

## Using Systems Thinking Tools to Improve Maternal Health

*Leigh Alderman, JD, MPH, DrPHc, Jimmy Dills, MUP MPH*

*Georgia Health Policy Center, Andrew Young School of Policy Studies, Georgia State University*

*Amy Mullenix, MSPH, MSW*

*Maternal Health Learning & Innovation Center, University of North Carolina at Chapel Hill*

### Learning Goals:

- Describe the value of a systems thinking approach and related tools to promote maternal health and equity
- Identify a variety of system thinking tools, including their varied purposes, strengths, and weaknesses

### Summary of Recommended Approaches:

- **Be clear on the purpose.** Systems thinking tools have many potential purposes in maternal health initiatives, and conveners/facilitators should be clear on their goals before selecting a systems thinking tool or method.
- **Start simple.** While there are many types of systems tools of varying levels of complexity, starting with the simplest tools available is usually best.
- **Build over time.** The iceberg tool offered in this brief is accessible to all, with minimal instruction. If

the group wants to keep going with systems tools, many types of system maps can be built to visualize various aspects of maternal health systems.

- **Leverage your networks.** Many maternal health initiatives bring together diverse stakeholders to consider how to tackle a multi-faceted challenge in communities.
- **Access web-based resources to learn more.** A variety of organizations curate materials and tools to support systems thinking for the maternal health workforce and others.
- **Get support.** Many universities have faculty and staff who are well-versed in systems thinking and are sometimes searching for complex community initiatives to support with systems methods; in many cases they do not charge for their services. Reach out to colleges with programs in public health, public policy, leadership or business to see if there are local systems thinking experts in your area.

## Background

According to a recent [report](#) from the Centers for Disease Control and Prevention (CDC), maternal mortality rates and maternal health inequities increased significantly between 1999 and 2021. In a similar review of pregnancy-related deaths, over 80% were determined to be preventable.<sup>1</sup> Evidence points to recent policies that limit reproductive rights as having significantly and inequitably increased maternal and infant death rates in states that have implemented such policies.<sup>2</sup>

As many work to address these challenges, they must traverse its myriad -- and interrelated -- influences (or structures and structural elements), including a complex set of risk factors (e.g., individual, community, governmental), and systems (e.g., health care, transportation, housing), while building a common agenda across a multitude of outcomes that are often measured and addressed in traditional siloed structures.<sup>3,4</sup> These structural risk factors and systems “work” together, often invisibly, to produce better or worse outcomes. Notably, the inequitable distribution of policies among groups that have been historically marginalized can lead to persistently poor and inequitable maternal and child health (MCH) outcomes.

Given these complexities, poor and inequitable health in maternal and child populations is a “wicked problem” as it crosses more than one system, lacks linear cause-effect relationships, and there are not readily knowable and scalable solutions<sup>5,6</sup>. “Wicked problems” is a term used to describe the most complex and seemingly intractable challenges we face, many of which harm human health<sup>7</sup> and require collaborative learning from multiple perspectives to co-create new knowledge, and integrated, innovative strategies.<sup>6,8,9,10</sup> This complexity can be overwhelming, and leaves many without a roadmap of where and how to begin. This brief is intended to provide one possible approach to help build this critical roadmap: systems thinking.

Systems thinking acknowledges that the trends we want to improve are produced and perpetuated through often invisible relationships.<sup>3,11</sup> Systems thinking helps make these interactions more visible, including helping surface elements such as the often-implicit mental models or mindsets of those who create, influence, and reinforce the policies and structures underlying the system(s) that produce the outcomes we must improve (e.g., inequitable maternal death rates).<sup>3,12</sup> Mental models are the overall concepts and frameworks individuals and cultures develop for how we view the world, which can unconsciously influence how we approach problems and make decisions. An example of a relevant mental model is implicit biases that influence how providers view and treat people of color, or people who are impoverished. By making mental models more explicit, systems thinking can help groups reframe their work by focusing more on the systemic and structural root causes of poor and beneficial health outcomes, rather than on individuals or specific populations, and allow more intentional redesign of existing systems.<sup>11</sup>

