, payers, and federal agencies, the CDSiC aims to identify more opportunities to advance PC CDS and address gaps in the evidence base. The goal is to continue refining practical resources and guidance for PC CDS and to facilitate widespread adoption of these tools to enhance patient health outcomes across health care settings.

Appendix A: CDSiC Progress Assessment Framework

Domain	Activities	Outputs	Outcomes
Definition	<p>Actions carried out in implementing the CDSiC</p> <p><i>Development and sustainment of CDSiC infrastructure</i></p>	<p>Products of CDSiC activities</p> <p><i>Number of written products and presentations, as well as dissemination activities to share this work</i></p>	<p>Engagement of CDS stakeholders and reach and adoption of CDSiC outputs</p> <p><i>Reach of CDSiC outputs and engagement of the broader CDS community, adoption of CDSiC outputs by CDS stakeholders, and broader awareness of PC CDS</i></p>
Operations Center	<ul style="list-style-type: none"> • Charter and Operational Framework Updates • Revision of CDSiC Outreach and Marketing Plan • Steering Committee activities • External SharePoint maintenance • Website maintenance 	<ul style="list-style-type: none"> • Newsletters • Dissemination plan materials • Social media posts • Number of blog posts/Leadership Viewpoints • Steering Committee meetings • Annual Meetings • Website pages • Spinoff products 	<ul style="list-style-type: none"> • Attendance/engagement in Steering Committee meetings • Newsletter engagement (subscribers, open rates, click rates) • Social media metrics (likes, shares, comments) • Annual Meeting engagement (registrants/attendees/feedback) • Website (visitors, landing page views, PDF downloads) • Presentation engagement as measured through QR Code scan metrics • Media pickup
Stakeholder Center	<ul style="list-style-type: none"> • Charter and Operational Framework updates • Planning Committee activities • Refinement of Workgroup scopes • Expansion of Workgroup membership • Workgroup activities 	<ul style="list-style-type: none"> • Workgroup products • Additional outputs (publications, conference presentations) • Presentations to AMIA and other industry workgroups 	<ul style="list-style-type: none"> • Product downloads and views • Peer-reviewed article metrics (citations, Altmetric scores) • Attendance by CDS stakeholders at presentations • Secondary dissemination • Qualitative information received about outputs

Domain	Activities	Outputs	Outcomes
Innovation Center	<ul style="list-style-type: none"> Charter and Operational Framework updates Planning Committee activities Core activities 	<ul style="list-style-type: none"> Innovation Core deliverables Additional outputs (publications, conference, presentations) 	<ul style="list-style-type: none"> Downloads/views of public-facing resources Peer-reviewed article metrics (citations, Altmetric scores) Attendance by CDS stakeholders at presentations Secondary dissemination Qualitative information received about outputs
Cross-CDSiC	<ul style="list-style-type: none"> Description of how the CDSiC's structure and activities support alignment and collaboration among Centers Cross-center collaboration to design and scope CDSiC products Identification of additional avenues/organizations to share CDSiC work and solicit feedback 	<ul style="list-style-type: none"> Timeliness of products and projects for CDS field Products that build off prior CDSiC work 	<ul style="list-style-type: none"> Inter-organizational collaboration with other CDS-focused groups Adoption of CDSiC outputs by CDS stakeholders Citations using "patient-centered CDS" over time Use of #PCCDS, #CDSiC registered hashtags over time Google trends related to "patient-centered CDS" over time

Appendix B. Manuscripts about PC CDS written by the CDSiC team

From the CDSiC (October 2023 – July 2024):

1. Sittig DF, Boxwala A, Wright A, Zott C, Gauthreaux NA, Swiger J, Lomotan EA, Dullabh P. Patient-centered clinical decision support challenges and opportunities identified from workflow execution models. *J Am Med Inform Assoc*. Published online June 22, 2024. doi:10.1093/jamia/ocae138
2. Dullabh P, Dhopeswarkar R, Cope E, Gauthreaux N, Zott C, Peterson C, Leaphart D, Hoyt S, Hammer A, Ryan S, Swiger J, Lomotan E, Desai P. Advancing patient-centered clinical decision support in today's health care ecosystem: key themes from the Clinical Decision Support Innovation Collaborative's 2023 annual meeting. *J Am Med Inform Assoc Open*. [in press as of July 2024].
3. Dullabh P, Leaphart D, Dhopeswarkar R, Heaney-Huls K, Desai P. Patient-Centered Clinical Decision Support—Where Are We and Where to Next? In *MEDINFO 2023—The Future Is Accessible 2024* (pp. 444-448). IOS Press.
4. Dullabh P, Zott C, Gauthreaux N, Swiger J, Lomotan EA, Sittig DF. Realizing patient-centered clinical decision support: a new performance measurement framework. *Learning Health Systems*. [under review as of May 2024].

From prior AHRQ PC CDS Initiatives and CDSiC (October 2021 – September 2023):

1. Shenvi EC, Boxwala A, Sittig DF, et al. Visualization of patient-generated health data: a scoping review of dashboard designs [published online ahead of print, 2023 Sep 13]. *Appl Clin Inform*. 2023;10.1055/a-2174-7820. doi:10.1055/a-2174-7820
2. Sittig DF, Boxwala A, Wright A, Zott C, Desai P, Dhopeswarkar R, Swiger J, Lomotan EA, Dobs A, Dullabh P. A lifecycle framework illustrates eight stages necessary for realizing the benefits of patient-centered clinical decision support. *J Am Med Inform Assoc*. 2023;30(9): 1583-1589. <https://doi.org/10.1093/jamia/ocad122>
3. Dullabh P, Heaney-Huls K, Lobach DF, et al. The technical landscape for patient-centered CDS: progress, gaps, and challenges. *J Am Med Inform Assoc*. 2022;29(6):1101-1105. doi:10.1093/jamia/ocac029
4. Dullabh P, Sandberg SF, Heaney-Huls K, et al. Challenges and opportunities for advancing patient-centered clinical decision support: findings from a horizon scan. *J Am Med Inform Assoc*. 2022;29(7):1233-1243. doi:10.1093/jamia/ocac059
5. Dullabh P, Heaney-Huls K, Hovey L, et al. The technology landscape of patient-centered clinical decision support - where are we and what is needed? *Stud Health Technol Inform*. 2022;290:350-353. doi:10.3233/SHTI220094
6. Lobach DF, Boxwala A, Kashyap N, et al. Integrating a patient engagement app into an electronic health record-enabled workflow using interoperability standards. *Appl Clin Inform*. 2022 Oct;13(5):1163-1171. DOI: 10.1055/s-0042-1758736. PMID: 36516969; PMCID: PMC9750793.

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