

# A Funding Proposal for a Sustainable Knowledge Network to Support a More Effective CDS Ecosystem

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On behalf of the Patient-Centered Clinical Decision Support  
Learning Network

January 31, 2020

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## Executive Summary

Today there is a fragmented ecosystem comprised of biomedical knowledge generators, vendors, consumers, regulators—and more—for clinical decision support (CDS). The fragmented ecosystem hinders health care organizations, providers, and patients (increasingly so), from utilizing the best and most current knowledge in their health-related decisions for individual patients as well as patient populations. For example, the Centers for Disease Control released its testing guidelines for Zika and Dengue Fever in June 2019<sup>1</sup> and then updated them again in November 2019<sup>2</sup>, yet fragmentation in the CDS ecosystem<sup>a</sup> has the potential to delay doctors and their patients from receiving that updated information at the point-of-care in clinics and hospitals. Relatedly, a recent review of hypertension guidelines found that leading clinical practice guidelines (CPGs) were highly inconsistent in their recommendations; which demonstrates the inconsistencies in today's CDS ecosystem for making the right knowledge available to the right people at the right time<sup>3</sup>.

A more robust CDS ecosystem could address the above example by establishing and spreading software standards that enable all stakeholders to format and deliver their guidance in executable forms, which healthcare organizations, doctors, and patients could download or access from their electronic health records or potentially into smartphone apps. A more robust CDS ecosystem would address guideline inconsistencies by providing forums for knowledge developers to better determine gaps—or conflicts—in their recommendations and provide tools that highlight those gaps and help to resolve them. A more robust CDS ecosystem would contribute to larger efforts to transform today's healthcare system.

There is a growing acknowledgment among CDS developers, guideline developers, healthcare organizations, policymakers—and others—that to more effectively and efficiently leverage the best knowledge for health decision-making, there needs to be a more cohesive and standards-based CDS ecosystem than what exists today. ***The Learning Network proposes establishing a Knowledge Network as a successor to the Learning Network to guide the development of a cohesive and standards-based ecosystem.*** The Knowledge Network will take advantage of a growing consensus among stakeholders in the CDS ecosystem that a pre-competitive entity, effectively governed and collaborative in nature, can foster the availability and use of computable biomedical knowledge that improves patient health, and healthcare delivery, at lower costs and with lower burden on providers. Such an entity could help bring to life the vision of a Learning Health System and manifest the value that has been long-expected from the United States' investments in electronic health record adoption.

### Mission

The mission of a Knowledge Network will provide a pre-competitive platform to accelerate the translation of knowledge into practice.

### Vision

A Knowledge Network will be a trusted entity to support collaboration and cooperation among stakeholders across the knowledge ecosystem.

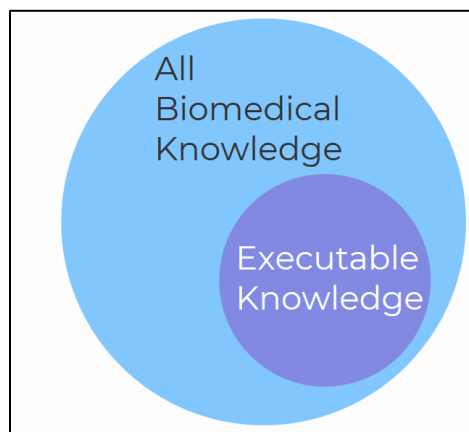
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<sup>a</sup> The term CDS ecosystem refers to all parties holding a “stake” in CDS. Another term gaining recognition is Computable Biomedical Knowledge (CBK). For the purposes of this document, we use “CDS Ecosystem” as a term that broadly overlaps with “CBK Ecosystem.”

## Overview

The Patient-Centered CDS Learning Network (Learning Network) began operations in January 2016 with cooperative agreement funding from the Agency for Healthcare Research and Quality (#U18 HS024849). Its charge was to promote the dissemination of patient-centered outcomes research—and patient-centered evidence—through clinical decision support (CDS), and to identify a strategy for achieving organizational sustainability beyond its four-year funding period. Over the past 10 months, the Learning Network convened and engaged a Sustainability Working Group (SWG) comprised of experts in clinical decision support, industry leaders in market-based solutions for disseminating actionable biomedical evidence, and national policy (see Contributors section). The SWG—in conjunction with direct stakeholder input as well as interactions with parallel initiatives—set out to identify the challenges to disseminating patient-centered evidence via CDS and to propose a solution that would achieve Learning Network sustainability and continue its efforts to advance CDS for evidence dissemination to the point-of-care.

The SWG identified core challenges into the foreseeable future that pertain to the development and maintenance of standards for stakeholders in a CDS ecosystem to make executable biomedical knowledge more findable, accessible, interoperable, and reusable (FAIR), and the establishment of a



**Figure 1: Executable Knowledge for CDS is a Subset of All Biomedical Knowledge**

stable multi-stakeholder network that develops standards and provides governance around the creation, exchange, and use of publicly available executable knowledge artifacts. Executable biomedical knowledge is knowledge that has been transformed from human-readable forms (e.g. narrative clinical guidelines) into computer-readable code. Executable knowledge will not only promote FAIR principles, it will also promote more rapid translation and dissemination of best available knowledge into user-facing systems such as EHRs and patient-facing apps. Executable knowledge represents a subset of all biomedical knowledge.

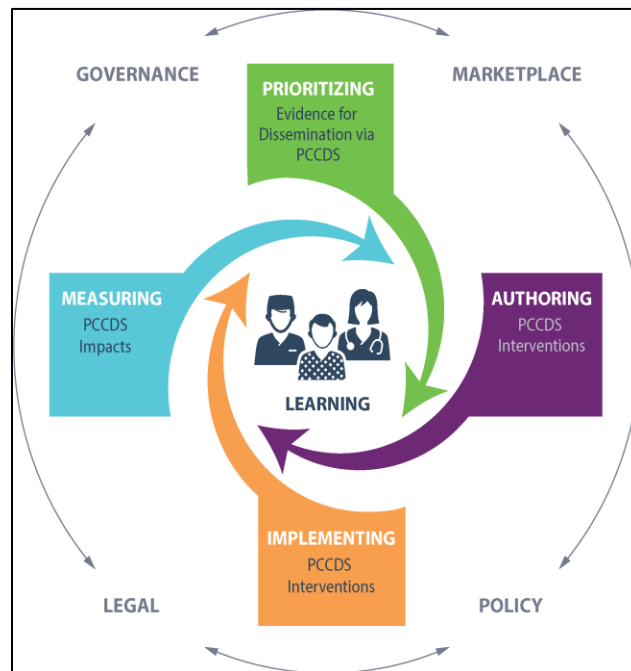
In this document we propose establishing a Knowledge Network, based on the Learning Network’s structures and its experiences, to focus efforts around standards development, coordinated supply, and governance of executable CDS. We believe a Knowledge Network can succeed based on the numerous examples of cooperative organizations that have established governance in support of sharing biomedical knowledge, such as the Sentinel Initiative, the Patient Innovation project<sup>4</sup>, and the World Wide Web Consortium (W3C). These organizations demonstrate that wide varieties of stakeholders can come together to determine common solutions for common benefit.

### The CDS “AFA”: CDS Components for a Learning Health System

The Learning Network developed the CDS Analytic Framework for Action (AFA) to depict the interconnected areas involved in transforming narrative biomedical knowledge into executable CDS (see Figure 2). We use the CDS AFA to orient discussions with stakeholders, determine where past work

has been carried out, identify gaps in the development of CDS activities, and propose opportunities for further work<sup>5</sup>. Yet few, if any, healthcare organizations have the means to conduct all the inter-related steps that are required to make executable knowledge available to providers and patients. Abbreviated descriptions of the AFA areas are (see Appendix for full descriptions):

- **External Factors:** External factors including the marketplace, policy, legal, and governance issues that impact development, dissemination, and implementation processes for CDS.
- **Prioritizing:** Selecting the knowledge that is to be made executable for CDS.
- **Authoring:** Translating knowledge into executable forms for CDS by applying well-accepted data and knowledge standards.
- **Implementing:** Applying standardized, best practice methods and architectures to operationalize CDS interventions into clinical workflows that deliver the right information to the right people in the right formats through the right channels at the right time to improve care processes and outcomes (Five Rights for CDS Implementation).
- **Measuring:** Ensuring that CDS interventions measurably improve clinician and patient decision making, care processes, and outcomes.
- **Learning:** Aggregating local CDS-related outcomes and effectiveness measures to facilitate both local and system-level learning from identified gaps in patient-centered outcomes research knowledge, and lessons learned from authoring, implementing, and using CDS in clinical practice to enhance care and outcomes.



**Figure 2: The CDS Analytic Framework for Action Identifies the Areas for Making Actionable CDS in a Learning Health System**

## The Current State of the CDS Ecosystem

Based off the Learning Network’s Trust Framework Working Group<sup>6</sup>, we identified 14 stakeholders in a CDS ecosystem plus the Learning Network’s SWG identified one more.

