Turning Challenges into Opportunities: Lessons from CODI Implementations

July 2025

Prepared for:
Administration for Community Living

Operator of the CMS Alliance to Modernize Healthcare (The Health FFRDC)
A Federally Funded Research and Development Center

This and other CODI resources are available at https://mitre.github.io/codi/.

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For further information, please contact The MITRE Corporation, Contracts Management Office, 7515 Colshire Drive, McLean, VA 22102-7539, (703) 983-6000.

Authors

The MITRE Corporation, McLean, VA

Acknowledgements

The Health Federally Funded Research and Development (Health FFRDC) would like to thank the Administration for Community Living, Chesapeake Regional Information System for our Patients, MAC, Inc., Meals on Wheels of Central Maryland, and Maryland Department on Aging for sharing their time, knowledge, and perspective in support of this document.

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1 Background

The Community and Clinical Data Initiative (CODI) is a model to harmonize clinical and community data for research, evaluation, quality improvement, and public health. The CODI Model brings together people, processes, and technology to build locally owned infrastructure that supports the community to improve health. CODI has been implemented in three communities across the United States since 2018: Colorado, North Carolina, and Maryland. The CODI Model was originally pioneered by the Centers for Disease Control and Prevention and is open source and free to use; resources to support implementers and outputs from the three successful implementations have been published to support communities interested in learning more about or implementing the CODI Model in their community.[1]

The third and most recent CODI implementation was in Maryland with a focus on non-medical drivers of health among older adults and the services and programs provided by community-based organizations (CBOs) to address identified needs. The Maryland CODI implementation was sponsored by the Administration for Community Living (ACL). Implementing partners included:

- Chesapeake Regional Information System for our Patients (CRISP), Maryland's Health Information Exchange (HIE),
- MAC Inc., an area agency on aging (AAA) on Maryland's Eastern Shore who also acts as a community care hub for the AAAs across the state, and
- Meals on Wheels of Central Maryland (MOWCM), a home-delivered meals provider for five counties in the greater Baltimore area.

In addition to the implementing partners, the MITRE Corporation supported the Maryland implementation by developing open-source resources, providing technical support, and providing project management and stewardship.

2 Purpose

This document describes key learnings from the Maryland CODI implementation with the objective of helping future CODI implementations improve efficiency and effectiveness. These lessons highlight what worked well, what didn't, and what could be improved in the future. This summary was prepared for individuals and organizations considering, planning, or executing a CODI implementation in their community. Lessons learned are most useful if applied during project planning but can be valuable at any point in the project lifecycle.

3 Methods

Near the conclusion of the Maryland implementation, MITRE interviewed each implementing partner, ACL, and the Maryland Department of Aging to identify how participating in the CODI

[1] Resources and outputs from the Maryland CODI implementation are available on GitHub: https://mitre.github.io/codi/docs/communities-using-codi/food-insecurity-in-maryland

implementation had impacted their organization and the communities that they serve.[2] In addition to identifying the impact that participating in the CODI implementation had on each partner, these interviews also yielded lessons learned that are applicable to future implementers which are described below.

In addition to these interviews, the MITRE team also conducted a retrospective review of the implementations in Maryland, Colorado, and North Carolina[3] to reflect on successful strategies that catalyzed progress, challenges that were encountered across implementations, risks that the project team identified and managed, and other experiences that may inform planning for subsequent CODI implementations.

4 Summary of Lessons Learned by Project Phase

Seventeen lessons learned were identified for consideration by future implementers. Each lesson learned below is framed as a strategy to enable the success of future CODI implementations; following each lesson learned is a brief discussion of the learnings from which the strategy originates. Lessons learned are organized according to the applicable CODI implementation phase: preparation, discovery, planning, implementation, and communicating impact. A concise summary is presented in Figure 1.

Project Phase	Lesson Learned
Preparation *Determining if a community will implement CODI and who will be partners*	1. Build on Existing Relationships 2. Customize Communication and Value Propositions
Discovery *Collecting information after partners have decided to implement CODI to inform planning*	3. Conduct CBO Needs Assessments to Understand Workflows and Data Availability 4. Prioritize Use Cases with Available and Linkable Data 5. Map Data Governance Early
Planning *Creating a workplan for a CODI implementation*	6. Maximize participating CBOs to Increase community value 7. Tailor Funding to Partner Needs 8. Verify Data Consent Practices 9. Assess CBO Technical Capacity and Provide Technical Assistance 10. Align with Broader Community Initiatives
Implementation *Carrying out CODI implementation activities*	11. Translate the CODI Data Model to HIE Context 12. Plan for Data Anomalies 13. Avoid Building Redundant Technology 14. Demonstrate Early Data Sharing Success
Communicating Impact *Communicating impact of programs and services by using combined clinical and CBO data*	15. Balance CBO and HIE Needs When Developing Reporting Capabilities 16. Confirm HIE Data Availability Early and Often 17. Exercise Caution When Combining Data