In this regard, systems thinking principles and tools are used by diverse groups of partners to collectively learn and build a shared understanding of a wicked issue across system and structure boundaries, views, and values.<sup>11</sup> This approach is needed because a variety of factors often work together to increase risks of poor and inequitable health outcomes. For example, people who are pregnant can face myriad challenges to access quality care – some of which are within the health care system and others fall within other systems, such as: a dearth of readily available and culturally appropriate providers, a failure to educate patients on symptoms requiring immediate care, a lack of reliable and affordable transportation options, and jobs that do not offer paid time off. Each of these on their own are problematic, but together, can compound the risk of inequitable health outcomes for maternal populations, and solving one may be important but insufficient on their own to make the meaningful difference needed.

To match the complexity and variety of these risk factors, relevant partners can use systems thinking to surface and better understand these and other myriad factors, including how they may work together to compound challenges. Partners using this approach can collectively build a shared and more informed and integrated picture and definition of the issue and broaden solutions available to solve it. This collective, systems-wide approach also helps identify potential unintended outcomes of proposed solutions to help groups account for or mitigate any potential negative side effects of proposed solutions.<sup>3,11</sup> Importantly, this approach can help move partners away from individual blame and individual-level interventions to focus on more holistic, shared, systems-level interventions that address the root cause(s) of the issue at hand.

Developing this shared understanding of poor maternal health outcomes and inequities is a critical first step to co-creating high leverage strategies to get to the root cause(s) of the problem rather than continuing to focus on and react solely on the outcomes we see (e.g., a maternal death, or near miss). Fortunately, everyone can engage in at least some level of systems thinking given the variety of approaches available, each with varying degrees of expert facilitation needs – from none to significant. As described in more detail below, these include, in order of the level of expert assistance from none to significant: the “iceberg” tool, system support maps, causal loop diagrams (CLDs), and simulated computer dynamic systems.