**Table 1: Key Stakeholders in a CDS Ecosystem**

<ul style="list-style-type: none"> <li>• Clinicians</li> <li>• Health IT Vendors</li> <li>• Knowledge Authors</li> <li>• Knowledge Curators</li> <li>• Knowledge Distributors</li> <li>• Knowledge Engineers</li> <li>• Governance Bodies</li> <li>• Medical Device Manufacturers*</li> </ul>	<ul style="list-style-type: none"> <li>• Patients</li> <li>• Payers</li> <li>• Policy makers</li> <li>• Population Health Analysts</li> <li>• Private Foundations and Research Institutes*</li> <li>• Quality Improvement Analysts</li> </ul>
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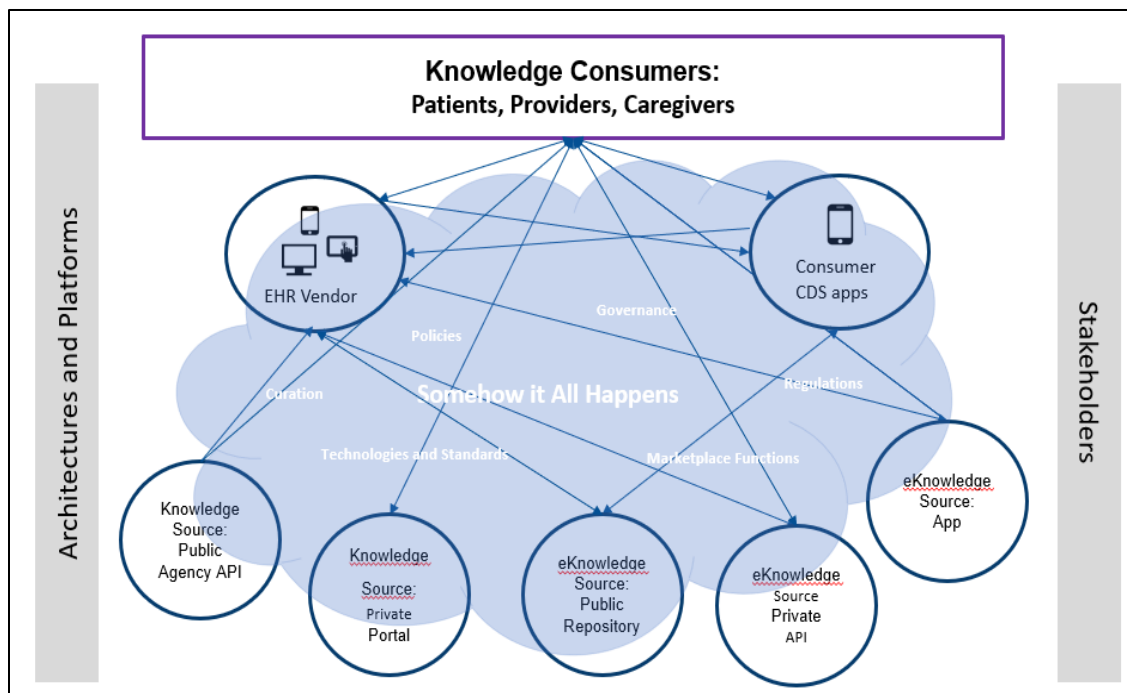
*\*Represents an additional stakeholder that was identified by the SWG*

These stakeholders, according to the Learning Network’s own 2016 Environmental Scan<sup>7</sup>, encounter multiple barriers to attaining executable knowledge across a CDS ecosystem. An overriding barrier is that the individual stakeholders—oftentimes responsible for developing and implementing executable knowledge to meet frontline workers’ and patients’ needs—do not have the economic means or informatics expertise to do the costly work at scale. One reason that costs are prohibitive for privately- and publicly-held organizations—especially for healthcare organizations—which are burdened with competing (and sometimes conflicting) quality improvement mandates, e.g. Accountable Care Organization transformations, quality reporting for MACRA/MIPS, etc. Another reason is that few healthcare organizations have the internal resources to support the expensive human resources necessary for prioritizing, finding, generating and implementing executable knowledge for CDS—leave aside the means to measure the impact that the executable knowledge may or may not have on improving patients’ and providers’ decision-making.

Stakeholders instead exist in a loosely coupled CDS ecosystem and rely on an array of standards and one-off business relationships to piece together solutions for approximating FAIR for executable knowledge, yet still at costs that exceed most stakeholders’ means.

Patients and providers typically use web browsers to search for relevant health information. Data, evidence and knowledge are available in narrative tabular, and human readable form. While searches may return many results, they may be off target or of poor quality, making it hard to find the most worthwhile information. This becomes exponentially worse when searching for knowledge related to patients with multiple concurrent conditions rather than a single well-defined problem. Searching and browsing can be improved by better indexing, tagging, and annotating of available knowledge, but the need to seek such knowledge outside regular workflow still presents challenges. Further, even when knowledge is accessed it is usually not in computable form – it cannot ‘plug in’ to support patient care or decision-making. Figure 3 below illustrates the current state.





**Figure 3: "Somehow it All Happens," Knowledge Translation in the CDS Ecosystem**

Recognizing this problem, AHRQ and other agencies have been exploring opportunities to disseminate evidence through CDS and other forms of computable or executable knowledge available at the point of care within knowledge enabled applications and platforms

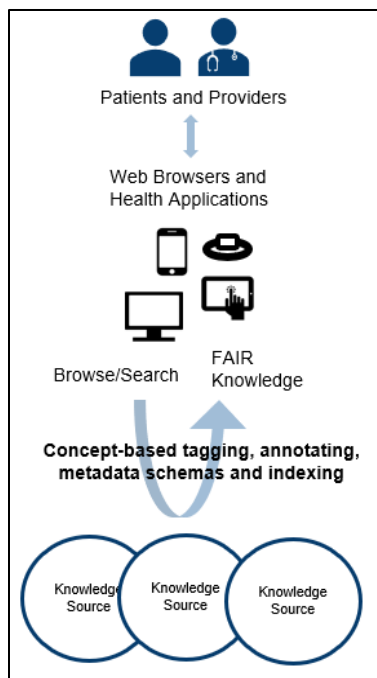
The Learning Network has determined that the infrastructure necessary to fully enable executable knowledge (and CDS) at the point of care involves many stakeholders, lacks effective governance, is not standardized, and brings together private and public knowledge producers and users in a “high friction” ecosystem. The Learning Network has collaboratively addressed several areas (patient-facing CDS design, trustability of knowledge artifacts, and technical gaps—but much work remains.

### The Knowledge Network: A Future State for the CDS Ecosystem

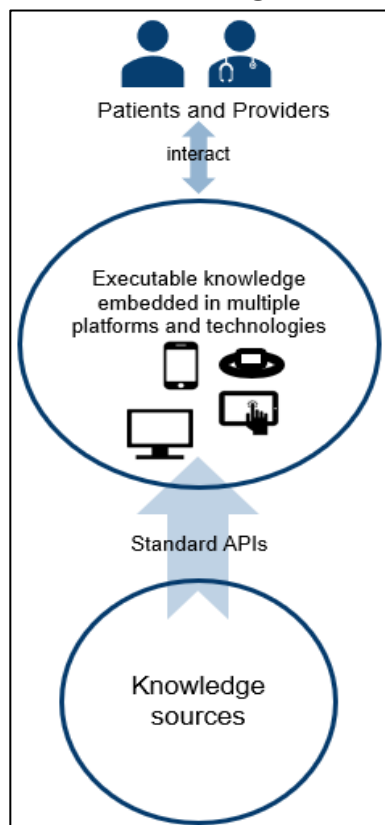
Over the past three years we have found that the infrastructure needed to fully enable executable knowledge (and CDS more broadly) at the point of care involves many stakeholders, lacks effective governance, is not standardized, and brings together private and public knowledge producers in a “high friction” ecosystem. The Learning Network has collaboratively addressed several areas (patient-facing design, trustability of knowledge artifacts<sup>6,8</sup>, technical gaps) but much work remains.

#### Improving the FAIR-ness of Executable Knowledge

A first step achieving a more effective CDS ecosystem is to improve access to executable knowledge by enhancing the end-user’s ability to search and browse for FAIR resources. Making knowledge resources more FAIR, both in AHRQ repositories and possibly other agency knowledge sources, would involve utilizing standard terminologies to tag resources, organizing them in a taxonomy, applying a metadata



**Figure 4: Near-future Search Strategy for Executable Knowledge**



**Figure 5: Far-future Search Strategy for Executable Knowledge**

schema to better categorize resources, and indexing the knowledge resources. Much of this could be achieved using leading edge machine learning techniques. Figure 4 illustrates this near-future approach albeit with users using traditional browsing and searching techniques in web browsers combined with leading edge terminology-based concepts, metadata superstructures, and indexing. While this approach improves access to knowledge sources and executable knowledge generally, it still driven by the manual processes of iterative search and browsing against web sites containing a variety and mix of information and knowledge types.

