Connecting Data to Improve Health: CODI Implementation Playbook for Communities with an HIE

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

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1 Introduction

The Community and Clinical Data Initiative (CODI) is a model to harmonize clinical and community data for research, evaluation, quality improvement, and public health. CODI was originally pioneered by the Centers for Disease Control and Prevention and has been implemented in three communities across the United States since 2018: Colorado, North Carolina, and Maryland. CODI implementations occur at a community level by bringing together people, processes, and technology by way of local partner organizations, business and data sharing processes, and data models and reporting infrastructure, respectively. The CODI model is open source and free to use; resources to support other communities interested in learning more about or implementing CODI have been published at https://mitre.github.io/codi along with outputs from past implementations.

1.1 Purpose

The purpose of this is playbook is to support communities interested in connecting data from non-clinical settings (e.g., community-based programs and services) with clinical data from healthcare providers. CODI's health information exchange (HIE)-centric Model helps communities leverage the capabilities of a HIE, including its existing infrastructure and governance to connect clinical and community data. This playbook is a guide for implementing the CODI HIE-centric approach; if you are interested in resources for CODI's distributed network approach, which does not require a HIE partner, please see https://phii.org/course/codi-toolbox/.

1.2 How to use the Playbook

This playbook was developed for HIEs and community-based organizations (CBOs) interested in implementing the CODI HIE-centric Model in their community. This playbook organizes implementation guidance by three phases:

- Preparation Phase
- Discovery Phase
- Planning Phase

In each phase, the playbook presents objectives, key activities to accomplish those objectives, and resources available to support those activities.[1] Implementing partners are ready to move onto the next phase once all objectives of the prior phase have been met. Where applicable, the playbook incorporates clarifying examples (CODI in Action) and lessons learned from past CODI implementations.[2]

This playbook was developed recognizing that many aspects of a CODI implementation depend on the unique technical and business environments of partner organizations, selected implementation scope, and use cases. The duration of each phase described below is variable and highly dependent on organizational readiness, desired scale of implementation, and resource availability. The goal of this playbook is not to be prescriptive but rather to help interested organizations efficiently and effectively plan their CODI implementation. Thus, the content in this playbook may be used in whole or part to support implementation planning

[1] Resources may appear in more than one phase.

[2] The comprehensive lessons learned report "Turning Challenges into Opportunities: Lessons from CODI Implementations" is available at https://mitre.github.io/codi/.

efforts. Figure 1 summarizes the outcomes and key steps of each phase described in the playbook.

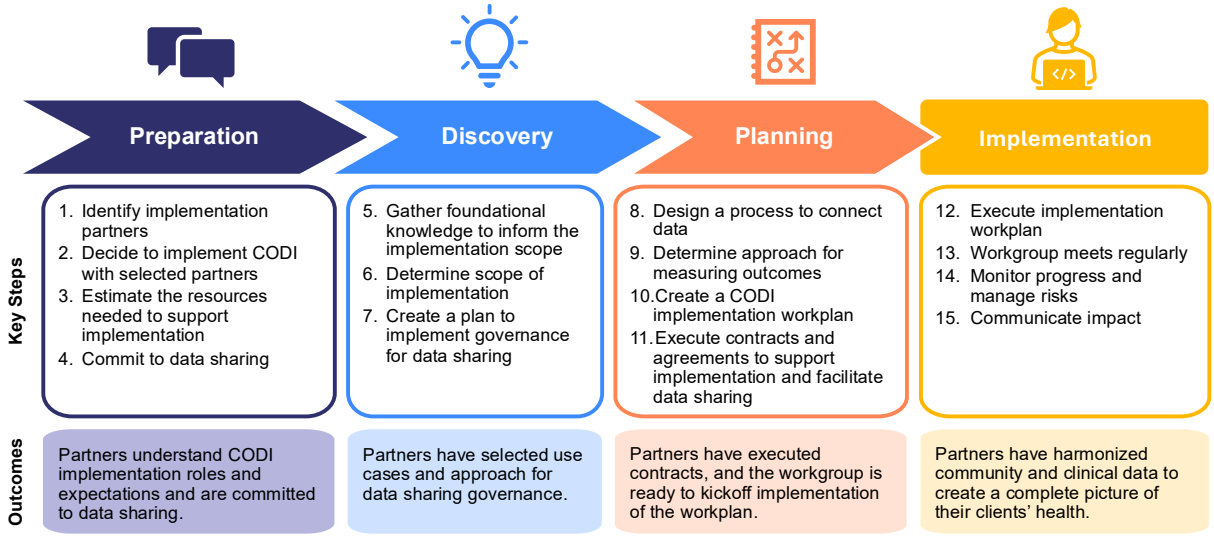

Figure 1. Overview of Phases Described in Playbook

1.3 Key Terms

For the purposes of this document:

- **Social services** are the services and programs provided by organizations outside of a clinical setting to help people maintain their independence and improve their quality of life, such as evidence-based programs, home-delivered meals, or assisted transportation.
- **Social service data** are the data about the organizations that provide the services and programs, the services and programs offered, and the people enrolling in or receiving those services and programs as well as screening and assessment data which identify and assess individual needs to select the best fitting services or programs.

2 Preparation Phase

This section contains guidance to help interested organizations determine if the HIE-centric CODI model can be implemented in their community and who will be part of the implementation. A CODI implementation generally begins with one interested organization who takes the lead to identify and engage other organizations who may benefit from CODI, resulting in a group of implementing partners (Objective 1). Together, the implementing partners decide whether to move forward with an implementation by thinking through the work required to implement CODI and the potential value for their community (Objective 2). Based on the desired implementation timeline and number of partners, implementing partners determine if additional funding and other dedicated support resources are needed for the implementation to be successful (Objective 3). Table 1 describes Preparation Phase objectives, key activities, and available supporting resources.

Table 1: Preparation Phase: Objectives, Key Activities, and Supporting Resources

Objective	Key Activities	Supporting Resources
1. Identify implementation partners	• Identify one HIE and at least one CBO partner interested in connecting social service data with clinical data • Validate that a CODI implementation would support organizational goals • Identify executive-level and program-level champions at each candidate implementation partner organization • Identify the CODI implementation role(s) that will be filled by each partner organization and ensure all required roles will be filled	• Description of Required Roles (Section 2.1, Appendix A.1) • CODI Model Overview Briefing • CODI Overview Fact Sheet • Maryland Pilot Overview Fact Sheet • Maryland CODI Impact Report
2. Decide to implement CODI with selected partners	• Validate that partner organizations meet minimum requirements to successfully implement CODI • Identify a primary point of contact at each partner organization and confirm that person has bandwidth to support Discovery Phase activities	• Key Organizational Requirements (Section 2.2, Appendix A.2)
3. Estimate the resources needed to support implementation	• Estimate duration of the CODI implementation • Determine if funding is needed to support implementation • Identify and pursue funding opportunities (if applicable)	• Considerations for Estimating Implementation Duration (Section 2.3, Appendix A.2)
4. Commit to data sharing	• Make foundational governance decisions that commit partner organizations to data sharing	• List of Foundational Governance Decisions (Section 2.4)

2.1 Identify potential implementation partners

The idea to implement CODI in a community may be driven by a HIE interested in increasing their services or a a community-based organization interested in being able to understand the impact of their services on clinical outcomes. To identify potential implementing partners, the organization leading the recruitment effort should meet with as many interested organizations as practical, starting with organizations where relationships have already been established (see box below).

LESSONS LEARNED 1: Forging CODI Partnerships

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.

The key roles required for a successful CODI model implementation are described below; a more detailed description of roles is available in Appendix A.1. The initial group of implementing partners must include one HIE and one or more CBOs. Organizations may fill more than one role. For instance, the HIE may also be the Technical Partner and Project Steward. Recruitment efforts should be focused on identifying partner organizations to fill the following roles:

- **Community Data Provider(s)**: This role is filled by one or more CBOs or government agencies. An organization filling this role contributes data from a non-clinical setting for linkage to clinical data. These organizations are responsible for extracting data from source information systems and transforming it into a standard format, sharing it with the HIE, and using reporting tools provided by the HIE to assess the impact of their social services.
- **Health Information Exchange(s):** An organization in this role receives data from Community Data Providers, processes it, links data at the person level to clinical data, computes outcomes, and makes outcomes accessible in reporting tools.
- **Technical Partner:** This role is filled by a trusted third-party or the HIE. An organization filling this role provides technical assistance to Community Data Providers and the HIE as needed.
- **Project Steward**: This role is filled by a trusted third-party or the HIE. An organization in this role is responsible for overall project management, including defining and executing the implementation plan, mitigating risks, managing budget, and communicating and coordinating with partners.
- **Project Sponsor**: This role may be filled by an implementation partner or a sponsoring agency (e.g., government agency, coalition). An organization in this role provides overall direction and funding; ensures strategic alignment and success.

