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Section D

Where Systems Thinking Helps: Understanding the Types of Problems, Theories, Methods, and Tools

Problems Where Systems Thinking Approaches Can Contribute

- How does intervention/program work? … How to intervene in complex conditions?
- How to grow or scale-up program?
- How to sustain program?

When “What Effect?” Is the Problem in a CAS: Systems Thinking Implications

- Assess unintended consequences
  - Use systems thinking to identify key system actors and relationships between actors
  - Look for effects other than main outcome
    - For example, change in health worker use of time, pharmaceutical availability, quality and use of other health services, antiretroviral resistance

When “What Effect?” Is the Problem in a CAS: Systems Thinking Implications

- Be skeptical of interpreting stable effect sizes (e.g., cost-effectiveness) for an intervention (or strategy) if it has characteristics of CAS
- Be careful of “fallacy of misplaced concreteness”
  - Assumption that because actions have been successful in some contexts, they will be again in another context
- Need new thinking for interpreting quality of evidence for conditions under CAS
  - Don’t fit assumptions about reproducibility and relationship between cause and effect that is used in “evidence-based” guidelines

When “Change” or “Sustainability” Is the Problem: Systems Thinking Implications

- Do we have analytic models to fit complex patterns of change?

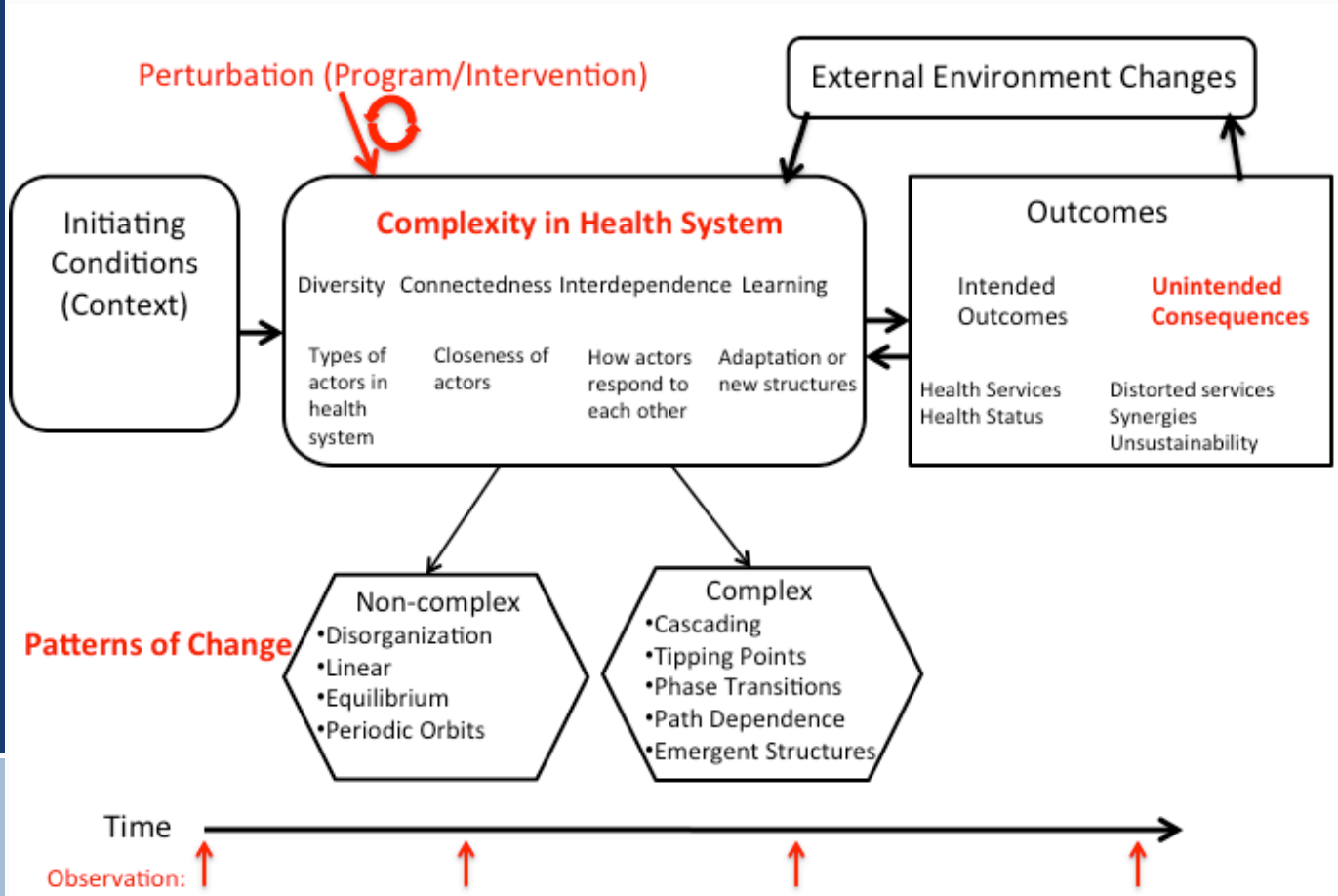
- Can we capture the right changes?
  - Strategy (intensity, components, locations, learning by doing)
  - Actors (leadership, influence), capabilities (implementers, beneficiaries, government) and incentives
  - Environment (policies and social factors)
  - Diverse trajectories of individual, institutional, and group level outcomes and impact
  - Intended and unintended consequences

- Which research designs will not unduly “interfere” with learning processes for program implementation?