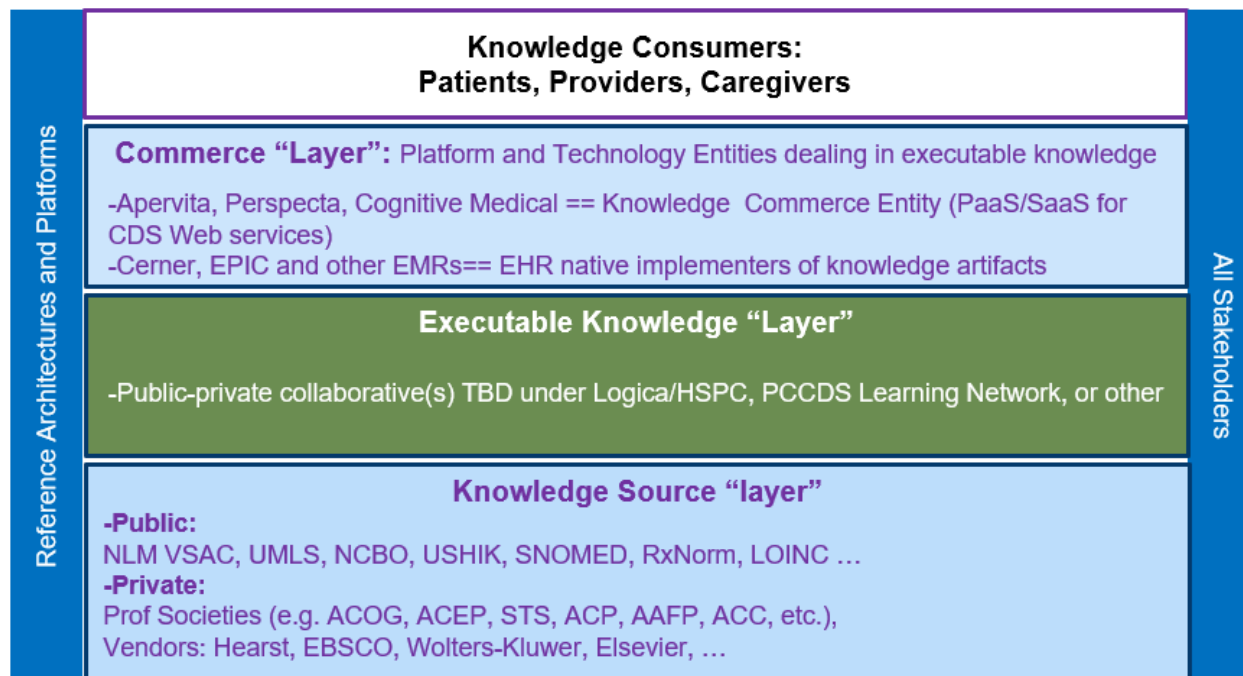
Further into the future, patients and providers—and other stakeholders—will continue to search and browse knowledge sources except that they will increasingly access knowledge that is embedded or in technologies and platforms that allow users to more seamlessly interact, learn, and make decisions via modular, sharable, standard-based CDS artifacts and application programming interfaces (see Figure 5). This approach will enable more efficient findability or knowledge in the context of workflows and life flows to more likely improve health outcomes, costs, and patient and provider satisfaction. This could be achieved through access to knowledge repositories and marketplaces (see Appendix A for a discussion of knowledge repositories and marketplaces).

#### *Bridging the Gap Between Layers of Knowledge and Commerce*

Beyond the findability of executable knowledge, a fundamental need is for a body that brings together content producers and implementers and numerous of other stakeholders. A system-level solution for the CDS ecosystem would provide a scalable approach that would lower costs for all stakeholders, much like how the World Wide Web Consortium (W3C) sets pre-competitive standards that provide a level playing field for all stakeholders to participate in the internet economy. **We therefore advocate for a Knowledge Network comprised of interested but neutral stakeholders to help advance the technologies and standards needed to enable a CDS ecosystem that operates with less friction.**

The Knowledge Network would be a pre-competitive entity that exists between broad-based and already-existing “layers” in the CDS ecosystem that we term the “Knowledge Source Layer” and the “Commerce Layer” (see Figure 6).

The Knowledge Source Layer encompasses numerous stakeholders that store, curate, and disseminate knowledge in ways that are already



**Figure 6: A Knowledge Network Entity Would Fulfill the Executable Knowledge Layer**

familiar to most in the biomedical field. The stakeholders are predominantly public or non-profit institutions that include, for example, the ECRI Trust (formerly AHRQ’s Guidelines Clearinghouse) and professional societies that house clinical guidelines, literature and data standards such as the National Library of Medicine’s PubMed and Value Set Authority Center, respectively, and standard vocabularies such as LOINC and SNOMED. Additionally, there are vendors such as Wolters Kluwer, EBSCO, Elsevier, etc. who make available these entities’ resources to customers. However, the vendors at this level do not provide the services and products that enable **executable knowledge** at the local levels such as within a hospital’s EHR.

The Commerce Layer encompasses numerous stakeholders that provide products and services to transform the materials made available from within the Knowledge Source Layer and localize as **executable knowledge** in setting such as hospitals’ EHRs. These stakeholders are predominantly privately-held, commercial organizations such as Apervita, Cognitive Medical, Perspecta, etc., and as add-on services from the EHR companies themselves (Cerner, Epic etc.). Yet the stakeholders in this level are oftentimes hindered due intellectual property rules and licensing requirements, heterogenous metadata and data structures, and any uniform compensatory mechanisms to knowledge producers in the Knowledge Source Layer. The result it added complexity and higher costs that get passed on their customers, and therefore likely reduce the uptake of executable knowledge in healthcare settings.

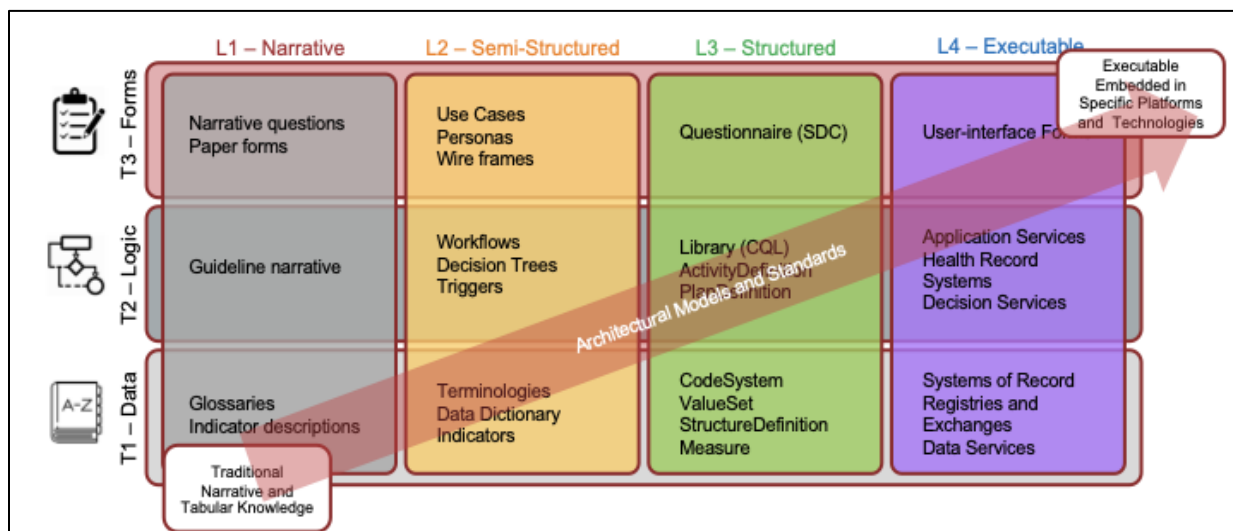
The Learning Network advocates for a Knowledge Network that provides services and products that would be beneficial to Knowledge Source Layer and Commerce Layer entities. Our advocacy is based on the Learning Network’s work with its own SWG comprised of investors, thought leaders, and influencers; direct engagement with stakeholders; and by contributing to efforts such as AHRQ’s own initiative, AHRQ evidence-based Care Transformation Support (ACTS)<sup>9</sup>. A Knowledge Network in the

form of a public-private partnership could provide the necessary governance to help the CDS ecosystem arrive at recommendations and best practices for contracting agreements, a uniform core set of metadata and their formatting, and provide advocacy for market-based changes that would promote more effective ways to translate knowledge that lives at the Knowledge Source Layer into executable knowledge through the Commerce Layer and into clinical care.

In this future state, stakeholders would still search and browse for knowledge sources—such as CDS artifacts—as they do today. Yet with a Knowledge Network infrastructure in place, users use could search tools and data science techniques to improve knowledge’s findability, and increasingly, stakeholders would access knowledge embedded or made available through technologies and platforms that allow them to interact, learn, and make decisions in the context of workflow and life flow thereby more likely improving outcomes, costs, as well as patient and provider satisfaction.