For each phase, the Project Steward is responsible for coordinating and managing activities; other implementation partners will contribute to successful completion of the activities in each phase as needed (e.g., responsible, consulted, informed). Additional interested parties, like state or local government agencies (e.g., health department, department of human services) or representatives from the healthcare provider community may be recruited to maximize impact by helping to align CODI efforts with state and local priorities. Depending on the community, recruitment of additional implementing partners may and can extend into the Discovery Phase once the preliminary scope is determined to help focus additional recruitment (see box below).

CODI IN ACTION 1: Starting Small

During this phase, the initial implementing partners in Maryland were the HIE and a CBO that had an established trusted data sharing relationship. A second CBO was recruited during the Discovery Phase after nutrition services and programs were selected as a focus of the implementation.

Initial recruitment engagements should explain the CODI model, the role of each organization, and communicate the value of participating. During these engagements, champions at multiple levels within each organization should be identified; executive-level and program-level champions at each organization are key to implementation success. The following key questions should be addressed during initial communications with prospective partners:

- What is the CODI model?
- What problems/challenges can the CODI model address?
- What change can I expect to see in my community at the end of an implementation?
- What will my organization's role and the implementation work be?

The following CODI communication resources are available on the GitHub site and can be customized to support implementation partner recruitment and identification of champions at each partner organization:

- The CODI Model Overview Briefing and CODI Overview Fact Sheet introduce the CODI model and describe the value of a CODI implementation.
- The Maryland Pilot Overview Fact Sheet describes the CODI implementation in Maryland and the issue CODI aimed to address. This serves as an example of what a CODI implementation can look like.
- The Maryland Impact Report summarizes how organizations participating in the Maryland CODI implementation were impacted. This provides an example for the impact that implementing partners can expect.

2.2 Decide to implement CODI with selected partners

Deciding to implement CODI with partners means cementing who the implementing partners will be with a formal decision and ensuring that the composition of committed partners will result in a successful implementation.

CODI implementations must include one HIE and one or more CBOs and are most successful when those organizations have sufficient capacity for data sharing with each other. The following summarizes the recommended requirements for HIEs and CBOs to successfully participate in a CODI implementation. Appendix A.2 provides a more detailed list of requirements for HIE(s) and CBO(s).

- **Health Information Exchange(s)** must have access to clinical data for individuals in the geographic region(s) served by each CBO and an interest in integrating social service data with a compatible demographic profile. The HIE needs resources to implement or adapt the CODI data model, the technical capacity to receive, process, and link CBO data with clinical data, and the ability to create reports using analytic tools or dashboards. HIEs must also have staff available to support planning and implementation, including a primary contact to coordinate implementation activities.

- **Community Data Provider(s)** must have structured, individual-level data collection systems for social services, and collect enough identifying information (such as name, date of birth, and contact information) to link this data with clinical data. These data providers (e.g., CBOs) also need participant consent to share data with the HIE, the ability to share data electronically, and staff available for regular CODI planning and implementation meetings. Staff should collectively have knowledge of workflows, data systems, and the technical skills necessary for data extraction and transformation, with a primary contact to coordinate implementation activities; implementation partners may provide technical support if the Community Data Provider does not have staff with the required skills to support data extraction and transformation (see box below).

CODI IN ACTION 2: Example Meeting Requirements with Support of Another CBO

During the Maryland implementation, a Memorandum of Understanding for Data Sharing established between two CBO implementation partners allowed the CBO with greater technical capacity to support data transformation for the other.

If these requirements are not met, delays in planning and subsequent implementation are likely. If an organization does not currently meet a requirement but believes they will by the time implementation starts (e.g., three months in the future), implementing partners may choose to move forward understanding this risk.

2.3 Estimate the time and resources needed to support implementation

Estimating an implementation's potential duration helps partners gauge the need for resources, clarify when they can plan to see the expected outcomes, and better assess if and how much funding would be required. Implementers should consider that multiple people within an organization are likely required for that organization to successfully fill its role(s). For instance, the HIE may fill its role with support of a team comprised of a program manager, data lead, data engineer, and one or more data analysts. Participation in a CODI implementation is unlikely to require full-time dedication by personnel in each partner organization. In prior CODI implementations, people that supported CODI at each organization were not fully dedicated to CODI and their level of effort shifted with the sequence of implementation work.

Implementing partners will want to approximate the resources required for a CODI implementation which include:

- What is the desired implementation timeline for CODI?
- How many partners will participate?
- What is each partner's role(s)? How much work will each partner need to do? What is their capacity for this work? What personnel will support this work? Do they require funding for that work?
- How much technology development is required?
- How long will it take to implement governance for data sharing?

The duration of a CODI model implementation depends on many factors, but progress can be accelerated by:

- A HIE who has already established a governance model for receiving and processing social service data
- A HIE who has an established governance framework for the participation of CBOs
- A HIE who has an understanding of CBO social service workflows and systems
- CBOs that are already HIE participants
- CBOs with an understanding of HIE infrastructure and available functions
- Established trusting relationships between implementation partners
- Previous collaborative projects that involved data sharing between the HIE and CBO(s)
- Use of existing outcome measure definitions to demonstrate impact
- Sufficient funding available to support prioritization of work at partner organizations
- Alignment with broader community efforts

Initial implementation duration estimates made during the Preparation Phase will be refined based on learnings and scope decisions made during the Discovery Phase and should be formalized in an implementation workplan in the Planning Phase. If an implementation needs to be shorter based on external factors, the scope can be limited, or the technical approach can be adjusted. If an implementation can be longer, the scope may be expanded if partners agree there is value to do so.

Prior CODI implementations have taken two to three years to plan and complete once the initial set of partners has been determined. Table 2 includes the approximate duration of each phase based on the prior three CODI implementations and factors that may impact the duration of a new implementation. Discovery and planning activities can be anticipated to take a total of about one year combined. Appendix A.2 shows an example high-level 24-month implementation timeline that starts after the Preparation Phase described in this playbook is completed.

Table 2: CODI Phase Duration and Considerations

Phase	Duration	Factors That May Impact Duration
Preparation	3-6 months	Organizational readiness, desired scale of implementation (e.g., 10 organizations versus 3), resource availability, strength of existing partnerships between HIE and Community Data Providers
Discovery	3-6 months	Number of partners, extent of preliminary scope, existing workflow and technical documentation, existing data governance policies and processes, and staff bandwidth
Planning	6-9 months	Number of partners, HIE staff bandwidth to draft approach to adapting the CODI model, and ability to schedule the work group kickoff meeting. Executing DUAs and contracts is often the most time intensive.
Implementation	1-2 years	Desired implementation timeline, number of partners, and funding or other dedicated support resources

2.4 Commit to data sharing

During the Preparation Phase, implementing partners must collectively make the following foundational governance decisions to inform subsequent governance planning and for the CODI implementation to proceed:

- **Decision 1 (required)**: The HIE will receive individual-level data from Community Data Providers, link the community data with clinical data ('connected data'), and use connected data for aggregate reporting to Community Data Providers
- **Decision 2 (required)**: The Community Data Provider(s) will share individual-level data about social services with the HIE
- **Decision 3 (conditional)**: The Community Data Provider(s) will determine if a Technical Partner to support data transformation and sharing is required, and if so, who that Technical Partner will be. A Technical Partner may be required if the Community Data Provider does not have staff with the required skills to support data extraction and transformation as discussed in Section 2.2.

Because implementing the CODI model includes initiating new sharing and use of data by CBOs and HIEs, partners should commit to data sharing early. Implementers will need to understand each other's processes for making decisions about data sharing and data use to avoid delays. Each organization will have different processes for decision making and different experience with these types of decisions. HIEs likely have an established process for making decisions about data receipt and use but Community Data Providers may or may not have a process to make similar decisions since the CBO data governance landscape can be highly varied and less formal. The Project Steward should assist partners with key decisions and whenever possible secure formal decision documentation from authorized individuals for the project's records.