What “Causes” Complexity? System Elements to be Considered

- Diversity: different types of elements (for example, types of providers, services, organizations)
- Connectedness: how close is one entity (for example, person or organization) to another
- Interdependence: how does one element (or entity) influence another
- Learning: ability to adapt, learn, create new structures

Model for Understanding Complexity in Health Systems



Systems Thinking: Selected Theories

Catastrophe theory	Mathematics and geometry theory on how small changes in parameters of a nonlinear system can lead to sudden and large changes in system behavior
Chaos theory	Based in mathematics to explain a dynamic system and that is highly sensitive to the initial conditions, so that small changes in initial conditions produce wildly different results. The changes occur through fixed rules about changing relationships, and without randomness.
Learning organizations theory	Organizations that facilitate learning by its members to continuously transform itself. Involves personal learning, challenging and building of mental models, developing a shared vision and team learning.
Path dependency theories	Economics, social sciences, and physics theories to explain why a similar starting point can lead to different outcomes, even if they follow the same rules. Outcomes are sensitive not only to initial conditions, but also to bifurcations and choices made along the way, which may be irreversible.
Punctuated equilibrium in social theory	Explains long periods of stasis interrupted by rapid and radical change, particularly as applied to the evolution of policy change or conflict

Source: Peters, D.H. (2014) The application of systems thinking in health: why use systems thinking? *Health Research Policy and Systems, 12*:51

Systems Thinking: Selected Research Methods

Agent-based modeling (ABM)	**ABMs are used to create a virtual representation of a complex system, modeling individual agents who interact with each other and the environment. Interactions are based on simple, predefined rules, and allow for the identification of emergence and self-organization.**
Network analysis (or social network analysis)	Network analysis uses graphical methods to demonstrate relations between objects. Applies network theory to social entities (e.g., people, groups, organizations), demonstrating nodes (individual actors within a network), and ties (the type of relationships) between the actors, and uses a range of tools for displaying the networks and analyzing the nature of the relationships.
Systems dynamics modeling	A range of methods to understand the behavior of complex systems over time. The methods are based on the concepts of stocks and flows and feedback loops. They are designed to solve the problem of simultaneity (mutual causation) by being able to change variables over small periods of time while allowing for feedback and various interactions and delays.

Source: Peters, D.H. (2014) The application of systems thinking in health: why use systems thinking? *Health Research Policy and Systems, 12*:51

Systems Thinking Research: Selected Tools

Causal loop diagrams (CLDs)	**A system dynamics tool that produces qualitative illustrations of mental models, highlighting causality and feedback loops. CLDs are often developed in a participatory approach.**
Innovation (or change management) history	Innovation or change management history aims to generate knowledge about a system by compiling a systematic history of key events, intended and unintended outcomes and measures taken to address emergent issues. It involves in-depth interviews with as many key stakeholders as possible to build an understanding of the performance of the system from a number of different points of view.
Participatory impact pathways analysis (PIPA)	PIPA is a workshop-based approach that combines impact pathway logic models and network mapping through a process involving stakeholder engagement, making assumptions and mental models explicit and used to reach consensus on how to achieve impact.
Process mapping	A set of tools, such as flow charts, to provide a pictorial representation of a sequence of actions and responses. Their use can be quite flexible, such as to make clear current processes, as a basis for identifying bottlenecks or inefficient steps, or to produce an ideal map of how they'd like them to be.
Stock and flow diagrams	**Stock and flow diagrams are quantitative system dynamics tools used for illustrating a system that can be used for model-based policy analysis in a simulated, dynamic environment. Stock and flow diagrams explicitly incorporate feedback to understand complex system behavior and capture nonlinear dynamics, often using CLDs.**

Source: Peters DH. (2014) The application of systems thinking in health: why use systems thinking? Health Research Policy and Systems 2014, 12:51

How Systems Thinking Informs Health Systems Interventions

- Better understanding of dynamics of disease transmission, and relationships with the health system, contextual factors, and population health
- Identify root causes of variations in behaviors and services
- Identify multisectoral factors which promote the spread of innovation
- Better understanding of intended and unintended consequences
- New tools and approaches to understand and facilitate decision making

Systems Thinking Implications for Working in Complex Health Systems

- Policy and planning needs flexibility to address dynamic and adaptive properties of health systems
- Use data in frequent cycles of adaptation, experimentation, and planning, involving key players

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