### A Knowledge Network to Make Narrative Knowledge into Actionable Knowledge

Core to the Knowledge Network’s mission would be to support entities at both Layers that better transform biomedical knowledge currently locked away in medical journals or guideline documents into executable code. Figure 7 represents the multi-faceted and coordinated efforts that are required to achieve this goal. The X-axis represents the industry-wide accepted steps for translating knowledge that is in narrative form (L1-Narrative) into increasingly complex logical representations and data structures until it is in machine-readable forms that EHRs and other systems can interpret (L4-Executable). The Y-axis represents increasing levels of complexity for making knowledge actionable at each step of L1 to L4. How this would be achieved is for industry-wide agreement as to the architectural models and associated standards needed to executable knowledge that is embedded in real-time systems that patients and clinicians use.



**Figure 7 Increasing Ecosystem Sophistication via Tiers (T1 to T3) and Layers (L1 to L4)<sup>10,11</sup>**

We advocate for a public-private partnership that builds on the Learning Network’s efforts to operationalize consensus-based processes, infrastructure, trust, and quality. We cannot understate how important it is to have in place a tested governance model for the CDS ecosystem to better insure

scalability and sustainability within one to two years. Based on our experience we are confident that the Learning Network's governance model can be transferred to a public-private partnership. In the following section we propose how to stand-up a Knowledge Network based on the Learning Network's experience and transform it into a sustainable entity that promotes a CDS ecosystem for executable knowledge that enables future where there is reduced friction in the ways biomedical knowledge is transformed from availability into action.

## Approach to a Sustainable Knowledge Network

We propose establishing a Knowledge Network as a public-private partnership provide services and products which, based on the Learning Network’s experience, oversees the areas of work to create and sustain a pre-competitive marketplace that benefits stakeholders in a CDS ecosystem.

**Table 2: Areas of Work, Goals, and Purpose for Sustaining a Knowledge Network**

Area of Work	Goal	Purpose
Governing	Create the Knowledge Network	Address the need for a pre-competitive entity that can foster the availability and use of computable biomedical knowledge.
	Develop a Public/Private Interchange (Commerce Layer) Operating Model	A commerce layer framework establishes common rules to address intellectual property, legal, regulatory, and other issues impacting CDS ecosystem stakeholders.
	Coordinate evolving standards	Adoption of a unified taxonomy and metadata schema will improve FAIR for executable knowledge.
Specifying, Building, Implementing, Maintaining	Create a shared knowledge taxonomy and metadata schema	Increased FAIR access to knowledge resources will accelerate the dissemination of evidence and advance the quadruple aim.
	Create a knowledge resource locator service	A minimal, standard rating system for stating provenance and compliance with standard metrics for comparing knowledge resources is needed.
	KMS for knowledge resources	Creates a trusted and reliable method for determining the safety and efficacy of Knowledge artifacts.
	Create a Product Information Label (PIL) for Knowledge Artifacts	Generates an industry standard for describing to developers and consumers the components of any CDS artifact.
	Create a digital rights infrastructure for knowledge resources	Establish a means for members to document and track digital rights for executable knowledge.
	Design and implement a safety and effectiveness rating system for knowledge resources	Develop a consensus-based rating system that conveys the safety and effectiveness of executable knowledge.

	Testing platform collaborative design	Provide a pre-competitive testing platform against which vendors and other interested parties may test the performance of executable knowledge.
Monitoring	Measurement criteria and framework development	Develop a standard set of measures with which to compare the use and effects of CDS artifacts.
Marketing, Disseminating, Training	Stakeholder advocacy	Represent members and interested parties around standards and shared interests around executable knowledge, e.g. respond to Federal requests for information.
	Educational meetings and webinars	Train members and interested public to Knowledge Network activities and the use of resources.

### Developing and Implementing a Governance Framework

The Learning Network gained experience from its own ramp-up that it can use to stand-up and over time sustain a Knowledge Network. We will put in place the necessary agreements and legal documentation to make the Knowledge Network a trusted, pre-competitive, public-private partnership that promotes collaboration on standards for knowledge representation, implementation, testing and exchange. Our goal is also to develop and operationalize a public/private interchange (“Commerce Layer”) that would establish common rules to address intellectual property, legal, regulatory, and other issues impacting CDS ecosystem stakeholders.

From its inception, The Learning Network invested time and thought into how it would govern itself so to achieve its goals of transparently engaging multiple stakeholders to promote the delivery of patient-centered evidence via CDS, or what we termed, “PCCDS”. These efforts were significant as previous and existing efforts around *shareable* CDS have demonstrated that an ecosystem cannot be sustainable, let alone succeed, without resources and rules that are available, trustworthy, and enforceable for and by all in an ecosystem.<sup>b</sup> Yet while the funding for the Learning Network’s efforts was necessary for conducting its efforts, it was insufficient for carrying out the activities that would be necessary for a Knowledge Network.

*The materials and knowledge around the Learning Network’s governance demonstrate the organization’s accomplishments in bringing together multiple stakeholders within a CDS ecosystem that conduct fundamental efforts in generating CDS-related products and services—this is a key launching point for any Public-Private Knowledge Network.*

For the readers of this proposal, we provide the Learning Network Charter that resulted from multiple meetings, discussions, and negotiations with a variety of CDS stakeholders (See Appendix B). Those discussions helped to shape a governance structure in which key groups informed and checked each

<sup>b</sup> Notable CDS efforts that have or current rest on a foundation of good governance include the AHRQ’s CDS Consortium and AHRQ’s CDS Connect, more recently



other. The materials and history around governance demonstrate the Learning Network's accomplishments in bringing together multiple stakeholders within a CDS ecosystem that carried out fundamental efforts in generating CDS-related products and services—this is a key launching point for any Public-Private Knowledge Network. A key element of The Charter was the RACI Matrix, which is a framework by which we made explicit the roles and responsibilities of four internal stakeholders:

- **Executive Team** made up of members funded to be responsible for laying out the Learning Network's strategy and seeing that the organization executes on that strategy;
- **Steering Committee** made up of the Executive Team plus volunteers from a variety of disciplines that weigh in on questions around governance, proposed strategies, desired working groups and work products, and provide constructive criticism as to how proposed strategies can best meet the needs of stakeholders in the CDS ecosystem;
- **Project Team** responsible for carrying out the decisions that the Steering Committee agreed on in ways that meet the day-to-day needs of the community while keeping within project scope and budgetary constraints
- **Project Director** that is accountable to the client—and community—for managing budget and achieving operational objectives while overseeing governance, strategy, and achieving work products.

Groups within the Learning Network's governance structured considered, proposed, debated, and approved Working Groups to build consensus—while building community—that generated work products deemed key to the development shareable CDS within a Learning Health System. The Working Groups (WGs) were led by Executive Team and Project Team members and composed of volunteer experts from a variety of disciplines to tackle key areas of need for shareable CDS, and CDS more broadly, that were:

- **Barriers and Facilitators WG**—The BFWG generalized a use case in self-monitoring blood pressure to begin elucidating barriers, facilitators and recommendations for implementing PCOR findings.
- **Trust Framework WG**— The TFWG brought together multiple stakeholders and proposed a framework for promoting trust in shareable, modular, and publicly available knowledge artifacts for CDS.
- **Opioid Action Plan WG**— The OAPWG was charged with convening key stakeholders (payers, providers, CDS developers, EHR vendors, government agencies, patients, and others) and identifying ways to accelerate the creation, dissemination, and broad value generation from Patient-Centered CDS for opioid prescribing and pain management.
- **Technical Framework WG**— The 45 participants of the TechFWG were charged with addressing the technical barriers and facilitators to adopting shareable, modular Patient-Centered CDS, and to develop recommendations for overcoming technical barriers to adopting Patient-Centered CDS.
- **Patient-Facing CDS WG**—The 102 members of the PFWG were charged with the development of a patient-facing prototype app for pain medication management and a set of features for developing patient-facing apps.



- **Sustainability WG**—The 14 participants represented thought leaders and entrepreneurs in knowledge translation and application for digital health.

Our experiences have given us insights into the levels of effort necessary for conducting volunteer WGs and successful strategies for seeing WGs through from start to finish.

The activities will be carried out for each goal in three phases over a five-year timeline, during which, the Knowledge Network will evolve from a publicly funded awardee to create the Knowledge Network (Phase I), then develop and begin execution of plan to transition from public to private (member) support (Phase II), and finally transition to member supported entity (Phase III). Table 3 captures goals and example activities for developing and implementing a governance framework.