For all three governance decisions, authorized decision makers may define technical conditions or governance terms as part of giving approval that can be integrated into the governance plan in the following section. The following box provides example conditions for these decisions in Maryland.

CODI IN ACTION 3: Example Conditions for Initial Decisions

- **Decision 1:** Yes, if Community Data Providers have signed a participation agreement, only aggregated data is shared, and small cells (<11) are suppressed
- **Decision 2:** Yes, if no personal identifiers are revealed in the data reporting
- **Decision 3:** Yes, if a business associates' agreement is executed

These three decisions determine which organizations will require governance that allows data sharing and data use. Decisions 1 and 2 may be conditional pending specific clarifications about which data elements will be shared and used so that the decision-making authority at each organization may assess the organization's risk. The CODI Data Model Implementation Guide can be used to identify the preliminary set of data elements to inform these decisions; the final data elements will be defined during Discovery and Planning Phases. Decision 3 is only required if applicable but is a necessary early clarification to determine if an additional party (a Technical Partner) should be included in governance planning. After decisions have been made that commit the organizations to sharing data, a governance approach will be formalized in the next phase.

3 Discovery Phase

This section contains guidance to help a group of implementing partners collect the information required to determine scope, select use cases, plan governance, and subsequently develop the implementation plan. This phase begins with the committed implementing partners determining the preliminary implementation scope and then conducting a needs assessment within that scope (Objective 1). After the needs assessment is complete, partners draft, refine, prioritize, and select use cases to determine the scope of the implementation (Objective 2). Based on implementation scope and use cases, the partners need to estimate the time required to establish the governance that will allow data to be shared; the existing data governance infrastructure should be used when possible to streamline this work (Objective 3). Table 3 describes the Discovery Phase objectives, key activities, and available supporting resources.

Table 3: Discovery Phase: Objectives, Key Activities, and Supporting Resources

Objective	Key Activities	Supporting Resources
1. Gather foundational knowledge to inform the implementation scope	• Define implementation goals and preliminary scope • Conduct a needs assessment to document workflows and characterize data availability and quality	• Guidance for Establishing Scope (Section 3.1.1) • Guidance for Conducting Needs Assessment (Section 3.1.2, Appendix B.1)
2. Determine scope of implementation	• Draft preliminary use cases • Establish prioritization criteria • Prioritize priority use cases • Select use cases	• Use Case Prioritization Criteria (Section 3.2, Appendix B.2)
3. Create a plan to implement governance for data sharing	• Conduct governance discovery • Define a governance approach for formalizing data sharing and use	• Guidance for Creating a Plan to Implement Data Governance for Data Sharing (Section 3.3)

The box below provides lessons learned from prior CODI implementations for consideration during this phase.

LESSONS LEARNED 2: Discovery Phase

- Document CBO social needs and social service workflows to understand the availability and fidelity of CBO data that can be connected with clinical data.
- 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.
- Map existing governance infrastructure and explore CBO data governance requirements and practices so that data sharing and implementation are not delayed.

3.1 Gather foundational knowledge to inform the implementation scope

3.1.1 Define implementation goals and preliminary scope

The preliminary scope defines the focus of the needs assessment from which the use cases will be created. Once drafted, it's important to validate the preliminary scope with implementing partners to make sure key areas are not excluded from the beginning (e.g., too narrow) or that the scope is not so broad that it would require too much time and effort to understand the workflows related to each different topic area within scope. Information gathered during the Preparation Phase about why each partner is interested in CODI can be leveraged to create an initial draft of the preliminary scope. Key informant interviews with each partner organization should be conducted to develop and validate the preliminary scope to ensure buy-in and support before moving forward.

1. **Finalize CODI implementation goals:** Short and long-term goals of local CODI implementation help define scope, guide decision-making, resource allocation, and progress tracking. Shared CODI implementation goals should be agreed to by partners before defining scope.
2. **Define preliminary scope:** The preliminary scope defines the topic areas for research from which the use cases will be created and should support implementation goals. The preliminary scope should define:
    - Population of interest
    - Geographic area (e.g., region, state, network)
    - Organizational scope (e.g., implementation partners)
    - Primary topic areas – Primary topics of interest that will be focus of use case creation (e.g., food, housing, transportation)
    - Social Services of interest (e.g., home-delivered meals, care transition programs) and their processes (whole or parts of workflows)
    - Secondary use case topic areas – Topics of interest but not focus of use cases. Gather information on where secondary topics interact with primary topic areas to understand connectivity, synergies, and dependencies.
    - Outcomes of interest – Categories of outcomes that are of interest to partner organizations and are relevant to selected topic areas and social services.
    - The CODI IN ACTION 4 box below summarizes the preliminary scope for the Maryland implementation.
3. **Validate and finalize preliminary scope:** Ensure consensus on the initial scope from partners before moving forward with research activities. Finalize preliminary scope based on feedback. The preliminary scope will guide subsequent needs assessment and planning activities.

CODI IN ACTION 4: Preliminary Scope Example

- **Geography**: Maryland
- **Population of Interest**: Older adults (60 years and older)
- **Primary Topic Area**: Non-medical drivers of health and the social service interventions that can address those needs (e.g., food, utility, housing, transportation).
- **Processes of Interest**: Social needs screening and assessment, referral, eligibility determination, enrollment, provision of programs and services, and evaluation
- **Outcome Types of Interest**: Clinical outcomes (e.g., hypertension and diabetes control), financial outcomes (e.g., reductions in total cost of care), event outcomes (e.g., prevented hospital readmission), and quality of life outcomes (e.g., PHQ-9 scores)

3.1.2 Conduct a needs assessment

The purpose of conducting a needs assessment is to gather and synthesize the data and information necessary to inform the design of and subsequent implementation of the CODI model in a community. The needs assessment should be conducted prior to planning a CODI implementation to understand implementing partners' current data collection, storage, and sharing practices, workflows, and opportunities for improvement that are within scope. The needs assessment should also explore the information systems where relevant data resides and the contents and quality of data resulting from those workflows. The needs assessment should result in process diagrams for selected workflows which may include social needs screening, referral, social needs assessment, eligibility determination, enrollment, provision of programs and services, and evaluation. Workflows related to secondary topics of interest can be documented as resources allow. The needs assessment should result in a report that summarizes the findings, proposes potential user stories, and discusses recommended next steps to inform scope and development of use cases and identify focus areas of highest impact. The following outlines the process for conducting a needs assessment; example guiding questions for the needs assessment are included in Appendix B.1:

1. Develop needs assessment questions to identify information that needs to be collected to inform planning (i.e., what questions will the needs assessment answer?)
2. Gather and review relevant workflow and information system documentation from implementing partners
3. Hold key informant interviews to document workflows, system functions and limitations, gaps, and current data collection, storage, and sharing practices that are within the preliminary scope
4. Conduct additional research to answer remaining and emerging needs assessment questions
5. Synthesize information from interviews and research to define key components of user stories that will inform use case development. Recommend next steps and proposed scope (e.g., food insecurity).
6. Present findings to implementing partners for validation and input. This may include the following by topic area (e.g., food, transportation, housing):
    - Characterizing the community needs

- Summarizing the programs and services available to address the need
- Describing the stakeholders
- Summarizing data available (e.g., screeners, individual-level data, service delivery)
- Describing the information systems where the data are stored
- Summarizing outcomes of interest
- Propose priority based on findings (e.g., in or out of scope based on findings) (see box below)

CODI IN ACTION 5: Prioritizing and Selecting Use Cases in Maryland

Although MD partners were originally interested in better understanding food, housing, transportation, and utility needs and related services, the needs assessment revealed that only data related to food insecurity was currently available in an information system, linkable, and standard. This focused selection of use cases to food-related services. Further application of the reach, value proposition, and extensibility and generalizability criteria resulted in the selection of two use cases.

3.2 Determine scope of implementation

Based on knowledge cultivated from the needs assessment, the implementing partners will define, prioritize, and select use cases that will dictate how the CODI model will be applied in the implementing community, thus scoping and guiding the implementation.

1. **Define and validate use case prioritization criteria:**

   The following criteria can help implementers develop, prioritize, and select use cases that will result in a successful and valuable CODI implementation. Prioritization criteria should be validated and agreed to by implementing partners. The box below describes how the scope was determined in Maryland. The criteria summarized below should be modified to meet local needs; see Appendix B.2 for more detail.