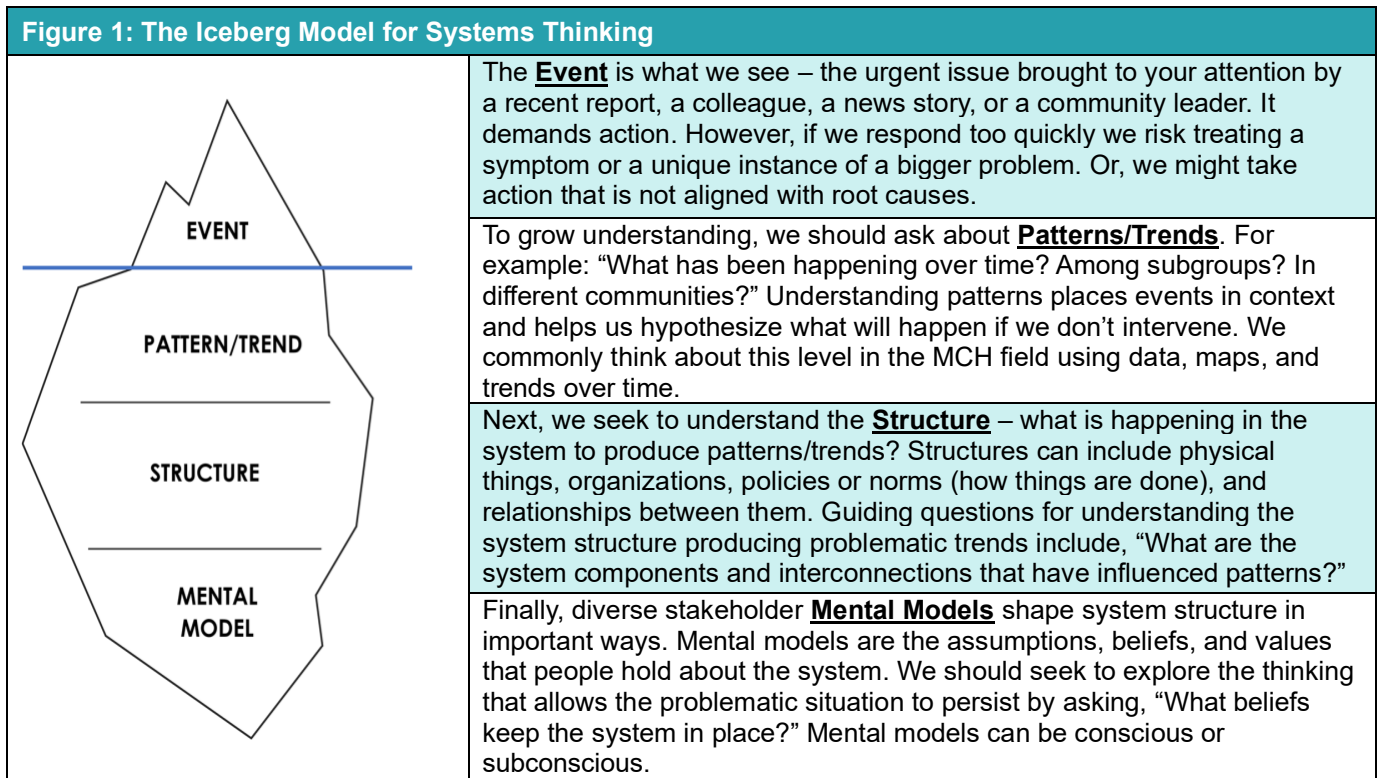
## Samples of Systems Thinking Tools

### Basic: Facilitate a Systems Thinking Mindset

Facilitating a systems thinking mindset requires limited resources and technical knowledge. People working to improve maternal health at a population level can facilitate a systems orientation to their efforts by asking the ‘right questions.’ Several tools exist that can help achieve that end.<sup>13,14</sup>

The systems iceberg is a common approach to initiate systems thinking in the context of complex challenges. This tool is particularly effective in helping people with different perspectives come together to surface collective understanding of a system structure and identify impactful action opportunities.

In a review of systems dynamics modeling in MCH from 2022, Guynn and colleagues cite one particularly useful iteration of the iceberg as a common foundational model for systems thinking.<sup>3</sup> That iteration is adapted below in **Figure 1**, along with language used to engage audiences in discussions about each layer, guiding them toward deeper understanding of the system.