Figure 1: Summary of Lessons Learned for Future CODI Implementations

[2] Full Maryland CODI Impact Report available at https://mitre.github.io/codi/docs/codi-resources-by-phase/preparation-discovery-and-planning/md-codi-impact-report

[3] MITRE provided technical and strategic support for all 3 CODI implementations so serves as a source of institutional knowledge

4.1 Preparation

The preparation phase of a CODI implementation project refers to the earliest work to determine if a community will implement CODI and what organizations will be part of the implementation. Preparation work includes explaining the CODI model to potential implementers, cultivating executive sponsorship, and sizing the project and number of implementing partners. Two learnings most applicable for consideration during the preparation phase are discussed below.

1. Start small by initially partnering with organizations where a strong, trusted relationship exists to build momentum and use early wins to recruit additional partners with similar services and programs.

Conceptualizing a CODI implementation in Maryland began through conversations between a handful of partners with an established trusting relationship and proven track record of collaboration. Initial CODI preparation conversations were between one CBO and their HIE; these two organizations had a strong working relationship prior to CODI. As initial conversations began to shape the CODI implementation in Maryland, the HIE expressed interest in adding more CBO partners to test the solution more widely across different organizations, programs, and services. The first CBO recommended a second CBO with complementary programs and mission with whom they had already partnered in other areas. As the CBOs had already built trust through a strong working relationship, recruiting the second CBO was significantly expedited. The second CBO had also already signed a participation agreement with the HIE which further reduced the barrier to participation. Prior CODIs have been slow to get started when forging new relationships suggesting that CODI implementations can be accelerated by recruiting based on existing partnerships in the community rather than introducing organizations to each other for the first time. This approach can yield early wins that create momentum for the project's start up and enable recruitment of additional partners.

2. Adapt publicly available CODI resources to communicate the value of CODI and use targeted messaging to develop champions and recruit additional partners.

Throughout the Maryland implementation, partners were called to describe how the project would deliver value and to whom. CODI's unique approach and technical complexity can make it difficult to tell a compelling story. Because the CODI model's available communication resources do not reflect local context, implementers customized content to be Maryland-relevant.

Telling a compelling and locally relevant CODI story is important when recruiting partners. Maryland CBOs were motivated by a desire to gain or strengthen exposure to their local HIE, cultivate data sharing readiness, demonstrate innovation, engage with larger initiatives in the state, close the referral loop with clinicians by providing information about services rendered, and a hope to gain access to more data to advocate for funding and provide better services to their clients. The HIE was drawn to participate to increase their clinical data reporting experience and expand the data that they receive from CBOs. Because Maryland CBOs and the HIE were drawn to participate by different factors, the most compelling value propositions discussed during early engagements with each partner were tailored appropriately for technology-focused entities like HIEs and service-focused organizations like CBOs.

4.2 Discovery

The discovery phase of a CODI implementation project refers to the work that occurs after a group of partners has decided to implement the CODI model and aims to cultivate the knowledge and information needed to plan an implementation. Discovery includes exploring each partner's workflows, practices, information systems, and data. Discovery also investigates other contextual factors in the community that influence data sharing, collaboration, and resources. Three learnings about discovery are discussed below.

3. Document CBO social needs and social service workflows to understand the availability and fidelity of CBO data that can be connected with clinical data.

CBOs maintain diverse portfolios of programs and services that are nonstandard across organizations, so it is important to understand how each CBO conducts its work. MITRE conducted a needs assessment in Maryland to understand how CBOs screen and assess for social needs, receive and respond to referrals, and enroll and deliver social service programs. The assessment also catalogued how each of those actions are documented and provided insights about the quality, meaning, and fidelity of the data stored in their respective information systems. For example, CBOs may use one or many screening and assessment tools and may record structured responses (e.g., yes or no) or nonstandard narrative responses (e.g., free text) that lack structure. Incoming CBO referrals may flow through many different pathways in common or different formats. Findings from the needs assessment directly informed use cases (Lesson 4) and were essential in the subsequent discovery, planning, and implementation work that followed (Lessons 5, 6, and 9).