   - **Reach**: How many individuals do program(s) or service(s) applicable to this use case reach?
   - **Available**: Are data about people receiving the program(s) or service(s) applicable to this use case collected at the person level in an information system (e.g., electronically)?
   - **Linkable**: Are there sufficient identifiers recorded about people reached by applicable program(s) or service(s) to link with clinical data?
   - **Standard**: Are program(s) or service(s) applicable to this use case provided and documented in a standard way?
   - **Value Proposition**: What and how much value results for each implementing partner by addressing this use case?
   - **Extensibility and Generalizability**: Is this use case relevant to other CBOs in the HIE's service area? Are the components of the solution translatable to other initiatives?

2. **Develop list of candidate use cases** based on needs assessment findings which meet prioritization criteria. Use cases may take many forms but should include a topical area, business events, actors, secondary actors, user objectives, preconditions, inputs, outputs, definition(s) of success, and assumptions to ensure that user needs are met.
3. **Rank candidate use cases** based on defined use case prioritization criteria. Each partner should provide input on the rank of each use case from their organization's perspective.
4. **Refine top candidate use cases** based on feedback from implementing partners
5. **Select use cases** for implementation planning based on available time and resources. Aim for consensus when selecting use cases for implementation to promote buy-in and commitment from implementing partners. The selected use cases should provide value for each implementing organization although the proposed value may not be the same across organizations.

3.3 Create a plan to implement governance for data sharing

The governance work that enables data sharing can consume a significant amount of project time and resources so planning governance for data sharing early in the project is recommended. Whenever possible, a CODI implementation should use existing data governance infrastructure and leverage existing data governance processes, tools, and templates (e.g., data sharing agreements).

CODI IN ACTION 6: Governance Efficiency

The Maryland implementation was significantly accelerated compared to prior CODI implementations in Colorado and North Carolina 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.

3.3.1 Conduct governance discovery

Community data providers and the HIE should dedicate time to share their existing governance infrastructure (e.g., policies, processes, rule, templates, and norms) with each other and the Project Steward. This discovery can occur as part of the needs assessment or separately. Additional conversations to explore concerns regarding data sharing and past experiences that have shaped the organization's current approach to governance are also recommended. Implementers can expect governance policies, processes, and norms regarding data sharing to vary widely between organizations. HIEs will likely have the most robust governance policies and rules as they are required to comply with sections of the Health Insurance Portability and Accountability Act. The purpose of this discourse is to gain a sense of the organization's posture around data sharing as well as level of experience. Organizations that are uneasy about sharing data because of past experiences can benefit from additional support.

This discovery effort also reveals where existing governance infrastructure can be leveraged in a CODI implementation. For policies, the CODI implementation should be designed within the context of existing data sharing or data use policies. For example, the HIE likely has a policy around the definition of a small cell that the CODI implementation would want to adopt. The HIE likely has a preferred location and means of transporting data from Community Data Providers

and the CODI implementation would want to plan to share data in the way that the HIE prefers to receive data. Regarding agreements, the CODI implementation should start from template agreements already used by partner organizations to limit the amount of time and effort expended on data sharing agreements.

3.3.2 Define a governance approach for formalizing data sharing and use

Three questions implementers can use to think through a governance approach are:

1. What is the governance work required to share data?
    - What agreements need to be signed? Are there existing templates?
    - What additional governance processes will the CODI implementation need?
    - How will the approved uses of data for the CODI implementation and the parameters of that use be documented?
2. Who will do what governance work?
    - Which implementing partners will lead each governance activity? Who are the decision-makers at each organization? Does the governance work require any individuals to be added to the project team?
3. What is the best sequence for the governance work?
    - Considering the requirements of agreements, what governance work needs to happen first?

The questions suggested above are not definitive but can make a start to defining the governance work that is required to complete a CODI implementation. The governance approach will be highly customized to the CODI implementing partners as it is designed around their requirements and existing infrastructure. Often governance activities are not managed within a project and those timelines can easily slip and cause delays in other project activities. The governance approach should be documented and incorporated into the implementation workplan which is developed in the next phase.

4 Planning Phase

This section contains guidance to support the creation of a workplan that will result in a successful CODI implementation. Planning Phase work is initiated after the needs assessment has been completed, implementation use cases have been selected, and a governance approach has been drafted. The Planning Phase begins with designing the technical process to connect community and clinical data (Objective 1); this activity should be led by the HIE with feedback from the CBOs to ensure that the process will work with the HIE's existing data model, data ingestion processes, and data governance. Next, the approach to measuring outcomes of value to the CBOs should be determined (Objective 2). Based on the technical approach and outcomes decisions, an implementation workplan is created. The implementation workplan plan defines the workstreams, key activities, deliverables, milestones, and responsibilities to implement CODI (Objective 3). Then, data sharing agreements and contracts to support the implementation work (e.g., funding agreements) should be carried out as soon as possible (Objective 4). Since establishing data sharing agreements can take time, partners can proceed to the next phase while this work is in process. Finally, a working group should be established to enable collaboration and communication between partners (Objective 5).Table 4 describes the Planning Phase objectives, key activities, and available supporting resources.

Table 4: Planning Phase: Objectives, Key Activities, and Supporting Resources

Objective	Key Activities	Supporting Resources
1. Design a technical and operational approach to share, connect, and use	• Draft approach for connecting community and clinical data with input from CBOs	• Guidance for Process Design (Section 4.1, Appendix C.1)
2. Determine implementation approach for measuring outcomes	• Identify relevant outcome measure categories and prioritize based on value and feasibility • Identify candidate outcome measures of interest • Rank candidate outcome measures for implementation • Categorize ranked outcome measures for implementation	• Guidance for Determining Approach for Measuring Outcomes (Section 4.2 Appendix C.2)
3. Create a CODI implementation workplan	• Define and plan each workstream • Obtain buy-in from implementing partners	• Guidance for creating a workplan (Section 4.3) • Example Workstreams (Appendix C.3)
4. Execute contracts and agreements to support implementation and facilitate data sharing	• Secure approvals • Execute contracts (as needed) • Execute data sharing agreements (as needed)	• Guidance for contracts (Section 4.4) • Example Memorandum of Understanding for Data Sharing
5. Convene working group	• Identify individual(s) responsible for work group • Determine workgroup member list that includes at least one representative from each partner organization • Establish meeting cadence • Establish norms	• Guidance for convening a working group (Section 4.5)
6. Kickoff implementation	• Prepare kickoff materials • Hold kickoff meeting	• Guidance for kickoff (Section 4.6)

The box below provides lessons learned from prior CODI implementations for consideration during this phase.

LESSONS LEARNED 3: Community Alignment

- Maximize the number of participating CBO partners to improve the reach and applicability of the implementation and increase the enduring value within a community.
- 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.
- Verify that CBOs have collected and documented consent from their clients to share their data for additional uses like CODI.
- Assess CBO technical capacity early and ensure technical assistance is available to help CBOs extract, normalize, and share data, as needed.
- Align implementation activities with larger community efforts to maximize impact, reach, and sustainability.

4.1 Design a technical and operational process to connect and use data

The technical and operational approach to connecting clinical and community data is focused on who will share data with whom, how the data will be shared, what data will be shared, and how the HIE will generate outcome measures and provide access to outcomes for authorized parties. This activity is a key point of clarity in the implementation where implementing partners reach agreement on the finer points of the CODI solution in their community.

The process design should include:

- A process diagram showing the key steps of data flow, including extraction, transformation, sharing, linkage, outcome computation, reporting, and use, as well as which organizations are responsible for each step (See Appendix C.1 for example).
- A description of the overall process and work required to support each step in the data flow. The description should include identification of any new processes or capabilities that need to be developed to support the work and the organization(s) responsible for each step. This will allow for resources and time to complete the process to be estimated.

As CODI is a local implementation where technical development occurs inside existing infrastructure, this approach will vary in each implementing community. Defining the process to share and connect data and generate outcomes is an important first step in implementation planning. This process will also be used to define the workstreams in the implementation plan and serve as a reference throughout the implementation.