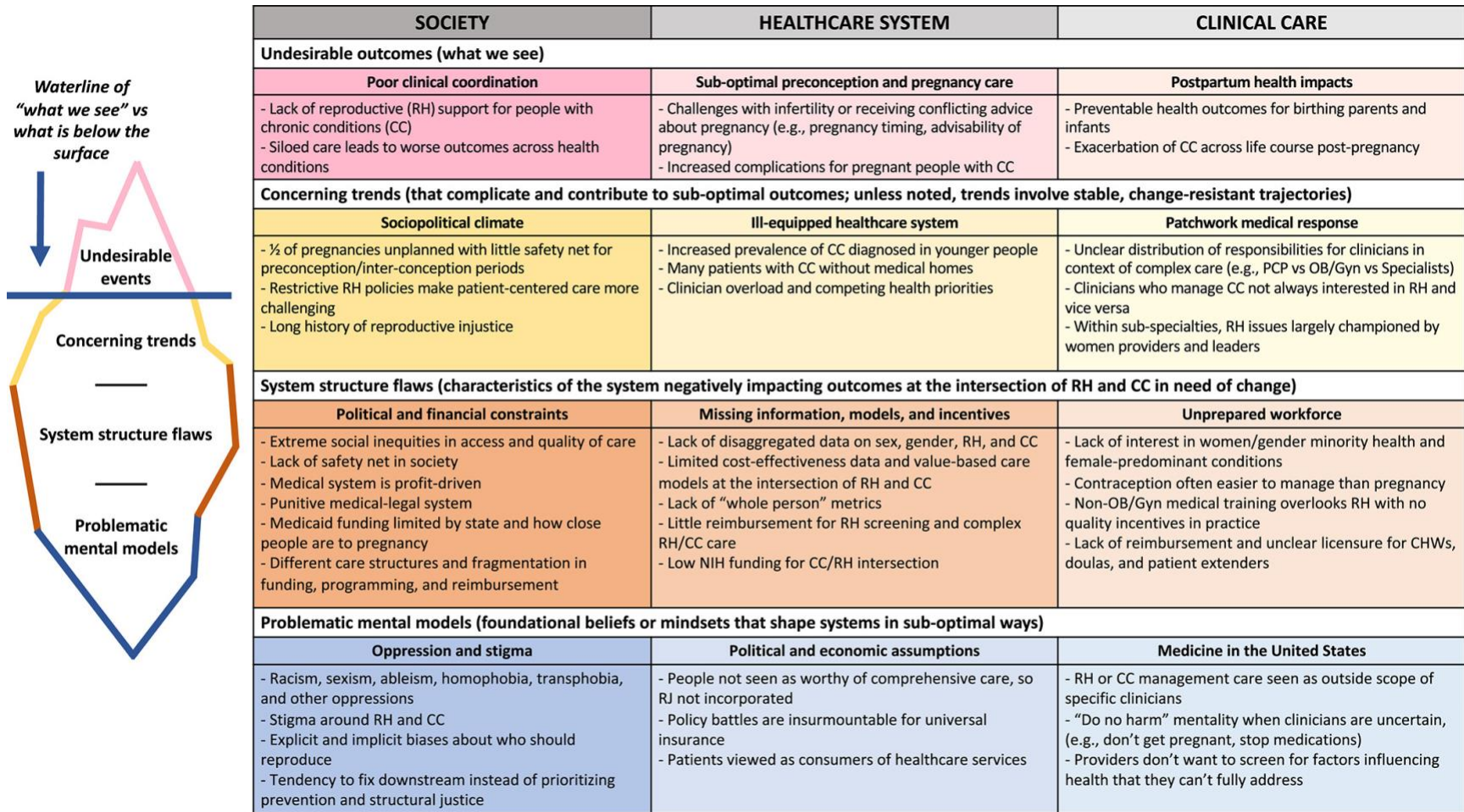


Using the iceberg model as a facilitation tool requires little training and can be an effective way to help groups working on a common challenge see different points of view on the complex system underpinning that challenge. It also helps participants better understand the types of actions needed to react to events, anticipate patterns or trends, design structural elements that lead to those patterns of behavior, and transform mindsets or mental models that may be impeding progress. Using the iceberg or other tools for facilitating a systems thinking mindset can lead to system mapping activities that further grow collective understanding of a challenge.

### Example of Iceberg Applied to Maternal Health Issues

Research published in 2023 by Smith and colleagues used the iceberg model to examine reproductive health among birthing persons with chronic conditions.<sup>15</sup> Building on awareness of the complexity of navigating health systems for this population, the research team identified the iceberg as a suitable approach to “draw out and synthesize the expertise of groups and individuals directly involved in caring, advocating, and paying for the care of this population to understand and identify changes needed to improve outcomes for women, birthing people, children, and families.” **Figure 2** below is reproduced from their research and demonstrates how the four levels of structural depth framed by the iceberg model can be used to identify targets for action across multiple perspectives.

**Figure 2: Using the Iceberg to Organize Perspectives on Reproductive Health Care for Birthing People with Chronic Disease (Smith et al, 2023)**



### Intermediate: Map Relationships within Systems for Greater Understanding

With more comfort on systems thinking and systems tools, or some helpful facilitation, groups can advance towards co-building system maps to illuminate the broader system and interdependent elements at play that are producing the outcomes of interest. These maps can help groups identify potential places to intervene in the system to change the structure in order to produce the desired outcomes, while anticipating and mitigating potential negative unintended outcomes from the intervention.