**Table 3: Creating a Governing Infrastructure**

Goal	Phase I (Year 1)	Phase 2 (Years 2 and 3)	Phase 3 (Years 4 and 5)
Create the Knowledge Network	<ul style="list-style-type: none"> <li>• Create and disseminate a charter</li> <li>• Get signed MOUs from Knowledge Network participants</li> </ul>	<ul style="list-style-type: none"> <li>• Develop the PPP infrastructure and begin the transition of PPP operations to a sustainable funding model</li> </ul>	<ul style="list-style-type: none"> <li>• Complete the transition to member-supported collaborative</li> </ul>
Develop a Public/Private Interchange (Commerce Layer) Operating Model	<ul style="list-style-type: none"> <li>• Convene Knowledge Network participants and other stakeholders to develop and ratify a framework and rules governing a public/private interchange</li> </ul>	<ul style="list-style-type: none"> <li>• Disseminate and foster adoption of interchange framework among members, seek additional membership and grow the organization.</li> </ul>	<ul style="list-style-type: none"> <li>• Continued recruitment and refinement of commerce layer framework, and Knowledge Network membership</li> </ul>
Coordinate evolving standards with external entities (e.g. HL7, NLM, etc.)	<ul style="list-style-type: none"> <li>• Initiate conversations with HL7 and arrive at a statement of understanding (SOU)</li> </ul>	<ul style="list-style-type: none"> <li>• Establish a Knowledge Network Work Group</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain Knowledge Network Work Group efforts</li> </ul>

### Specifying, Building, Implementing, Maintaining

The next cohort of goals in Table 4 is for a publicly-privately held Knowledge Network to plan, develop, implement, and maintain an information infrastructure with which to operationalize its efforts around standards-based data structures, locators, a CDS artifact product information labels (PIL), managing digital rights, and more.

**Table 4: Creating a Technical Infrastructure**

Goal	Phase 1 (Year 1)	Phase 2 (Years 2 and 3)	Phase 3 (Years 4 and 5)
Create a shared knowledge taxonomy and metadata schema	<ul style="list-style-type: none"> <li>Convene a workgroup to examine current environment, then develop and disseminate a proposed metadata schema</li> </ul>	<ul style="list-style-type: none"> <li>Ratify and encourage adoption of the schema</li> </ul>	<ul style="list-style-type: none"> <li>Unified metadata schema</li> </ul>
Create a knowledge resource locator service	<ul style="list-style-type: none"> <li>Convene a WG to develop the requirements for consensus-based recommendations and a specification for a knowledge resource locator service</li> <li>Concomitantly, consider the governance and infrastructure requirements for such a service</li> </ul>	<ul style="list-style-type: none"> <li>Develop the infrastructure for a knowledge resource locator service</li> <li>Implement a shared a knowledge locator service</li> </ul>	<ul style="list-style-type: none"> <li>Oversight of knowledge locator operations and governance</li> </ul>
Create a Product Information Label (PIL) for Knowledge Artifacts	<ul style="list-style-type: none"> <li>Design a stage I PIL for CDS knowledge artifacts</li> <li>Develop a trustability and case reporting framework design</li> </ul>	<ul style="list-style-type: none"> <li>Implement the CDS PIL, (v1.0)</li> </ul>	<ul style="list-style-type: none"> <li>PIL, (v2.0)</li> </ul>
Design and Implement a safety and effectiveness rating system for knowledge resources	<ul style="list-style-type: none"> <li>Convene a WG to develop the requirements for consensus-based recommendations and a specification</li> </ul>	<ul style="list-style-type: none"> <li>Define requirements for framework share feedback from implemented knowledge artifacts in diverse systems on patient safety, impact, cost</li> </ul>	<ul style="list-style-type: none"> <li>Operating a CDS safety and efficacy reporting framework</li> </ul>
Create digital rights infrastructure for CDS knowledge resources	<ul style="list-style-type: none"> <li>Convene a WG to develop the requirements for consensus-based recommendations and a specification</li> </ul>	<ul style="list-style-type: none"> <li>Facilitate the creation of a digital rights management system collaborative specification</li> </ul>	<ul style="list-style-type: none"> <li>Metadata schema and digital rights management systems implementation and maintenance</li> </ul>
Testing platform collaborative design	<ul style="list-style-type: none"> <li>Internally determine the strengths and weaknesses to insourcing or outsourcing development and management</li> </ul>	<ul style="list-style-type: none"> <li>Based on Year 1 results either a) insource or b) outsource the development the infrastructure for a knowledge resource locator service</li> </ul>	<ul style="list-style-type: none"> <li>Implement and maintain a testing platform</li> </ul>
Knowledge Management System (KMS) for knowledge resources	<ul style="list-style-type: none"> <li>No activity</li> </ul>	<ul style="list-style-type: none"> <li>KMS (governance, curation, tracking and versioning, etc.) planning and assignment to appropriate layer Knowledge Network model</li> </ul>	<ul style="list-style-type: none"> <li>KMS implementation and maintenance</li> </ul>

## Monitoring

The third goal is for a publicly-privately held Knowledge Network to plan, develop, implement, and maintain an information infrastructure with which measure the use and various impacts of CDS artifacts (see Table 5).

**Table 5: Creating a Monitoring Infrastructure**

Goal	Phase 1 (Year 1)	Phase 2 (Years 2 and 3)	Phase 3 (Years 4 and 5)
Develop measurement criteria for CDS use and tracking analytics	<ul style="list-style-type: none"> <li>Convene a workgroup to examine feasible, economical, yet novel metrics for measuring CDS use (e.g. number needed to remind)</li> </ul>	<ul style="list-style-type: none"> <li>Track adoption and use of CDS artifacts and the PIL (v1.0)</li> </ul>	<ul style="list-style-type: none"> <li>Track adoption and use of CDS artifacts and the PIL (v2.0)</li> </ul>

## Marketing, Knowledge Transfer, and Training

The final set of goals in Table 6 is for a publicly-privately held Knowledge Network to plan, develop, implement, and maintain internal mechanisms to perform advocacy activities on behalf of participants—and eventually its dues-paying members—as well as training and education, and marketing efforts.

**Table 6: Creating a Dissemination Infrastructure**

Goal	Phase 1 (Year 1)	Phase 2 (Years 2 and 3)	Phase 3 (Years 4 and 5)
Advocacy	<ul style="list-style-type: none"> <li>Stakeholder advocacy</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholder advocacy</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholder advocacy</li> </ul>
Educational meetings and webinars	<ul style="list-style-type: none"> <li>Educational meetings and webinars</li> </ul>	<ul style="list-style-type: none"> <li>Identify topics of interest and opportunities to report on work</li> <li>Review state of the art white papers and manuscripts</li> </ul>	<ul style="list-style-type: none"> <li>Conduct educational meetings and webinars</li> </ul>

# Proposed Budget and Staffing

## Proposed Total Costs and Labor Hours

The proposed budget below (see Table 7) illustrates the establishment and sustainability of a public private Knowledge Network. The tables provide a five-year overview of labor hours by title and role as well as a cost breakdown by each year. The tables reflect an assumption that the Learning Network will transition from an organizational model funded with seed money from public (and possibly private foundation) sources in Year 1 to an entirely member-supported organization by year five.

We have tallied the year-by-year costs over five years to arrive at a proposed budget totaling \$17,671,298. The line items account for five line-items that are labor, other direct costs (ODCs), travel, subcontractors and contractors (Subk/Cons), and indirect costs. The numbers are informed by RTI figures but are not derived from RTI. Indirect costs decrease beginning in year three as the organization transitions from a funded project status to a free standing, member supported entity.

**Table 7: Summary Costs Over Five Years**

	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Total</b>
<b>Labor</b>	1,216,843.26	2,325,901.43	3,323,530.17	4,264,076.20	4,254,733.69	15,385,085
<b>ODCs</b>	38,861.14	39,897	40,921.00	43,541	46,012.40	209,232
<b>Travel</b>	42,928.50	55,839	102,694.00	213,917	284,760.00	700,138
<b>Subk/Cons</b>	20,000.00	20,000	20,000.00	20,000	20,000.00	100,000
<b>Indirect Costs</b>	243,368.65	465,180.29	332,353.02	213,203.81	212,736.68	1,466,842
<b>Total</b>	<b>1,562,001</b>	<b>2,906,818</b>	<b>3,819,498</b>	<b>4,754,738</b>	<b>4,818,242</b>	<b>17,861,298</b>

Table 8 breaks down proposed hours by role over five years, we project 86,574 hours of labor. The roles are organized by the Project Director and Associate Director down. It is important to note that beginning in Year 3, a transition begins between the Project Director and a new Chief Executive Officer.