4.2 Determine approach for measuring outcomes

Implementers should plan for how connected community and clinical data will be used to measure the impact of social services; this is one of the core workstreams listed above. This requires implementers to prioritize and select suitable outcome measures of interest to best meet reporting needs of CBOs which may include: a) adoption of existing measure definition(s), b) adaptation of existing measure definition(s), or c) development of new measure definition(s). Because building outcome measures is time intensive, implementers can save time and resources by reusing existing outcome measures when appropriate. During the Planning Phase, the selected approach to measuring impact (e.g., adopt, adapt, design) should be included in

the implementation plan to ensure the effort is appropriately resourced and incorporated in the implementation timeline; implementers can expect that outcome measure development may take 3-6 months for each measure developed. Planning Phase work includes initial information gathering to prioritize candidate measure and inform the implementation approach, but the actual work to adopt, adapt, or develop outcome measures occurs during the Implementation Phase. Appendix C.2 provides a process on determining the approach for measuring outcomes.

4.3 Create a CODI implementation workplan

An implementation workplan is perhaps the most essential resource for a successful CODI implementation. The Project Steward should create a workplan with buy-in from each implementing partner to ensure success.

4.3.1 Define and plan each workstream

The CODI implementation workplan should describe the activities, roles, and responsibilities of participating organizations and expected milestones and deliverables to support the local CODI process defined earlier (Section 4.1). The implementation plan will likely include the following high-level workstreams, but these should be modified based on the CODI process design:

- Data Model
- Data Sharing
- Outcome Measures
- Reporting Tools
- Project Management

For each workstream, goals should be established so that implementers know when success has been achieved. Within each workstream, goals, key activities, start and completion dates, deliverables, roles and responsibilities, and decision-making process should be defined to help guide work. The implementation plan should also document planning assumptions, risks, and apply any lessons learned from the Preparation and Discovery Phases. For each workstream, applicable training and user support materials should be created. Appendix C.3 provides a summary of the primary workstreams, goals, key activities, and supporting resources from the Maryland CODI implementation for reference. The Project Steward should develop the implementation workplan with input from relevant implementing partners.

4.3.2 Validate workplan with implementing partners

After the workplan has been drafted, it should be shared with all implementing partners to ensure understanding of work and timelines that each organization has committed. The workplan can provide information required for contracts and data sharing agreements.

4.4 Execute contracts and agreements to support implementation and facilitate data sharing

During this phase, necessary contacts and agreements to support implementation should be executed. This may include:

- Executing required governance and data sharing agreements to allow data sharing and use that were identified in the governance plan defined during the Discovery Phase (Section 3.3)
- Executing contracts or agreements to distribute available funding, as applicable, to support implementing partners

If a necessary contract or agreement is expected to take significant time to execute, but the contracted organizations reasonably believe it will be executed before becoming a blocker to established milestones defined in the implementation workplan, then implementing partners may choose to move forward understanding this risk to prevent delaying progress.

4.5 Convene working group

The purpose of the working group is to enable implementing partners and interested parties to track the progress of the CODI implementation work, provide feedback, make decisions, assess risks, align work with other relevant initiatives, and discuss learnings. Key questions that help guide formation of the implementation workgroup include:

- What is the workgroup's purpose and organizational structure?
- What meeting cadence is most appropriate to achieve the workgroup's purpose?
- Who will prepare meeting materials and facilitate meetings?
- How will decisions and action items be tracked and shared?
- Will this be a formally chartered workgroup?

The working group should be convened in the final planning stages to help build rapport and consensus among implementing partners before moving into the Implementation Phase. A kickoff meeting should be scheduled with implementing partners to initiate the CODI implementation. The box below provides lessons learned from prior CODI implementations for consideration during this phase.

LESSONS LEARNED 4: Implementation

- 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.
- Expect data sharing to reveal additional data anomalies that may require remediation, data model refinement, or highlight potential improvements to data collection.
- Utilize existing HIE tools and infrastructure to avoid creating redundant technology, accelerate project implementation, and promote sustainability.
- Demonstrate that CBO data has been successfully connected with clinical data to build momentum towards implementation completion and excitement about CODI's value.

4.6 Kickoff implementation

The final step of planning is preparing for implementation kickoff. It is recommended that a workgroup meeting is used to kick off the implementation so that partners are convened. During the kickoff meeting, review of the implementation plan, including workstreams, milestones, planning assumptions, and risks. Lessons learned from the preparation, discovery, and planning

phases should be shared and progress on governance activities should be provided by partners.

5 Next Steps and Conclusion

Following the kickoff, the implementation begins and partners execute the implementation activities defined in the workplan, the Project Steward monitors progress and mitigates risks, and the workgroup meets regularly to share learnings, progress, and opportunities for alignment with other initiatives. Accomplishment of key milestones, like the first successful data transmission from each Community Data Provider, should be celebrated and shared with partners and leadership to build and maintain the project's momentum. Partners can expect to uncover unplanned implementation activities, such as unexpected data anomalies that require remediation, that should be integrated into an updated workplan.

Implementing partners can consider a CODI implementation complete when the goals defined in Section 3.1 have been met. Implementers should consider contributing any new resources developed to the CODI GitHub which serves as a knowledge repository for implementers of the HIE-centric CODI model.[3]

This playbook presents a phased approach for implementing CODI in a community and provides guidance and resources to support a successful implementation effort. By meeting the objectives of each phase, communities can plan a successful CODI implementation tailored to their local needs. Success hinges on strong collaboration, clear governance, and alignment with broader community initiatives, ensuring that the resulting data sharing, use and reporting delivers value for all partners, and ultimately, the populations they serve.

[3] To submit resources for consideration, please contact: CODI@mitre.org.

Appendix A Preparation Phase Supporting Resources

This appendix includes resources and guidance to support the Preparation Phase of CODI implementation planning. Lists of required implementation roles (e.g., what types of organizations are required) and organizational requirements for participating in a CODI implementation (e.g., what participating organizations must possess) as well as an example timeline are provided below.

A.1 Required Implementation Roles

Table A-1 describes the types of organizations required to support a successful CODI implementation. Importantly, one organization may act in multiple roles.

Table A-1. Description of Roles Required to Implement CODI

Implementation Role	Role Description
Community Data Provider	• Filled by one or more community-based organizations or government agencies • Contributes data about programs and services from a non-clinical setting (e.g., social service data) for linkage to clinical data (could be a CBO or government program or service) • Extracts data from source information systems and transforms it into the standard data format • Shares social service data based on existing or new data sharing agreements with the HIE • Uses reporting tools to assess the impact of social services
Health Information Exchange (HIE)	• Receives and stores individual-level clinical data from healthcare providers • Receives data from Community Data Provide(s)r, processes it, links data at the person level to clinical data, computes outcomes, and makes outcomes accessible in reporting tools • Develops processes and technology within existing infrastructure following established data governance practices • Establishes new data sharing agreements with social service care data providers, as necessary
Technical Partner	• Can be filled by a trusted third-party (e.g., contractor) or the HIE • Assists Community Data Provider(s) in sharing data in standard format (e.g., data extract, transform, and load activities) • Provides technical assistance to the HIE, if required, to support implementation of the CODI model or translate it to their own model • Develops supporting resources for implementers

Implementation Role	Role Description
Project Steward	• Can be filled by a trusted third-party or an implementing partner (HIE or Community Data Provider) • Leads implementation coordination and carries out project management tasks • Defines and executes implementation plan • Identifies and mitigates risks • Communicates with implementing partners and interested parties
Project Sponsor	• Can be filled by an implementing partner or a sponsor organization (e.g., government agency, coalition) • Provides overall project direction • Affirms project scope • Secures or provides implementation funding • Monitors project progress and ensures strategic alignment

A.2 Organizational Requirements for Participating in a CODI Implementation

The following lists define key organizational requirements for HIEs and Social Care Data Providers interested in participating in a CODI implementation.

Health Information Exchange

- An interest in receiving and working with social service and social needs data
- An understanding of the geographic region where the implementation will take place and access to person-level clinical data for individuals reached by the participating organizations
- Staff with technical skills and bandwidth to participate in CODI planning and implementation activities
- Primary point of contact has bandwidth to support coordination of planning and implementation activities at organization
- Resources to implement the CODI Data Model or match the components to their own data model
- Existing technology or an ability to build technology to receive data from the Social Care Data Providers, process it, link it to clinical data, compute outcomes of interest, and present outcomes for authorized users (e.g., dashboards)
- Commitment to maintain technology for receiving and processing social care data, linking social care data to clinical data, computing outcomes, and presenting outcomes for authorized users.