System Support Maps (SSM) offer one particularly relevant approach for understanding how individual roles are supported by others in an interconnected system, often revealing insights on specific needs for team-building and work-planning. **Figure 3**<sup>16</sup> shows how this mapping tool guides a user to focus on a specific role within a system, the corresponding responsibilities of that role, the needs for meeting each responsibility, the resources used to support needs, and wishes for being better supported. Critical to the effectiveness of SSM is the subsequent collective discussion of maps for different roles. These conversations can often reveal opportunities for strengthening connections between roles that may initially seem disparate. Using a mapping approach like SSM can further nurture systems thinking mindsets and contribute to more involved system modeling that begins to consider implications of different courses of action, emphasizing the dynamic aspects of complex systems.

**Figure 3: Excerpts from a System Support Mapping Facilitation Guide**

	<p>Write a short description of your <b>Role</b> in the system of focus on a sticky note and place it in the center of your map.  <i>Example: Role of Title X Program Manager</i></p>
	<p>Think about the <b>Responsibilities</b> of your Role in the system of focus. Write each Responsibility on separate sticky notes using the color designated for this circle. Place these notes around the second ring. Draw arrows from your Role to each Responsibility.  <i>Example: Responsibilities for the Title X Program Manager include identifying a list of required trainings; setting up training list in Family Planning National Training Center Training Tracking System; informing subrecipients of training requirements; training them to use Training Tracking System; monitoring training completion quarterly; and following up with subrecipients.</i></p>
	<p>Consider what <b>Needs</b> arise from each identified Responsibility. Write each Need on a separate sticky note using the color designated for this circle. Draw arrows that link each Responsibility to each corresponding Need.  <i>Example: A Need for setting up training for subrecipient staff is to have up-to-date training materials for all of the Title X training requirements as listed in the Program Requirements.</i></p>
	<p>Consider any <b>Resources</b> you have utilized, whether or not they have helped, to address each Need. Write each Resource on a separate sticky note using the color designated for this circle. Place each Resource note close to the Need(s) that it addresses.  <i>Example: The Title X Program Manager relies heavily on the training materials from the Family Planning National Training Center (FPNTC), as well as on internal training resources, for meeting the training needs of subrecipient staff.</i></p>
	<p>Consider your top three <b>Wishes</b> for this role that would aid you in meeting your Responsibilities. Write your three Wishes on separate sticky notes using the designated color. In the area outside of the rings, place the notes with your Wishes. Draw an arrow from each of these Wishes to a corresponding Responsibility, Need, or Resource in your map.  <i>Example: A wish of the Title X Program Manager is for providers to apply the skills of available training to make effective referrals.</i></p>

## Example of System Support Mapping with Members of the Maternal & Child Health Workforce

In research published in 2020, Calancie and colleagues focus on the use of SSM with representatives of the MCH workforce.<sup>17</sup> The research team examined SSM maps from 34 state- and local-level Title V professionals, identified common responses, and coded the information for analysis. Table 1 from that research is adapted below as **Figure 4** to demonstrate the richness of information contained across those maps. Based on their analysis the authors elevated the following two implications for policy and practice:

- SSMs provide a “language” for the multiple actors and “moving parts” that comprise the complex systems that Title V–funded MCH professionals and their partners are constantly navigating.
- Public health leaders could use SSMs systematically to examine the allocation of resources to both local- and state-level MCH professionals. Regular use of SSMs by state health systems can ensure that professionals in the entire Title V–funded MCH workforce are being supported in ways that best align with actual roles, responsibilities, needs, and current gaps.”<sup>17</sup>

**Figure 4: Example Information from Qualitative Analysis of System Support Maps for Multiple MCH Workforce Roles (Adapted from Calancie et al 2020)**