4. Scope the implementation to use cases where data is available and linkable, and interventions are standard, observable, and far reaching – thus resulting in valuable community impact.

Because the CBO landscape is vast, discovery activities will reveal many different and interesting services and programs that can be engaged during a CODI implementation. Scoping the work is a critical step to setting up an implementation for success; developing and implementing a process to identify and prioritize use cases is an effective scoping strategy. In Maryland, partners were initially interested in nutrition, housing, evidence-based programs, care transitions, and transportation. Despite the highest interest in potential housing and transportation use cases, discovery revealed very limited access to housing and transportation data. Topics where data will have to be created, collected, or re-entered from paper are not candidates for a successful CODI implementation as CODI is a data-sharing project. Nutrition services, evidenced-based programs, and care transition were prioritized as initial use cases for further discovery because those data were structured, available in electronic format, and had the potential for immediate data sharing and rapid implementation progress to help CBOs communicate the impact of those programs.

5. Map existing data governance infrastructure and explore CBO data governance requirements and practices so that data sharing and implementation are not delayed.

Because the governance work that enables data sharing can consume a significant amount of project time and resources, identifying existing data governance processes, tools, and templates (e.g., data sharing agreements) early in the project is recommended. Whenever

possible, a CODI implementation should use existing data governance infrastructure. The Maryland implementation was significantly accelerated by leveraging the HIE's existing governance processes which included agreements to onboard CBOs to their system and a process to permission new uses for data. The HIE was able to quickly onboard CBOs and gain approval to use clinical data to calculate clinical outcomes and share aggregate results with participating CBOs. Previous CODI implementations required over 12 months to establish governance for decision making and develop governance agreements that allowed data to be shared. New governance processes and agreements should only be created when no existing infrastructure is available.

Three CODI implementations have demonstrated that the CBO data governance landscape is highly varied and can be less formalized. CBOs can have unique data governance challenges that impact data sharing. Implementers will need to understand each CBOs process for making decisions about data sharing and data use which will impact the ability to obtain permission to share data with the HIE as part of a CODI implementation.

4.3 Planning

The planning phase of a CODI implementation project refers to work to create a workplan for the implementation. Planning includes defining the workstreams, assigning tasks and responsibilities to partners, identifying dependencies, sequencing the implementation activities, identifying and mitigating risks, and tracking progress. Planning also includes resourcing the project by creating the contracts that distribute resources and executing other agreements that allow data to be shared. Five learnings about planning are discussed below.

6. Maximize the number of participating CBO partners to improve the reach and applicability of the implementation and increase the enduring value within a community.

Each implementing CBO provides a fresh perspective that tests and improves the local CODI implementation in different ways. While it is prudent to start small when building support for a CODI implementation (Lesson 1) and scoping the initial use case (Lesson 4), nurturing and growing a CODI implementation so that as many CBOs as possible are sharing data over time increases the implementation's reach in the community. During planning, implementers should plan to recruit additional CBOs to participate in data sharing for the selected use case(s) to ensure implementation decisions are not inadvertently applicable to only one or two CBOs (e.g., changes to data model that meet one CBOs needs but not others). Only having two CBOs implement CODI in Maryland makes it difficult to say whether CBOs across Maryland can implement CODI. Because leaders want to invest in solutions that have demonstrated their ability to scale and work for many different types of organizations, implementers should attempt to recruit and include as many CBOs as project resources can accommodate.

7. Tailor funding to the implementing partners by considering the amount of resources available, relative level of effort by each organization, and the funding amounts worthwhile to each organization.

All three CODI implementations have been completed with varying levels of funding and different funding distributions that reflected level of effort and type of work. Resourcing is a key driver of implementation success; if implementers do not have the right amount of funding to carry out the work when it needs to occur, the implementation's progress can stall. First,

implementers should consider whether partners want to be funded or not. Some organizations may find that executing a contract can create delays in the project activities and maintaining a contract, especially for a relatively small funding amount, is more of a burden than the contract is worth. For other organizations, direct funding may make it easier to prioritize CODI activities. Resourcing is essential in cultivating partners' enduring commitment to CODI throughout the duration of the implementation and beyond.

8. Verify that CBOs have collected and documented consent from their clients to share their data for additional uses like CODI.