Community Data Provider(s)

- Information systems that collect social needs and social service data at the individual level in a structured format. This includes individual demographics, social needs screeners, assessment tools, program or service enrollment data, and program or service delivery data.
- Sufficient capture of person identifiers to link social care data to clinical data (e.g., first name, last name, date of birth, address, phone number)
- Participant consent to share data with HIEs for reporting purposes
- Staff with time to meet regularly during planning and implementation with the knowledge of workflows, data collection and storage processes, and information system capability and use. Multiple staff members may collectively meet these staffing requirements.
- Primary point of contact has bandwidth to support coordination of planning and implementation activities
- Staff with knowledge of information systems and skills to support data extraction and transformation activities required to share data with HIE. If staff do not have the technical ability to support data transformation directly, other implementation partners may be able to help.

A.3 Example 24-month Timeline

The timeline below shows high-level activities for Discovery, Planning, and Implementation Phases over a 24-month period; the Preparation Phase is not shown since this is when the decision to implement CODI occurs.

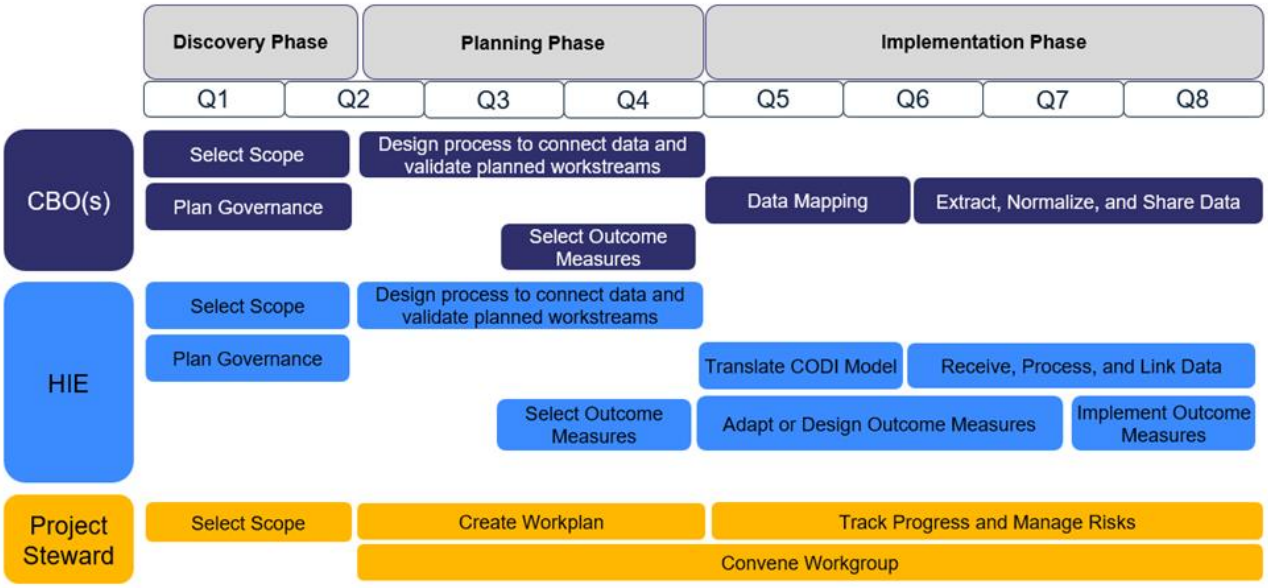

Figure A-1. Example High-Level Timing of Activities

Appendix B Discovery Phase Supporting Resources

This appendix includes resources and guidance to support the Discovery Phase of CODI implementation planning. Questions to guide a needs assessment and recommendations to prioritize and select use cases are listed below.

B.1 Example Needs Assessment Guiding Questions

Articulating the questions a needs assessment should answer is a recommended approach to effectively scope and execute a needs assessment. The box below provides an additional resource that could help shape a needs assessment.

CODI IN ACTION 7: North Carolina's Additional Needs Assessment Resources

The NC CODI used a similar process, called the Clinical and Community Linkages Assessment, to gather technical and organizational information from potential implementing partners. Resources may be adapted to help with conducting the needs assessment. https://phii.org/module-4/clinical-and-community-linkages-assessment/

An example of the questions a CODI needs assessment might answer are listed below:

- What are relevant health policies in the implementation's geography that influence the primary topics of interest (e.g., social need screening and referral)?
    - How do these policies affect the partners and health ecosystem in the implementation community?
    - Do these policies support or conflict with goals of CODI implementation?
- What are the Community Data Provider (e.g., CBO) social services related to the primary topics of interest?
    - What and how many individuals and communities do these programs and services reach?
    - What are the primary workflows for those programs and services?
    - What data elements are documented about enrollment and delivery of these programs and services?
- What data sharing work has already happened between CBOs, HIE, healthcare providers, and others?
- How would CBOs like to improve data collection, data sharing and reporting workflows and capabilities?
    - What are the known challenges?
    - What outcomes related to the primary topics are of interest?
    - What efforts (e.g., projects or policy changes) to optimize workflows related to the primary topics of interest have occurred?
    - Are there any learnings that are applicable to CODI?

- What other partners in the implementation geography may be interested in the work of a CODI implementation and are important to engage with?
- What are the partnership dynamics between CBOs, HIE, healthcare providers, and others in the implementation geography?
    - How might these dynamics impact a CODI implementation?
- What technical infrastructure and data flows currently exists for data sharing between the partner CBOs and the HIE?
- What governance currently exists to facilitate data sharing and use between CBOs and the HIE?

B.2 Use Case Prioritization and Selection Criteria

The following criteria can help implementers develop, prioritize, and select use cases that will result in a successful and valuable CODI implementation. The criteria described should be modified to meet local needs.

1. **Reach**: How many individuals do program(s) or service(s) applicable to this use case reach?
    - Implementers should establish a minimum threshold in order for program(s) and services(s) to be considered (e.g., 50 individuals per year)
    - Larger numbers better justify resources required to connect data
    - Small numbers may result in privacy issues when computing outcome measures due to loss of people after linkage and application of exclusion criteria
2. **Available:** Are data about people receiving the program(s) or service(s) applicable to this use case collected at the person level in an information system (e.g., electronically)?
    - Program(s) and services(s) without electronically captured data should be excluded.
    - The HIE should share which electronic formats are acceptable (e.g., .csv, JSON) with the understanding that many CBOs do not have the ability to exchange information through APIs.
    - Information captured at an aggregate level does not allow for linkage
3. **Linkable:** Are there sufficient identifiers recorded about people reached by applicable program(s) or service(s) to link with clinical data?
    - Program(s) and services(s) without linkable data should be excluded.
    - The HIE should establish minimum data needed for linkage. This often includes first name, last name, date of birth, address, phone number. Program(s) and services(s) without linkable data should be excluded.
4. **Standard:** Are program(s) or service(s) applicable to this use case provided and documented in a standard way?
    - Program(s) and services(s) without established eligibility, assessment, enrollment, delivery, and documentation practices will likely have poor data quality. Inclusion of program(s) and services(s) without these standards should be by exception only (e.g., process will be fixed by start of implementation).

5. **Value Proposition:** What and how much value results for each implementing partner by addressing this use case?
    - It is important to select a use case that provides some value to all partners. Use cases with no to little value for one or more organizations should not be selected. Perceived value is important to maintain the commitment from organizations and champions required for a successful implementation.
6. **Extensibility and Generalizability:** Is this use case relevant to other CBOs in the HIE's service area? Are the components of the solution translatable to other initiatives?
    - Extensibility and generalizability are not required but can increase the value proposition of a use case

Appendix C Planning Phase Supporting Resources

This appendix includes resources and guidance to support the Planning Phase of a CODI implementation. Examples for an approach for a CODI implementation, defining outcome measure work, and workstreams are included below.

C.1 Example Approach to Sharing, Connecting, and Using Data

Informed by a comprehensive needs assessment, the CODI Maryland pilot design (Figure **C-1**) presents a technical approach for sharing social needs and services data, connecting that data with clinical records, and computing outcomes that is centered around CRISP, Maryland's HIE. In this model, CBOs provide social needs and services data to the HIE, the HIE processes and links the CBO data with clinical data already stored by the HIE, computes outcomes, and provides tools to visualize the impact of social services. This HIE-centered model leverages existing HIE infrastructure to reduce technology redundancy and limit long-term maintenance and cost to partners.