Response Category (i.e. Qualitative Code)	Example Participant Response	Summary of Participant Responses from SSM Assigned to Category
<b>Roles</b>		
State	Title V coordinator, CYSHCN director	Public health leaders, program coordinators
Local	Services coordinator, navigator of community systems, county division director	Coordinators, program managers, outreach workers, health workers
<b>Responsibilities</b>		
Link to or provide care or resources	Find resources for families in need (state) Make referrals (local)	Identify resources and organizations in communities; communicate, link, or refer families to those resources; enroll eligible program participants
System management	Convene meetings (local) Contract oversight (state) Oversee Title V program (state)	Supervise staff; coordinate grant applications and programs; convene meetings and facilitate communication; budget, contract, and resource oversight
Mobilize community and organizational partnerships	Engage partners (in and out of agency) (local) Convene stakeholders (state)	Identify and work with partners; coalition building; engage stakeholders
<b>Needs</b>		
Coordination and partnerships with another agency or group	Foster ongoing partnership with Medicaid team to allow for continued communications (state)	Need engagement, support, information, buy-in, and input from partners; Build collective impact approach; Opportunities to network
	Create a network with agencies where mutual services–provided families are optimally coordinated (local)	
Access to and information from stakeholders	Work with communities to do a needs assessment (state)	Input from families, consumers, and CYSHCN populations to better understand their needs, challenges, and feedback
Funding and financial resources	Funding for staff time, training, travel, and equipment Government support for incentives to recruit and retain providers (local)	Funding for staff time, travel, equipment, and specific projects or programs; adequate and stable funding; money
<b>Resources</b>		
Stakeholder or community input, support, or engagement	Community partners (state and local) Parent partners (state)	Community and parent partners; working groups; coalitions
Data or information	EHRs (local)	Information about existing programs; national health surveys; electronic health records; web sites; staff knowledge

Wishes		
Funding or resources	Access to scholarship programs offering financial assistance to families with special needs children that help with copays, therapies, transportation, and equipment (local)	Additional funding for specific initiatives, including professional development, projects, and community resources; noncategorical funding; electronic forms that replace paperwork; updated software
Political will	Political will to make MCH issues a priority (state)	Political will to prioritize MCH and children and youth with special health care needs' issues
Target population is informed and supported	Make sure that families are getting the help they need for their children (local)	Families have access to information they need; youth will transition to adult health care system; workforce and provider capacity

### Advanced: Model Systems to Understand Dynamics and Invest in Decision Support

The modeling of dynamic systems requires significant investment of human, financial, and informational resources. The process of building a useful model will often include system thinking and mapping approaches as part of a comprehensive process; the potential insights offered by these approaches may obviate the need for a comprehensive quantitative systems model, depending on the context and intended use. When justified, dynamic system models can be powerful tools to analyze different potential decisions and courses of action.

The review of system dynamics in MCH from Guynn et al (2022), notes three main approaches to models: qualitative diagrams, concept models, and tested/analyzed models.<sup>3</sup> They note the following distinctions between the three:

- *Qualitative diagrams* are developed, often with stakeholders, to better understand complex, problematic trends that need to change. They facilitate conversations among diverse stakeholders by providing a tangible language for understanding structures and mental models surrounding persistent challenges.
- *Concept models* build upon qualitative diagrams by introducing preliminary (often hypothetical) numbers as model parameters and inputs. The model is then used to test hypotheses and explore the impact of system feedback on outcomes of interest.
- *Tested/analyzed models* model parameters that are calibrated, often using historical data, until users feel confident in the model's validity; from there, future trends and evidence can be generated using simulation modeling to test hypotheses, inform decision-making, and holistically study complex challenges.