CODI data sharing leverages CBO data that have been collected from individuals for a different purpose meaning that sharing and harmonizing CBO data with clinical data is a secondary application. Because every CBO defines their own approach to consent and data uses, investigating whether existing consent processes sufficiently cover data sharing for CODI is a key activity. In Maryland, the project encountered different approaches to consent and identified some consent practices that limited the data that could be shared with the HIE. For example, one CBO's information system did not consistently store whether the person consented to their data being used for various other purposes (i.e. CODI), despite the information being collected on a paper form. As part of selecting data and priority systems to extract data from, implementers should ensure that appropriate consent was collected and recorded at the person level in the information system.

9. Assess CBO technical capacity early and ensure technical assistance is available to help CBOs extract, normalize, and share data, as needed.

To share data in CODI, CBOs have to extract, transform, and load (ETL) and then transmit data to the HIE. CODI implementations have found that CBOs can lack the capabilities to carry out some of these technical activities. This work can be even more difficult when CBO information systems lack flexible data extraction or transformation tools. The planning phase included identifying a technical readiness gap and selecting a technical partner to assist organizations with a need. Technical assistance can be provided by another CBO, a local vendor, or the HIE. Identifying local partner organizations that might be able to provide technical assistance and incorporating technical assistance into the implementation plan is recommended. In Maryland, one CBO had the technical resources to develop and execute ETL and the other did not. Facilitated by a data sharing agreement, the CBO with the technical resources was able to support the ETL needs of the other CBO.

10. Align implementation activities with larger community efforts to maximize impact, reach, and sustainability.

In every community, multiple projects focused on health are occurring at any given time and planning should consider how the CODI implementation may support or diverge with other important health work happening in the community; this is especially true of other efforts CODI implementation partners are involved in. The Maryland CODI implementation was aligned with several major health-related efforts including the states All-Payer Health Equity Approaches and Development (AHEAD) Model work[4], the state health improvement plan[5], and the state's ten

[4] https://hscrc.maryland.gov/Pages/ahead-model.aspx
[5] https://health.maryland.gov/pha/Documents/PHAB%20documents/MD%202024%20State%20Health%20Improvement%20Plan%20(SHIP)%2010Sep2024.pdf

year multi-sector plan for aging (Longevity Ready Maryland[6]). Implementing partners presented CODI to leadership of other initiatives to make them aware of the CODI work and ensure that CODI was not in conflict or competition with similar work. CODI kept a standing agenda item for local updates during monthly implementation workgroup meetings to discuss alignment and how CODI functions could enhance work already being done in the state.

4.4 Implementation

The implementation phase of a CODI project refers to the work to action an implementation workplan and carry out implementation activities. In Maryland, implementation included extracting CBO data from information systems, mapping those data to the data model, sharing data with the HIE, developing outcome measures, and building reporting tools. Throughout the implementation phase, communication activities are also critical to keeping all partners informed about progress and risks. Four learnings about implementation are discussed below.

11. Translate the CODI Data Model to the HIE's data model to develop a local data sharing approach that aligns with the HIE's technical infrastructure.

Though CODI includes a data model[7], implementation requires the HIE to determine what model for social needs and social service data works for their organization and unique existing infrastructure and processes. Part of this exercise is considering how the HIE can leverage their existing data model for the clinical data that they receive. Implementation will include a process to translate the contents of the CODI data model to a data model that works for the HIE, considering which data and how much data they will ingest and process. CBOs may be willing to share more data than an HIE wants to receive or can use. Data model translation may mean customizing CODI data model resources to reflect the contents and format that CBOs should share their data with the HIE; the Maryland Community-Based Organization Data-Sharing Implementation Guidance document is one such resource.

12. Expect data sharing to reveal additional data anomalies that may require remediation, data model refinement, or highlight potential improvements to data collection.

Every CODI implementation has uncovered unexpected features of CBO data that only appear once the data sharing begins. These data anomalies may be markers of a data quality problem or may just be unexpected variation that the HIE needs to plan for, or the data model can be updated to accommodate. Because there are multiple points in a data sharing workflow where fixes can occur, Mayland partners made a number of decisions about if an issue should be fixed in the information system, during data transformation, or in the data model. Through the implementation, participating CBOs gained insights about not only the limitations of their information systems, but also the quality (i.e., accuracy and completeness) of the data those information systems hold. CBOs can use this opportunity to improve their data through better data collection or documentation practices.

[6] https://aging.maryland.gov/Pages/LRM.aspx
[7] https://mitre.github.io/codi/docs/codi-resources-by-phase/#implementation

13. Utilize existing HIE tools and infrastructure to avoid creating redundant technology, accelerate project implementation, and promote sustainability.