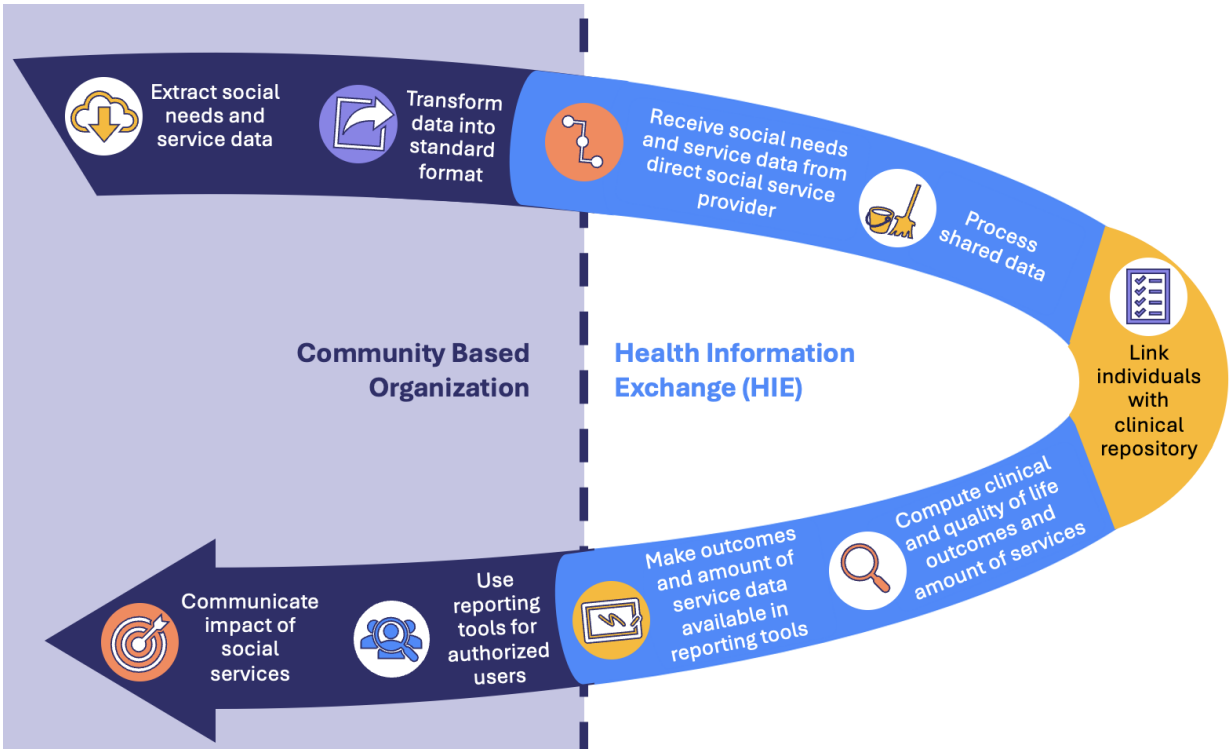

Figure C-1. CODI Maryland Pilot Design

Creating a single figure that visually depicted the flow of data and core activities that comprise the CODI solution is recommended. This graphic was the most useful resource in explaining how CODI in Maryland would work.

C.2 Identify Outcome Measures for Inclusion

C.2.1 Identify relevant outcome measure categories and prioritize based on value and feasibility

The first step is to identify and prioritize outcome measure categories. The following process may be modified as needed:

- Conduct a literature scan to identify outcome measure categories that are relevant to implementation use cases. Example categories for food insecurity use cases are hospitalization, quality of life, diabetes, weight, and hypertension. Some categories like hospitalization are relevant to many use cases while others like hypertension outcomes may not be applicable to all use cases, like transportation insecurity.
- Present outcome measure categories to implementing partners and solicit additional categories for inclusion (e.g., CBOs in Maryland added quality of life measures in this step)
- Define criteria to prioritize outcome measure categories. Criteria can consider:
    - Proposed value of each outcome measure category and type in demonstrating impact of programs and services *on populations served* (e.g., improvement in clinical outcomes, reduction in hospitalization rate)
    - Proposed value of each outcome measure category and type in *communicating impact of programs and services to key stakeholders* (e.g., funders, leadership, community partners)
- Distribute prioritization criteria and list of outcome measure categories to implementing partners for feedback on highest priority outcome measure categories. In addition to relative ranking, collect observations from implementation partners about feasibility, existing measures, and specific measures of interest. Feedback should explore:
    - Relative ranking of outcome measures for each prioritization criteria (e.g., from most to least valuable)
    - Availability of clinical data for that category Concerns with feasibility of calculating measures in the outcome measure category
        - The HIE should identify categories where data are not likely sufficient to compute outcome measures to remove them from consideration
    - Specific measures within each category that are of interest to each partner organization (e.g., for clinical outcome measure/chronic disease management, readmission frequency)
- Collate prioritization rankings and feedback
- Rank outcome measure categories in terms of value, interest by more than one partner, and feasibility and present rankings to implementing partners
- Select outcome measure categories for further exploration. The number of categories that advance to the next step is determined by the implementing partners. In Maryland, three categories were selected.

C.2.2 Identify candidate outcome measures of interest

The next step is to identify candidate outcome measures within the selected outcome measure categories. Outcome measure categories may have one or many measures. For the category of diabetes, example measures are diabetes prevalence and diabetes control. Outcome measures should maintain relevance to project use cases.

For some use cases, there will be outcome measures that are considered gold-standard whereas other use cases may only have emerging outcome measures for consideration. Implementers can identify outcome measures by conducting a literature scan, reviewing outcome measures used in other health initiatives like state health improvement plans, common measure sets, and clinical quality measures. Outcome measures may also be referred to as indicators.

Candidate outcome measures should be inventoried with measure name, description, and examples of how those measures were constructed and used.

C.2.3 Evaluate if those outcome measures are already available or have been created from previous CODI implementations

The candidate outcome measure inventory is compared with existing outcome measure definitions to determine if selecting that outcome measure means creating a new measure definition. This step is important because developing a new measure definition is a much higher level of effort than implementing an existing measure definition.

The measure definitions developed during previous CODI implementations include:

- Dose of Services Measure Definition
- Diabetes Prevalence Outcome Measure Definition
- Diabetes Control Outcome Measure Definition
- Hypertension Prevalence Measure Definition
- Hypertension Control Measure Definition

Existing CODI outcome measures can be selected for implementation but do not require new development. The HIE can confirm which of the candidate outcome measures have already been developed and implemented in their environment (e.g., readmission).

C.2.4 Rank candidate outcome measures for implementation

Present candidate outcome measures to implementing partners and discuss each measure's value in the implementation. Consider the following:

- **Dose/Response relationship**: How likely are selected programs or services to impact this outcome measure?
- **Reach**: How many individuals receiving selected programs or services would be included in this measure? Are the numbers sufficient to meet data reporting guidelines (are data likely to suppressed)?
- **Feasibility**: Are data available to calculate the outcomes of interest? Does the HIE have sufficient quality and quantity of data to compute the outcome? How difficult will it be to extract the data needed and perform the computation for this measure? If suitable

outcome measure definitions for the use case do not exist, are resources available to design an outcome measure definition?

- **Value**: How valuable will this measure be to share with my stakeholders (e.g., primary care providers, hospitals, state agencies, funders)? Do existing outcome measures (like some electronic clinical quality measures) have too many exclusions to be valuable to CBOs? Are these outcome measures of interest to other community partners?

Based on discussion, rank order outcome measures for development and implementation, removing outcome measures that already exist at the HIE and those that should not be developed because that measure is too difficult to build or offers little value. Outcome measures ranked highest will be developed first and those with the lowest rank will be developed last or not at all, depending on time and resources.

C.2.5 Categorize ranked outcome measures for implementation

Assign ranked outcome measures for adoption, adaptation, or development. Any outcome measures whose implementation is not feasible during the implementation period should not be selected. The HIE is the organization that will ultimately implement outcome measure(s). The three implementation approaches include:

- **Adopt**: Existing CODI outcome measures that have already been developed and will be implemented by the HIE. This is the least resource and time intensive option.
- **Adapt**: Established outcome measures that have been defined for a similar purpose but require some modification before they are implemented by the HIE. Example modifications may include modifying the inclusion or exclusion criteria to better meet CBO reporting needs.
- **Develop**: New outcome measure(s), for which no relevant definition exists, will be developed, validated, and implemented by the HIE. This is the most resource and time intensive option. Measure definition development can take 3-6 months.