**Table 8: Labor by Role Over Five Years**

<b>Title</b>	<b>Role</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Total</b>
Project Director	Project Director	444.00	828	1,060.00	768	-	3,100
Associate Director	Project Associate 2	578.00	1,236	2,328.00	1,582	1,532.00	7,256
Administrator	Administrative Support	434.00	818	818.00	1,350	1,970.00	5,390
Editor/Graphics support staff	Editor/Graphics Designer 1	150.00	310	310.00	484	868.00	2,122
Senior Research Analyst	Sr. Survey Scientist 2	752.00	752	1,076.00	1,362	1,372.00	5,314
Research analyst	Data Collection Support	320.00	480	1,078.00	1,018	968.00	3,864
Senior Informatics Analyst	Sr. Computer Programmer/Scientist 2	1,078.00	1,552	2,180.00	1,636	1,636.00	8,082
Informatics Architect	Senior Engineer 3	434.00	942	1,376.00	1,028	978.00	4,758
Informatics Analyst	Research Assistant 2: Engineer	928.00	1,536	1,786.00	2,404	2,180.00	8,834
Senior Advisor	Senior Advisor	100.00	250	200.00	250	150.00	950
Executive Director and CEO	Senior Advisor	-	-	50.00	2,030	1,980.00	4,060
Project Manager 1	Project Associate 2	580.00	2,314	1,124.00	1,078	928.00	6,024
Administrator	Administrative Support	-	160	434.00	868	868.00	2,330
Communications Coordinator	Project Associate 1	360.00	1,050	1,200.00	1,970	1,920.00	6,500
Publishing/Graphics support	Publishing Associate 2	384.00	644	1,252.00	1,152	1,152.00	4,584
Project Manager 2	Project Associate 1	384.00	384	928.00	928	704.00	3,328
Statistician/Analyst	Sr. Statistician 3	-	50	594.00	818	594.00	2,056
Policy Analyst	Project Associate 2	-	320	594.00	978	1,634.00	3,526
Financial Analyst	Project Associate 1	384.00	384	768.00	1,020	1,940.00	4,496
<b>Total</b>		<b>7,310</b>	<b>14,010</b>	<b>19,156</b>	<b>22,724</b>	<b>23,374</b>	<b>86,574</b>

## Budget Assumptions for Total Costs and Labor Hours

This budget narrative illustrates the creation of a public private partnership that transitions from a model that is initially supported with seed money from public (and possibly private foundation) sources to an entirely member supported organization by year five. Of note, we made several assumptions:

- By year five, the Knowledge Network is a member-supported public-private partnership;
- Beginning in Year 3, the Knowledge Network transitions to a member supported organization and functions as a free-standing member-supported entity by year five;
- The five-year budget assumes the first two years are funded by a federal entity and/or private foundation, and/or a research institute;
- A full-time CEO/Executive Director is hired in Year 3 and assumes full leadership in Year 4;
- The Knowledge Network assumes ongoing support of up to 10 paid steering committee members that meet on a quarterly basis, and the proposed compensation is set at \$500 per each meeting that members attend;
- One consultant is retained at \$50,000 per year;
- Indirect costs begin tapering in Year 3 to transition to a member-supported entity;
- By year five, all employees are at least 50% full-time equivalents;
- The costs include the necessary infrastructure to support basic operations;
- All staff roles are represented in the “Title” column.
- One annual public facing meeting covering a topic of interest is budgeted

## Proposed Costs by Task

The following table breaks down costs by 13 tasks, which are specified in the associated legend:

- |  |
|--|
| <ol style="list-style-type: none"><li>1. Administration and Infrastructure</li><li>2. Create KN</li><li>3. Develop Public Private Partnership model and agreements</li><li>4. Coordination with Standard Development Organizations (SDO)</li><li>5. Develop Knowledge Resource taxonomy, meta-data schema and Indexing</li><li>6. Develop Knowledge Locator Service</li><li>7. Develop Product Information Label (PIL)</li><li>8. Develop Safety Rating Framework</li><li>9. Develop Digital Rights Management Framework and Plan</li><li>10. Propose Knowledge Management Solution for CBK</li><li>11. Collaborative development of CDS Measurement Criteria</li><li>12. Education Event and Webinar Management</li><li>13. Website development and content</li></ol> |
|--|

**Table 9: Cumulative Labor Hours Over Five Years by Task**

Title	Role	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10	Task 11	Task 12	Task 13	Total
Project Director	Project Director	2,920	-	-	-	-	-	-	-	-	-	-	180	-	3,100
Associate Director	Project Associate 2	-	470	800	250	-	1,248	768	1,152	1,152	1,152	-	264	-	7,256
Administrator	Administrative Support [SCA 01020]	5,140	-	-	-	-	250	-	-	-	-	-	-	-	5,390
Editor/Graphics support staff	Editor/Graphics Designer 1	1,572	150	-	-	-	-	-	-	-	-	-	-	400	2,122
Senior Analyst	Sr. Survey Scientist 2	-	470	740	-	-	1,920	-	-	-	-	1,920	264	-	5,314
Research analyst	Data Collection Support	-	320	680	-	-	-	1,312	-	300	100	1,152	-	-	3,864
Senior Programmer/Analyst	Sr. Computer Programmer/ Scientist 2	-	250	560	1,696	1,152	1,252	1,252	-	-	-	-	-	1,920	8,082
Informatics Analyst	Senior Engineer 3	-	-	-	1,586	1,152	300	400	-	-	-	1,152	168	-	4,758
Research assistant	Research Assistant 2: Engineer	-	-	-	1,696	1,586	1,536	300	-	868	928	-	-	1,920	8,834
Senior Advisor	Senior Advisor	-	250	200	150	100	-	150	100	-	-	-	-	-	950
Executive Director and CEO	Senior Advisor	3,840	-	-	-	-	100	-	-	-	-	-	120	-	4,060
Project Manager	Project Associate 2	-	1,990	350	-	580	-	1,472	-	-	704	928	-	-	6,024
Administrator	Administrative Support	2,080	-	100	-	-	150	-	-	-	-	-	-	-	2,330
Analyst	Project Associate 1	-	432	300	-	-	-	-	-	-	-	-	5,768	-	6,500
Publishing/Graphics support	Publishing Associate 2	1,312	100	-	-	100	-	-	-	-	-	-	-	3,072	4,584
Project Manager 2	Project Associate 1	-	-	-	-	-	1,696	-	928	704	-	-	-	-	3,328
Statistician/Analyst	Sr. Statistician 3	-	-	-	-	-	-	200	704	1,152	-	-	-	-	2,056
Policy Analyst	Project Associate 2	-	-	-	2,512	-	-	150	-	-	-	-	864	-	3,526
Financial Analyst	Project Associate 1	4,456	-	40	-	-	-	-	-	-	-	-	-	-	4,496
<b>Total</b>		<b>21,320</b>	<b>4,432</b>	<b>3,770</b>	<b>7,890</b>	<b>4,670</b>	<b>8,452</b>	<b>6,004</b>	<b>2,884</b>	<b>4,176</b>	<b>2,884</b>	<b>5,152</b>	<b>7,628</b>	<b>7,312</b>	<b>86,574</b>

### **Budget Assumptions for Costs and Labor Hours by Task**

- The KN would utilize the services of a compensated Steering committee composed of 10 members, meeting quarterly. Members would receive an honorarium of \$500 per meeting.
- The KN would employ an external consultant with industry-leading expertise to advise on strategy and operation for \$50k per year;
- This model assumes normal operating costs and infrastructure but leaves details regarding web infrastructure unspecified.



## Conclusion

The Learning Network has summarized its efforts over the previous four years in promoting standards-based CDS with which to disseminate patient-centered evidence into clinical workflows and patient life flows. Based on our experiences—and advances—we propose the development of a public-private Knowledge Network that over five years transforms into member-supported entity to promote the translation of knowledge from a Source Layer to a Commerce Layer. The Knowledge Network's efforts would be structured within a pre-competitive environment to benefit all stakeholders within a CDS ecosystem. Its mission and vision are the following:

### **Mission**

The mission of a Knowledge Network will provide a pre-competitive platform to accelerate the translation of knowledge into practice.

### **Vision**

The Knowledge Network will be a trusted entity to support collaboration and cooperation among stakeholders across the knowledge ecosystem.

We have provided a proposed budget for the Knowledge Network along with estimated hours by role and by task for each of five years. The resources and staff would carry out several activities within four key areas of work, from establishing governance and information infrastructures, to monitoring, to marketing and education. The Learning Network believes this support and these efforts are part of an effective strategy to achieving a sustainable Knowledge Network.

## Acknowledgements

We would like to acknowledge the funding from the Agency for Healthcare Research and Quality Cooperative Agreement (U18 HS024849) that made this work possible.

The opinions expressed in this document are those of the authors and do not reflect the official position of AHRQ or the U.S. Department of Health and Human Services.

### Preferred Citation:

Richardson JE, Blumenfeld BH, Middleton B. A Funding Proposal for a Sustainable Knowledge Network to Support a More Effective CDS Ecosystem. Research Triangle Park, NC: RTI International; 2020 Jan p. 39. (Patient-Centered Clinical Decision Support Learning Network).

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# Appendix A: Knowledge Repositories vs Marketplaces

The discussion carries highly ambiguous terms, some in overloaded or incompatible ways. For our purposes, we adopt the following understanding in discerning between a repository and marketplace, recognizing our general categorizations are imperfect.

Existing projects creating repository-like content hubs typically differ in that repositories take a more passive role in the specifics of how artifacts are consumed, whereas marketplace-like systems presume the consumer holds certain capabilities, may initiate local functions, aid in acquisition of licensing rights (“entitlements”), and generally facilitate a meaningful degree of interaction between a knowledge consumer with the various custodians in the knowledge supply chain relevant to the act of consuming an asset.