The primary rationale for CODI's HIE-centric data sharing approach is that HIEs have already established a robust data exchange infrastructure that is designed to ingest and link data from many sources. As technology organizations, HIEs avoid operating competing infrastructure where different tools provide the same function. Thus, a CODI implementation should use the HIE's existing process for ingesting and linking data and existing reporting capabilities; new capabilities should only be built if they do not already exist. Leveraging HIE infrastructure means less technology to establish during an implementation. The benefit of using existing HIE infrastructure is a less expensive and faster implementation because there is less technical development that needs to occur.[8] When CODI's value is aligned with the HIE's goals and uses the HIE's technical infrastructure that is also supporting many organizations, it is more likely to be sustained.

14. Demonstrate that CBO data has been successfully connected with clinical data to build momentum towards implementation completion and excitement about CODI's value.

Data sharing and technology projects can struggle to maintain interest and momentum because visualizing progress and data sharing is difficult. The Maryland implementation demonstrated data sharing progress as early as possible by sharing updates during the monthly workgroup meetings and sharing the number of records and match rate after each CBO's initial dataset was successfully linked to clinical data by the HIE. The moment when computed clinical outcomes for a CBO population can be seen by all implementing partners validates that the end-to-end data flow recommended by the CODI model is possible and lends confidence to the broader team of implementers.

4.5 Communicating Impact

Communicating impact refers to work that occurs in the final stages of CODI implementation as work is being completed, and after the implementation work has concluded. Communicating impact includes using the functionality that was established such as using the harmonized clinical and community data. Three learnings about communicating impact are discussed below.

15. Balance CBO user needs and practical HIE application when designing outcome measures to evaluate CBO programs and services.

CBOs desire measure definitions that are easily explained and exclude the fewest individuals. Compared to clinical outcome measures, CODI measures were defined to minimize complexity and retain as much of the CBO cohort as possible. Some exclusion when linking CBO and clinical data is unavoidable from individuals who have insufficient HIE data to be measured accurately. In Maryland, 20-40% of individuals in CBO data were lost during linkage such that addition exclusions would only further reduce the measure denominator.

[8] In comparison to a distributed network model which was used in the Colorado and North Carolina CODI implementations.

16. Confirm HIE data availability with each outcome measure design decision to ensure that outcome measures can be successfully built and meaningfully deployed.

Measure validation is a crucial aspect of measure design and refers to the HIE implementing the measure's logic to affirm that the measure can be built and operated as it is defined. The validation process reveals gaps in a measure definition that require discussion, decision, and documentation. Validation also confirms that the data needed to calculate the measure exist within the HIE's data model and are available at a level of sufficient quality and quantity from key clinical data sources (e.g., inpatient, outpatient). Because HIEs have such a vast array of incoming data from various sources in different formats, HIEs have to explore the availability and quality of data domains use case by use case. For an element such as blood pressures, validation can reveal that an HIE doesn't have a specific data element, cannot surface it in a structured way, may not be receiving data from key data sources, or has insufficient completeness meaning that there is not enough data to use it in a measure.

17. Exercise caution when combining data across similar programs or services provided by different organizations to ensure clarity of resulting inferences.

Many CBO programs in Maryland identified during the discovery phase were unique; however, there was significant variation in workflows among similar programs (e.g., nutrition services) across organizations. The same type of program (e.g., home-delivered meals) at two organizations can have different client eligibility, delivery models, enrollment processes, and data. For example, one home-delivered meal program operates in 90 day enrollment periods while another enrolls individuals in perpetuity; one program provides meals for four days in a week while the other provides meals for seven days in a week. Implementers can anticipate different data and context across organizations for the same program that makes combining that data only appropriate when the analytic goal does not assume standardization. While the impulse is to combine data to create a larger measurement population, the heterogeneity of CBO programs and services can make aggregation unwise at times.

Conclusion

The Maryland CODI implementation offers valuable insights for future implementers seeking to harmonize clinical and community data to improve health outcomes. By leveraging existing relationships, tailoring communication strategies, and aligning efforts with broader community initiatives, the Maryland team demonstrated how CODI can be effectively introduced and scaled within a local context. Key lessons emphasize the importance of understanding CBO workflows, data governance, and consent practices, as well as scoping use cases based on available and actionable data. Additionally, the implementation phase highlighted the need for technical assistance, the utility of existing HIE infrastructure, and the importance of addressing data anomalies to improve data quality and usability. Maryland's experience also underscored the importance of balancing the needs and perspectives of different partners in building capabilities and using data. Ultimately, applying lessons learned from the Maryland CODI implementation can help future CODI implementers and maximize the impact of harmonized clinical and community data.