

The Partners for Advancing Health Equity Collaborative hosted a three-series workshop sprint on Community Based System Dynamics (CBSD). This brief outlines the foundational concepts of CBSD, with an emphasis on applications to promote health equity.

1

System dynamics approaches, particularly Group Model Building and CBSD, can be useful, participatory methods to address complex health equity issues.

2

Systems thinking tools, including causal loop diagrams and scripts, help to understand relationships within a system and map system dynamics.

3

Facilitating group modeling should involve several key players, each with a specific role, in order to manage ownership of the model and identify and engage partners in the system.

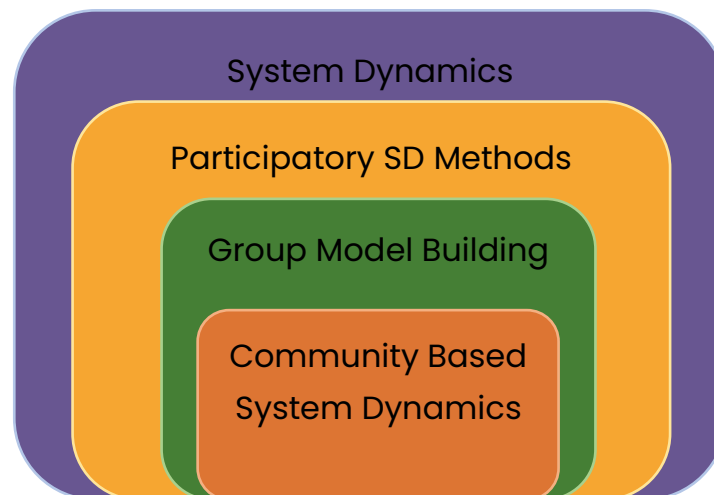
What is Community Based System Dynamics?

Community Based System Dynamics is an innovative participatory approach that integrates the principles of system dynamics with community engagement and participation. System dynamics involves studying the complex interconnections and feedback loops within a system to understand its behavior over time. Through Community Based System Dynamics, community members actively contribute their knowledge, experiences, and perspectives to develop dynamic models that represent the intricate relationships within their community. This collaborative process helps partners visualize the potential outcomes of different interventions and policies, fostering a deeper understanding of the system's dynamics. By promoting a shared learning experience, Community Based System Dynamics empowers communities to address challenges, make informed decisions, and work towards sustainable development in a more inclusive and participatory manner.

How can System Dynamics be used to address complex problems for health inequity?

Session 1 introduced attendees to systems science, system dynamics, and Participatory System Dynamics (SD) approaches, including Group Model Building and Community Based System Dynamics. Learners explored the different approaches and strategies to mapping and modeling systems to understand how they enforce and perpetuate structural marginalization, ultimately leading to inequity.

Layers of System Dynamics Approaches



Overview

1. Systems Science for Health Equity

- Problems of health equity are complex and challenging to solve with linear approaches.
- Systems approaches are excellent tools to unpack complex problems of health inequities.
 - A system is a set of individual elements or things that are interconnected in a way that produces a pattern of behavior over time.
- Mental models help us understand problems and complex systems.

2. System Dynamics

- [System Dynamics](#) is the use of informal maps and formal models with computer simulation to uncover and understand endogenous sources of system behavior.
- System Dynamics approaches seek to understand the feedback system responsible for generating dynamic behavior of complex systems in order to improve our decision-making mental models.

- System Dynamics is useful in equity because structural marginalization is driven by feedback processes that reproduce over time.
- Mental models vary based on an individual's positionality within the system.

3. Participatory System Dynamics (SD) Approaches

- Systems approaches do not automatically emphasize participation.
 - For problems of structural exclusion and marginalization, centering the voices of those with lived experience remains integral to correctly operationalizing the problem.
- [Participatory Systems Dynamics \(SD\) approaches](#) have been developed to expand whose knowledge is represented in models.