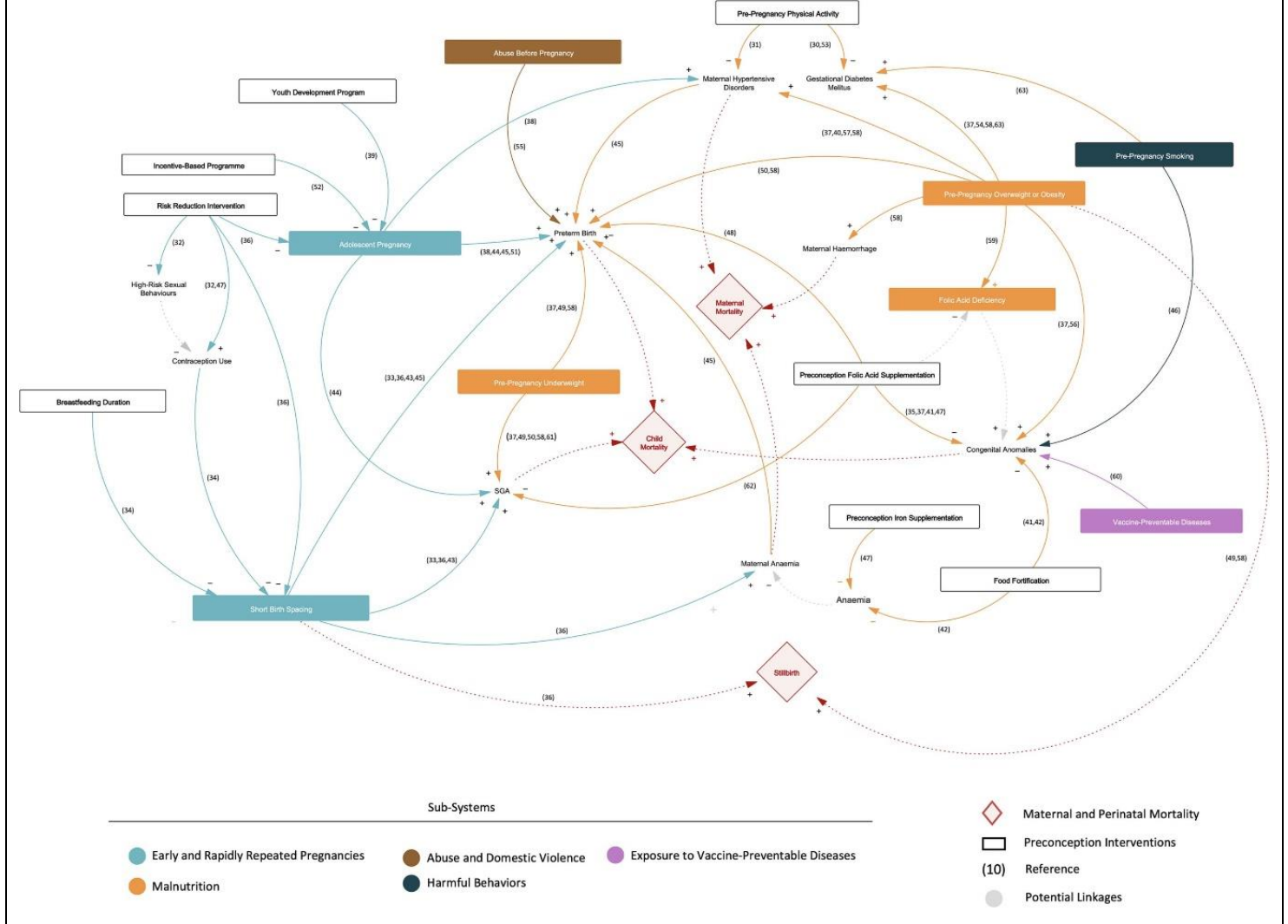
### Example of a Conceptual Model for Preconception Care using Causal Loop Diagramming

Pox and Elmusharaf published research in 2023 that demonstrates the use of Causal Loop Diagramming (CLD) in the context of preconception care.<sup>18</sup> Their CLD was informed by a scoping review of meta-analyses and summarizes evidence on the outcomes and interventions related to eight preconception risk factors. The reproduction of their model as **Figure 5** illustrates how a CLD enabled description of the interplay of pathways linking preconception interventions to maternal, perinatal and child mortality. Further, it helps show the potential of comprehensive strategies that address multiple risk factors simultaneously. It is also a tool to advocate for better integration of preconception care within strategies to prevent maternal and child mortality. For a higher resolution version of this CLD please access the original research article here:

<https://doi.org/10.1016/j.pmedr.2023.102274>.