Characteristic	Repository	Marketplace
Physically holds product.	Yes	No/Maybe
Moderates consumer/producer communication.	Maybe	Yes
Supports automated local orchestrations.*(what is this)?	No	Yes
Tolerates non-conventionalized ?standardized? artifacts.	Yes	No
Facilitates updates/decommissioning processes.	No	Yes

I suggest that the Knowledge Network marketplace hub be someplace between these two:

Characteristic	Hub
Physically holds product.	No (at least initially)
Moderates consumer/producer communication.	Yes

Tolerates non-conventionalized artifacts.	No (by convention)
Facilitates updates/decommissioning processes.	No (but tracks recency/updating of artifacts)
Aids accessing license rights (conduit to distributed marketplaces)	Yes
Scope	CDS services, applications, L3 artifacts, Other?
Commerce functions	No - Phased in?

Functionally, an activity in the first phase of the Knowledge Network work plan might also be to take steps to establish the key parameters marketplaces would adhere to, essentially carrying on some of the work in the AHRQ ACTS ask with respect to knowledge asset standards and marketplace development. Again, borrowed heavily from the ACTS discussion:

- Build governance/steering group (AHRQ, HL7, MCBK, HSPC, Providers, Professional Societies, Vendor(s) to establish a common vision for a network of competitive, yet interoperable, ecosystem constituents wherein no single marketplace implementation or operator is given unfair advantage, and operator policies may naturally vary to support development innovation, validation, and testing
- Establish network of Prof Society SMEs and other Publishers vested in curation of computable artifacts within their domain and technical capabilities.
- Engage with EHR vendors via organizations/meetings like HIMSS and OSEHRA. Encourage vendors to make their knowledge repositories interoperable and accessible via a knowledge locator service.
- Bring stakeholders together - e.g., potential public-private partnership governance candidates and 'suppliers and consumers' of marketplace offerings to establish collaboration on operational reference implementation; core curation and governance processes; initial operating capacity (IOC) domain foci and artifacts cataloged and available.
- Finally, the table below is borrowed from the ACTS Marketplace discussion but is based on the Trust whitepaper categories out of the Learning Network. The categories may help to further qualify Knowledge Network activities.
- From these efforts we defined actors, generated recommendations, and applied to the functional use cases as described in the next sections.

## Stakeholder Value Propositions

Successful ecosystems balance the incentives of all critical stakeholder groups. Understanding the motivations of detractors across these complicated relationships is key to enticing symbiotic participation. The table below builds upon the PC-CDS Trust Framework exploration of “key actors” to include their incentives and concerns likely to affect participation in a marketplace ecosystem.

<b>Actor</b>	<b>Description</b>	<b>Value Proposition</b>	<b>Concerns</b>
Clinicians	Medical professionals who care for patients (physicians, nurses, etc.).	Ability to quickly discover available assets, gauge suitability for purpose, understand supporting evidence, and estimate costs/risks; evaluate performance in sandbox context using local data	Quality of artifacts; safety for stated purpose; level of support; clinical localization; technical bindings; fitness for purpose; costs
HIT Vendors	Commercial entities that provide health-related technology solutions (EHR vendors, CDS vendors, etc.).	Clear testing/certification criteria; access to validation tooling & data sets; easy licensing and distribution mechanism; access to captive audience	Submission costs; sales commission; duplicating efforts for different marketplace systems
Knowledge Authors	Professionals such as domain experts and professional societies who write guidelines or other materials that provide clinical evidence to users in unstructured format (narrative text, image files, etc.).	Targeted packaging format per specification type; access to runtime testing tools	Restricted to supported standards/representations
Knowledge Curators	Professionals who maintain knowledge artifact libraries to ensure evidence is trustworthy (accurate, reliable, timely, etc.).	Oversight of publication process from initial submission through end of life; ability to apply domain endorsements	Overwhelming amount of content beyond what is reviewable; lifecycle management beyond publication; access to testing/certification tooling
Knowledge Publishers / Distributors	Professional organizations that package, market, or sell knowledge artifacts as private organizations or in public-private partnerships.	Control policies, licensing, and rights management; standardized API for submission activities and downstream consumer systems; ability to sustain an ecosystem independent of specific EHR platform	Complex ecosystem and operational requirements; many actors required to be successful; no common metadata structures across classes of products
Knowledge	Professionals who translate clinical guidelines into	Targeted packaging format per specification type; access to	Restricted to supported

Engineers	artifacts in semi-structured human readable form (L2), a computer interpretable form (L3), and machine-executable formats (L4).	runtime testing tools	standards/representations
Organizational Governance Bodies	A governance body that reviews and approves CDS to be used in an organization or across networks.	Trusted source of rapidly deployable clinical knowledge modules and services.	
Patients	Persons who are the ultimate decision-makers in their healthcare and managing their health.	Alternate end user to clinicians; PHR tooling/services; direct value in addition to care activities; transparency into care; trust in quality	Difficult to understand; different from general-purpose computing marketplaces.
Payers	Organizations that pay clinicians or patients for health-related activities.	Fairness; Common vehicle for distribution of payer services and tools, e.g. HL7 DaVinci	IP protections; leaking of proprietary/confidential information; reverse engineering of risk models
Policymakers	Persons who develop legal or policy guidance that guide care or payment.	Operational target regarding governance, culture, and technology	
Population Health End Users	Professionals who support clinicians and clinical teams by monitoring population health trends and recommending actions.	(Same as OGB??)	
Quality Improvement Analysts	Professionals who measure the impact of implemented CDS within health IT.	Multiple vectors - Direct integration w/marketplaces themselves for certification purposes and monitoring of usage, feedback, response, licensing etc.; distribution vehicle for CQMs and other formalized computable quality measures	



# Appendix B: Learning Network Charter

Patient-Centered Clinical Decision Support Learning Network Steering Committee Charter

Update January 19, 2018

Original Date: 7/8/2016 Updated: 1/15/2018

## A. Primary Functions

The AHRQ Patient-Centered (PC) Clinical Decision Support (CDS) Learning Network (Learning Network) Steering Committee (SC) is responsible for strategic leadership of the Patient-Centered Clinical Decision Support Learning Network (PCCDS-Learning Network). The PCCDS-Learning Network SC shall provide oversight to the PCCDS-Learning Network project in its entirety with the primary purpose of engaging stakeholders to identify and foster opportunities to disseminate and incorporate patient-centered research findings into CDS to drive appropriate care and improve health outcomes. The SC will serve as the authoritative decision-making body for issues that project teams cannot resolve without escalating to a higher level and require adjudicating. The SC will monitor and review the project's status, as well as providing timely guidance for overcoming potential barriers.

The SC is responsible for providing direction, vision, and insight on long-term strategies to ensure the PCCDS-Learning Network works toward the purpose outlined above and aligns with identified patient-centered CDS scientific and stakeholder needs. Members of the SC ensure business objectives are being adequately addressed and the project remains on target. In practice, these responsibilities are carried out by performing the following functions:

- Providing strategic and general guidance to support the completion of key deliverables
- Voting and making final decisions on key strategic decisions brought to the SC for a vote
- Resolving project conflicts and disputes, reconciling differences of opinion and approach

## SC Approval Responsibilities

The SC is responsible for approving major project elements such as:

- Prioritization of project objectives, strategies and outcomes
- Verification of appropriate effort
- Development of risk management strategies to address potential threats to the project's success
- Creation and management of workgroups designated to address specific issues

## B. Membership

The SC will consist of 18 members, drawn from the stakeholder groups representing the PCCDS-Learning Network membership. These include:

- EHR Vendors
- Clinicians and Care Delivery Organizations
- CDS Intervention Developers and Vendors
- PCOR
- Patients and Families
- Payer
- Academic Clinical Practice
- CDS
- Standards
- Informatics
- Policy
- Implementation
- Government Agencies
- Quality Improvement Organizations and Networks
- Researchers – Clinical/Informatics/PCOR
- Societies – Clinical/Informatics

A single individual shall be designated by the principle investigator (PI) as the chair of the SC, who shall serve for the duration of the project unless she or he voluntarily steps down, or a majority of voting SC members determine that the chair be replaced. In addition, the PI, AHRQ project officer, and senior researchers (Drs. Middleton, Osheroff, Kawamoto) will constitute the Executive SC. The Executive SC will serve for a term of 4 years (or project duration, whichever is shorter) whereas members of the Non-Executive SC will serve for a term of 2 years (February 1, 2018 to January 31, 2020).

#### *Role of a SC Member*

Each of the SC members represent a stakeholder group that is critical to the success of the PCCDS-Learning Network. It is intended that each SC member leverage her or his experiences, expertise, and insights as a representative member of their stakeholder groups. SC members are not directly responsible for managing project activities, but are encouraged to provide guidance, support and vision for those who do. Thus, individually, SC members should:

- Understand the strategic implications and outcomes of initiatives being pursued through project outputs;
- Come to each meeting having read the pre-distributed materials and be prepared to share experiences, expertise and insights;
- Appreciate the significance of the project for all major stakeholder groups; and
- Be genuinely interested in the initiative and be an advocate for broad support for the project outcomes.
- Serve as a liaison to gather PCCDS-Learning Network related information *from* the stakeholder group they represent and share information *back to* this group to drive effective action toward learning network goals.