4. Participatory System Dynamics (SD) Approaches: Group Model Building

- [Group Model Building](#) is a participatory approach for involving partners in the modeling process to build shared insights, develop consensus, and increase motivation for implementing results.
- [Group Model Building](#) iteratively guides participants' use of system dynamics to create a shared dynamic hypothesis of a complex problem represented through system maps and/or models.
- Tools of Group Model Building include modeling, facilitation, and teamwork.
- Structured facilitation in Group Model Building is achieved through use of scripts.
 - [Scripts](#) are model building and mapping exercises that include well-defined inputs and a clear set of outputs and contribute to one group task to build shared learning processes.

5. Participatory System Dynamics (SD) Approaches: Community Based System Dynamics

- [Community Based System Dynamics](#) is a participatory method for involving communities in the process of understanding and changing systems from the endogenous perspective of system dynamics.
- This approach emphasizes capacity building for long-term community engagement.
- Key features include:
 - A core modeling team (CMT) to support design of workshop
 - Use of Group Model Building scripts
 - Emphasis on capacity building within groups and empowering individuals in the use of systems thinking and design tools

6. Step 1 to System Dynamic Approaches: Define a Dynamic Problem

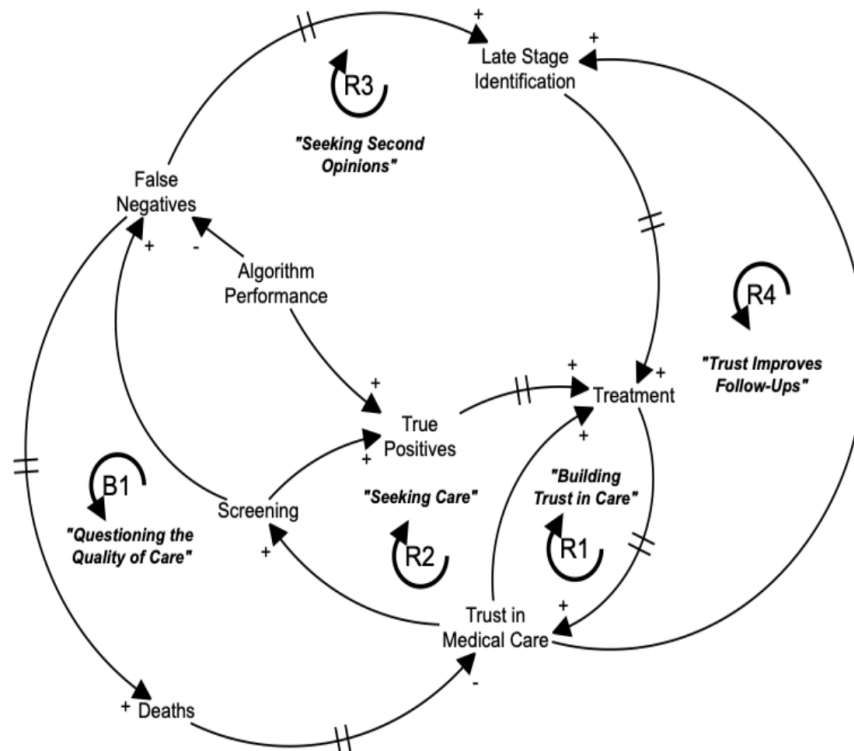
- Defining a clear, dynamic problem is integral to successful Group Model Building sessions and Community Based System Dynamics projects.
- Structure creates behavior, so we have to have a clear problem framing our model building to make sure that we create an actionable at the end.
- Characteristics of complex problems include:
 - Changing over time (dynamic)
 - Have time delays between action and response
 - Feedback loops linking factors
 - History dependent
 - Counterintuitive behavior
 - Policy resistant

How can systems-thinking tools and strategies be used in group modeling?