**Figure 5: Conceptual Model of Preconception Care using Causal Loop Diagramming from Poix & Elmusharaf (2023)**



### Recommended Approaches to Supporting Systems Thinking

In short, there are many systems approaches and tools that can help maternal health professionals and partners “get below the water line” of the iceberg and begin to understand, articulate, and communicate what often remains murky or unknown in the complex world of maternal health outcomes. Systems thinking tools have many potential purposes in maternal health initiatives, and conveners/facilitators should be clear on their goals before selecting a systems thinking tool or method. When using systems thinking tools, keep the following suggestions in mind:

1. **Be clear on the purpose before choosing a tool.** Some goals of systems thinking tools are to:
  - a. Get everyone on the same page: When everyone is clear about the big “end goal,” it’s easier to determine how individual organizations might use their own particular expertise or resources to make change in maternal health outcomes.
  - b. Zoom out: Stepping back in a coordinated way to examine the big picture can help identify gaps, duplication of efforts and identify new partners and resources. Many systems tools produce maps or

- other visual representations of large systems, which can be helpful to rely on as initiatives move forward.
- c. **Prevent unintended consequences:** Examining how all the parts of a system (or several potential intervention ideas) are connected to one another often leads to better decisions than considering all potential choices in a vacuum.
  - d. **Align resources:** In maternal health there are often many initiatives in a single community that lack coordination and synergy. Systems thinking tools can help coordinate efforts, bring stakeholders into alignment and infuse new energy where it may be lacking.
2. **Start simple.** While there are many types of systems tools of varying levels of complexity, starting with the simplest tools available is usually best. This helps groups gain confidence in their ability to use systems thinking in their work and builds trust among group members. More advanced tools can produce more nuanced and detailed models and outputs, but higher levels of facilitation expertise are needed to use more complex tools.
  3. **Build over time.** The iceberg tool is accessible to all, with minimal instruction. If the group wants to keep going with systems tools, many types of system maps can be built to visualize various aspects of maternal health systems. Systems models are the most complex but especially useful for policymakers and others who are focused most on using quantitative data and can help maternal health groups understand potential impacts of various interventions.
  4. **Leverage your networks.** Many maternal health initiatives bring together diverse stakeholders to consider how to tackle this multi-faceted challenge in communities. Diversity of perspectives can sometimes cause conflict, but this is where systems thinking and systems tools can really shine. They can bring order to what might seem like chaotic discussions and ensure everyone's voice is heard and valued. Maternal health professionals often have extensive networks; they build on those relationships and "snowball" to pull together all types of thinkers, professionals, and people with many types of lived experience.
  5. **Access web-based resources to learn more.** The [Georgia Health Policy Center](#) has excellent overview information about systems thinking. For MCH focused tools, the National MCH Workforce Development Center houses several excellent 5-minute overview videos of several systems tools on the [MCH Navigator](#). For a public health-oriented overview of systems thinking, [the CDC](#) has a good introductory webpage and videos.
  6. **Get support.** Many universities have faculty and staff who are well-versed in systems thinking and are sometimes searching for complex community initiatives to support with systems methods; in many cases they do not charge for their services. Reach out to colleges with programs in public health, public policy, leadership or business to see if there are local systems thinking experts in your area. Simple web searches with "systems thinking" plus a local college or university may result in unexpected but fruitful partnerships.

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