### *Responsibilities of an SC Member*

To fulfill the role, each SC member is expected to:

- Attend and actively participate in bi-monthly SC meetings;
- Notify the Research Program Manager (Beth Lasater- boverman@rti.org) about their planned absence at least 24 hours in advance of any SC meeting;
- Provide honest and unbiased opinions on matters under consideration;
- State any conflicts of interest, or potential conflicts of interest, prior to any discussion or vote;
- Review and comment on materials that inform a SC vote;
- Record a vote on motions or issue that the SC votes upon;
- Promote communications outside of the SC regarding the project's progress and outcomes; and
- Attend and actively participate in one Annual Learning Network meeting held in the Washington DC area.
- Serve as a conduit for bi-directional information sharing and action with their respective stakeholder group(s).

### *C. Meetings*

The SC will meet on a bi-monthly basis for 90 minutes and will provide guidance to all governance, scientific, and other elements critical to achieving PCCDS-Learning Network goals. The Principle Investigator (PI) and SC chair will facilitate the SC meeting. A written notice of any regular meeting shall be communicated by email to all SC members at least five (5) calendar days prior to such meeting. The PI and SC chair will be responsible for providing these materials (see below re: meeting agendas). Special meetings of the SC may be held at any time at the request of any two (2) SC members, provided that written notice of such special meeting shall be provided to all SC members at least fourteen (14) calendar days prior to the date of such meeting, and shall contain the time, date and purpose of the meeting. A SC member shall be considered present for a meeting if he or she participates by telephone conference call so that all SC members participating in the meeting can hear each other simultaneously. Committee resolutions may be adopted without a meeting if set forth in writing and signed by all the SC members.

#### *Chairperson; Record of Proceeding*

The SC chair, or acting chair, will bear primary responsibility for directing each portion of the meeting prior to each meeting. The steering committee chair will be responsible for setting the agenda with the input of the executive steering committee, facilitating the meeting, and managing all official actions that are called during the meeting. One RTI staff support person shall be designated to serve as the clerk of that meeting and make a written record of the proceedings. Within a reasonable time after each meeting, the record for that meeting shall be circulated for the review of the SC members and shall be approved (or modified, if appropriate) within thirty (30) days of the date of the meeting. Meeting materials and minutes will be posted on the Learning Network website.

#### *Quorum*

A quorum of the SC at any meeting shall exist when 75% of SC members are present at the meeting.

*Voting*

Any decision or action of the SC shall require the affirmative vote of at least a quorum. Quorum is defined as 51% or more PCCDS-Learning Network SC members. In the event of a tie vote, a second vote will be held, allowing SC members to recast their votes. If the second vote is a tie, the discussion will be tabled until the next meeting.

The SC members may vote by proxy. A proxy is defined as one that receives the right to vote for a SC member in this member’s absence from the meeting. For a proxy to be approved, such SC member must give notice and receive approval from SC Chair 24 hours before the next meeting.

*Meeting Agenda*

Prior to each meeting, the chair will develop an agenda which will be distributed to the SC members at least five (5) calendar days prior to the meeting. Any requests to include a topic on the agenda should be sent to meeting administrator (Beth Lasater- boverman@rti.org) 10 calendar days prior to the convening of the meeting. The meetings shall cover project updates, workgroup reports and other key strategic areas that need to be brought to the SC’s attention for consideration.

*Inputs to the SC*

- Individual/combined team or Workgroup reports;
- Deliverables for approval; and
- Communication and coordination technologies questions;
- Or other topics as determined relevant by the PI or SC chair.

*Outputs of the SC*

- Guidance to achieve the vision and strategic objectives of the PCCDS-Learning Network given foundational inputs;
- Ratification of all decisions requiring steering committee approval (i.e. deliverables, timelines, functionalities); and
- Guidance on timeline and budgets.

D. Appendix I. List of Current PCCDS-Learning Network SC Members

**List of Executive PCCDS-Learning Network SC Members**

<b>Area of Expertise</b>	<b>First Name</b>	<b>Last Name</b>	<b>Organizational Affiliation</b>
Academic Clinical Practice, CDS, Standards, Informatics, Policy	Blackford	Middleton	Apervita

CDS, Care process/outcome improvement, Implementation, Policy	Jerry	Osheroff	TMIT Consulting
Standards, Academic Informatics	Kensaku	Kawamoto	University of Utah
PCOR, Policy, Standards	Edwin	Lomotan	AHRQ
Informatics, Standards, Policy	Barry	Blumenfeld	RTI

## Appendix C RACI Matrix

RACI Matrix for the Patient-Centered Clinical Decision Support Learning Network (PCCDS-Learning Network)

RACI Definitions:

**R – Responsible (“The Doer”)**

The “doer” is the individual(s) who completes the task. The “doer” is responsible for action/implementation. Responsibility can be shared. The degree of responsibility is determined by the individual with the “A”.

**A – Accountable/sign off (“The Buck Stops Here”)**

The accountable person is the individual who is ultimately answerable for the activity or decision. This includes “yes” or “no” authority and veto power. Only one “A” per row.

**C – Consult/two way (“In the Loop”)**

The consult role is individual(s) (typically subject matter experts) to be consulted prior to a final decision or action. This is a predetermined need for two-way communication. Input from the designated position is required.

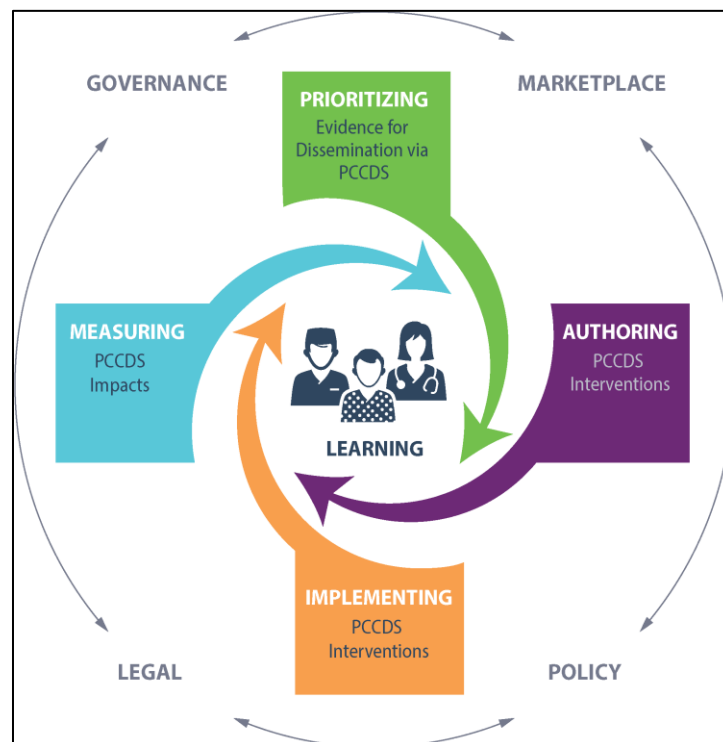
**I – Inform/one way (“Keep in the Picture”)**

This is individual (s) who needs to be informed after a decision or action is taken. They may be required to act as a result of the outcome. It is a one-way communication.

	<b>Steering Committee</b>	<b>AHRQ Project Officer</b>	<b>Project Team</b>	<b>PI</b>
Governance	A	C	R	R
Strategy	A	C	R	R
Project/Ops Management	C	C	R	A
Work Products	A	C	R	R
Budget	C	C	R	A

## Appendix D: Detailed Areas of the AFA

- **Prioritizing:** Applying objective measures of evidence for identifying and prioritizing findings that are to be transformed and disseminated via CDS, assessing or defining their implementability, and defining stewardship and governance requirements.
- **Authoring:** Applying accepted data and knowledge standards for translating findings into one or more CDS intervention types that support key decisions, actions, and communications that are essential to ensure that the finding improves care and outcomes.
- **Implementing:** Applying standardized, best practice methods and architectures to operationalize CDS interventions into clinical workflows that deliver the right information to the right people in the right formats through the right channels at the right times to improve care processes and outcomes (Five Rights for CDS Implementation).
- **Measuring:** Ensuring that CDS interventions measurably improve clinician and patient decision making, care processes, and outcomes.
- **Learning:** Aggregating local CDS-related outcomes and effectiveness measures to facilitate both local and system-level learning from identified gaps in patient-centered outcomes research knowledge, and lessons learned from authoring, implementing, and using CDS in clinical practice to enhance care and outcomes.
- **External Factors:** External factors including the marketplace, policy, legal, and governance issues that impact development, dissemination, and implementation processes for CDS.



**The CDS Analytic Framework for Action Identifies the Areas for Making Actionable CDS in a Learning Health System**