Session 2 featured answers to key attendee questions from Session 1, an overview of causal loop diagrams and scripts, and a guide to designing engaging processes for modeling in groups. Attendees practiced these skills through group modeling exercises to demonstrate the different systems-thinking tools and highlight their utility.

The example causal loop diagram below demonstrates causal relationships between some variables in the health care system. Refer to [this study](#) for additional examples of causal loop diagrams in health systems to learn how to create and use such diagrams and to leverage this understanding to advance health equity.

Example Causal Loop Diagram



Overview

1. Key Questions and Answers from Session 1

- What are measures of success in [Community Based System Dynamics?](#)
 - With regards to measures of success, it really depends on your goal or desired insight for the Group Model Building. This is often developed with the core modeling team and revised as the Group Model Building unfolds with the full set of partners.
 - Measures of success could be a specific deliverable (i.e., causal loop diagram, behavior over time graphs, reports), increased consensus among participants, shifts in mental models, identification of places to intervene, etc.
 - Refer to [Peter Hovmand's book](#) on CBSD or [Jac Vennix's book](#) on Group Model Building for some ideas, but this is an evolving area.
- What do we do when we have agents acting within a larger system dynamic? Do we squish models together?
 - In this case, it would be a bit difficult (and very labor intensive!) to squish the models together (although this can be done! See: <https://ieeexplore.ieee.org/document/10015353>).
 - Start with reflecting on which dynamic of the problem you are more interested in or you perceive to be most important for how complexity operates.
 - If it's mostly through the behavior and interactions between agents, then it might be helpful to start there.
 - If it's mostly by rules or processes guiding aggregate behavior of groups, then system dynamics might be a better way to go.
 - Starting with one does not preclude you from going to another later in the project. Be sure that it's guided by your desired insight!

2. Casual Loop Diagrams

- [Causal loop diagrams](#) are a visual tool to illustrate the relationships between variables that create the system.
- Drawing and creating causal loop diagrams requires an understanding a few rules and tools of the trade:
 - Use "+" for positive polarity or a positive causal relationship.
 - Use "-" for negative polarity or a negative causal relationship.
 - Use an arrow to demonstrate a time delay in causal effect.
 - Use "R" for a reinforcing causal loop. This means that the loop creates more of a starting behavior.
 - Use "B" for a balancing causal loop. This means that the loop creates less of a starting behavior.

3. Modeling in Groups: Designing an Engaging Process

- Teaching the process of causal loop diagramming and promoting systems thinking in a group requires some structure.

- Scripts are designed activities meant to walk people through the concepts, tools, and actions needed to create informal maps that are foundational to system dynamics.
 - [Scriptapedia](#) is an online repository of different types of scripts for different activities that one can do in groups.
 - Scripts are organized in alternating divergent and convergent activities interspersed with presentations to present the problem and orient the group to relevant skills.
- Additional aspects of Group Model Building sessions include:
 - Artifacts, which are the outputs of scripts that scaffold group learning and the development of causal loop diagrams.
 - Iterative bridging of script using artifacts (i.e., the output from script A is the input for script B).
 - Adapted for community/cultural fit.
- Scripts provide part of the necessary structure, but design (and co-design) processes are key to making sure things go smoothly.
- Cultural/Community fit can be achieved with a core modeling team to co-design workshops from the beginning.
 - A core modeling team is 5-7 people representing key stakeholder groups.
 - The team is tasked with designing workshops for a larger set of representative partners.
 - Over several meetings, the group will consider both technical (i.e., problem statement, script selection) and qualitative (i.e., power dynamics, group availability, appropriate spaces) aspects of the Group Model Building.
 - The individuals on this team need to be aware of and can communicate community engagement needs.
- The design process is often captured in a facilitation manual.
- A facilitation team is also recruited to provide support through specific roles detailed in Scriptapedia.

What are best practices for facilitating Group Model Building sessions and engaging partners?