The box below includes related lessons learned from prior CODI implementations for consideration.

LESSONS LEARNED 5: Communicating Impact

- Balance CBO user needs and practical HIE application when designing outcome measures to evaluate CBO programs and services.
- Confirm HIE data availability with each outcome measure design decision to ensure that outcome measures can be successfully built and meaningfully deployed.
- Exercise caution when combining data across similar programs or services provided by different organizations to ensure clarity of resulting inferences.

C.3 Example Workstreams for CODI Implementation

The following sections describe five workstreams of a CODI implementation, the goal of each, and the supporting resources available. Implementers should include each of the following workstreams but the details of the work depend on the local process to connect data (Section 4.1, Appendix C.1) and implementing partners' infrastructure, capabilities, and resources. The implementation plan should also identify responsibility for each workstream, deliverables, and

key milestones. Lead organizations are suggested for each step, but the work may be completed by different partners based on best fit for the planned implementation.

C.3.1 Data Model Workstream

Goal: Apply CODI Data Model to support local data sharing approach

Description: This workstream includes translating the CODI Data Model to fit the HIE environment, establishing a standard format, and providing guidance for data exchange to Community Data Providers (e.g., CBOs) (Table C-1). This work also includes defining the data elements necessary to support the implementation use cases and calculate the selected outcome measures. While the HIE is translating the CODI Data Model, CBOs can map their data attributes to the CODI Data Model to preliminarily identify any missing concepts. Based on these findings, CBOs may identify gaps and modify their data collection practices as needed to improve data sharing.

Table C-1. Data Model Workstream: Example Activity and Steps

Activity	Key Steps
Translate the CODI data model to develop local data sharing approach	• Implementing partners define data elements necessary to support use cases • HIE translates CODI data model to HIE environment • HIE defines data attributes and standard format and provides guidance for data extraction • CBOs map relevant data attributes to CODI data model to identify missing concepts • CBOs identifies gaps and modifies data collection practices, if needed

Each CODI implementation requires a data model that is a consensus structure and format to store and exchange data. Implementers may choose if they want to use the CODI Data Model exactly, select parts of the CODI Data Model to adopt, or develop their own data model entirely. If using the CODI Data Model, the data dictionary is the technical specification. If adopting aspects of the CODI Data Model or using it for inspiration, the data dictionary provides a source describing the potential attributes and value sets needed.

Available Resources: The following resources were developed during the Maryland CODI implementation and should be reviewed to determine how they can be used to support this workstream:

- Data Model Data Dictionary
- Data Model Implementation Guide
- Structured Data Extract Mapping Tool
- Maryland Community-Based Organization Data Sharing Implementation Guidance
- Best Practices for Community-Based Organizations in Collecting and Storing Data

C.3.2 Data Sharing Workstream

Goal: Share data between Community Data Providers (e.g., CBOs) and HIE

Description: This workstream includes extracting and standardizing social service data from CBO information systems, then testing and refining the process of sharing this data with a HIE to ensure quality and compatibility (Table C-2). After iterative feedback cycles, the process transitions to recurring, production-level data sharing processes, with ongoing improvements to data quality and procedures. The HIE and CBOs should share lessons learned with each other throughout the process.

Table C-2. Data Sharing Workstream: Example Activities and Steps

Activity	Key Steps
1. Extract and normalize social service data from CBOs	• CBOs define parameters of data extract including information system, time period, and any inclusion or exclusion criteria • CBOs extract data from information systems • CBOs normalize data to CODI Data Model format and apply value sets
2. Initiate and refine social service data sharing with the HIE	• CBOs generate test file • CBOs examine missingness and data quality of identifiers and other key data elements like dates • CBOs address data quality issues • CBOs generate improved test files and sends to HIE • HIE validates test files conform with requirements and provides feedback to CBOs • CBOs refine test files as necessary and sends to HIE • HIE links test data to clinical data and examines match rate
3. Transition to recurring data sharing process	• HIE builds data pipeline • HIE creates user support materials • HIE deploys data pipeline to production • CBO establishes recurring monthly data extraction and transmission process • CBO initiates recurring data extraction and transmission • Implementing partners identify opportunities to improve data quality and procedures

Available Resources: The following resources were developed during the Maryland CODI implementation and should be reviewed to determine how they can be used to support this workstream:

- Structured Data Extract Quality Assurance Script
- Structured Data Extract Sample Data #1: Nutrition and Care Transition Programs
- Structured Data Extract Sample Data #2: Evidence-Based Programs

- DETERMINE Your Nutritional Risk Checklist FHIR-formatted Questionnaire
- Expanded Food Security Screener FHIR-formatted Questionnaire

C.3.3 Outcome Measures Workstream Example

Goal: Implement outcome measures to assess impact

Description: The workstream involves the HIE developing and implementing outcome measures to enable CBOs to communicate impact of their social services (Table C-3). If needed, new or adapted outcome measure definitions are developed, drawing on best practices and aligning with existing standards where possible. Finally, the measures are tested, finalized, and implemented by the HIE, with CBOs determining how they will use the results in practice.

Table C-3. Outcome Measure Workstream: Example Activities and Steps

Activities	Key Steps
1. Finalize list of outcome measures for implementation	• HIE reviews list of prioritized outcome measures of interest to validate which outcome measures must be adapted and developed • CBOs share how they intend to use outcome measures to inform development approach • For existing outcome measures partners plan to adopt, HIE confirms data quality and application in CODI is appropriate and feasible.
2. Adapt or design outcome measure definition(s) (if needed)	• HIE convenes a team to develop outcome measure definition(s) for implementation • HIE determines how many metrics are needed to measure each outcome • HIE conducts a literature review to identify how similar metrics are designed • HIE drafts measure and metric specification(s), aligning with validated measure definition(s) from the literature when possible • HIE confirms data quality and fidelity sufficient to compute outcome measure(s) • HIE revises and finalizes measure definition(s)
3. Implement outcome measures	• HIE tests measure definition with linked data and addresses any issues • HIE deploys measure definition for use

Available Resources: The following resources were developed during the Maryland CODI implementation and should be reviewed to determine how they can be used to support this workstream:

- Dose of Services Measure Definition
- Diabetes Prevalence Outcome Measure Definition
- Diabetes Control Outcome Measure Definition

- Hypertension Prevalence Measure Definition
- Hypertension Control Measure Definition

C.3.4 Reporting Tools Workstream Example

Goal: Measure the impact of social services on selected health outcomes

Description: This workstream includes using combined clinical and community data to communicate value of social services provided by the Community Data Provider (e.g., CBO) (Table C-4).

Table C-4. Reporting Tools Workstream: Example Activities and Steps

Activity	Key Steps
1. Develop reporting tools	• HIE collects user requirements • HIE determines technology platform to present reports • HIE develops reporting tools to make outcomes and other data of interest available to CBOs • HIE tests reporting tools with users • HIE develops reporting tool user guides
2. Deploy data use tools to production	• HIE deploys reporting tools in production to authorized users • HIE offers training and supports • HIE notifies CBOs that reports are available • HIE grants authorized users access
3. Communicate impact of social services	• CBOs use reporting tools to evaluate outcomes and communicate impacts

Available Resources: The following resources were developed during the Maryland CODI implementation and should be reviewed to determine how they can be used to support this workstream:

- Reporting Tool Wireframes and Requirements

C.3.5 Project Management Workstream Example

Goal: Support successful implementation of the workplan

Description: This workstream includes work to support implementation of the workplan by monitoring progress, managing and mitigating risk, managing contracts (if applicable), and communicating with partners (Table C-5). These tasks are fulfilled by the Project Steward.

Table C-5. Project Management Workstream: Example Activities and Steps

Activity	Key Steps
1. Monitor progress	• Project Steward tracks progress against milestones and works with partners to identify and remove blockers to progress • Project Steward updates implementation plan • Project Steward manages funding and contracts (if applicable)
2. Risk management	• Project Steward identifies and mitigates risks
3. Communicate with partners	• Project Steward schedules workgroup meetings • Project Steward sets workgroup meeting agendas, prepares and distributes meeting materials, and facilitates workgroup • Project Steward share key updates with partners