Session 3 concluded the workshop by outlining key roles for individuals on the facilitation team, facilitation tips to help maintain ownership of the model, and questions to consider when identifying and engaging partners. This session emphasized the importance of effective facilitation and use of systems-thinking tools to map and build relationships with partners, enabling better understanding of stakeholder interactions, interests, and perspectives.

Overview
<p>1. Group Model Building Sessions: Facilitation Team Roles</p> <ul style="list-style-type: none"> ➤ Convener/Closer: someone with high status with participants in the room; opens and closes out the session. ➤ Community Facilitator: someone with group facilitation skills; familiar with the language of the participants; makes sure that communication is flowing; and manages power dynamics. ➤ Modeler Facilitator/Modeler: someone familiar with system dynamics and Group Model Building; helps parse language into system dynamics; introduces system dynamics concepts; and can translate those ideas into model structure. ➤ Theme Builder: someone who participates in divergent activities; takes contributions from participants and groups them into relevant themes for the problem at hand. ➤ Runner: someone who manages the transfer of individual artifacts from participants to either the modeler facilitator, modeler, or cluster/theme builder. ➤ Reflector: someone who provides a structured reflection on session; provides key highlights, insights, and potential next steps. ➤ Notetaker(s)/Recorder(s): someone who takes notes in the session.
<p>2. Group Model Building Sessions: Facilitation Tips</p> <ul style="list-style-type: none"> ➤ Managing ownership of the model is a key goal for facilitating sessions. <ul style="list-style-type: none"> ○ Maintain language of participants as much as possible, including their stories about the loops they share. ○ Aggregate variables and merge links across different causal loop diagrams with caution. <ul style="list-style-type: none"> - Aggregation/merging should go at the pace of the groups' capabilities. ○ Doing live editing, at least with core modeling team, can help maintain transparency and ownership during the model synthesis process. ○ Changes to model increase the time needed to maintain ownership. ○ Trust needs to be well managed.
<p>3. Group Model Building Sessions: Identifying Partners</p> <ul style="list-style-type: none"> ➤ Tools from outside the system dynamic field (e.g., design thinking, dialogue work) can be useful in mapping out stakeholder dynamics. ➤ Key questions to consider when relationship mapping (adapted from Sustained Dialogue): <ul style="list-style-type: none"> ○ What are the patterns of interaction among partners? ○ What are the implications of these interactions? ○ What perceptions/misperceptions/stereotypes exist between partners? ○ What are the identities present? What does this mean for this process? ○ How is power experienced among stakeholder groups? ○ What interests do partners have?

Key Resources

- [Social System Design Lab](#) – This Social System Design Lab provides training opportunities to learn more about system dynamics modeling and CBSD approaches.
- [Creative Learning Exchange](#) – This Center Learning Exchange offers free curriculum for K-12 educators on systems thinking, system dynamics, and active, learner-centered approaches.
- [System Dynamics Society](#) – This website features the System Dynamics Society which is an international non-profit organization that offers courses, membership information, upcoming webinars, and additional resources on system dynamics.
- [Waters Center for Systems Thinking](#) – The Waters Center for Systems Thinking is a non-profit organization that offers opportunities for live online learning, self-guided learning, and customized learning on concepts of systems thinking.

About P4HE

The P4HE Collaborative harmonizes goals, advances learning, and facilitates collaboration to improve health equity. It is led by the Tulane University School of Public Health and Tropical Medicine and is part of the Tulane Institute for Innovations in Health Equity. Support for this program is provided by ICF. Funding is provided by a grant from the Robert Wood Johnson Foundation.



Foster

the co-creation and spread of knowledge.



Sharpen

our research tools to focus on solutions; facts and stories.



Disrupt

traditional research approaches.



Harmonize

our voices.



Challenge

the status quo.



Shine

light on practices that are indefensible, irrational and inconsistent.

Interested in learning more? Resources related to this session are available [here](#). For more Partners for Health Equity content including summit sessions, past, webinars, and a resource library, visit the P4HE [website](#).