

An Introduction to Complex Systems Thinking in Health

Complex Systems Thinking is a promising and potentially transformational way of understanding and approaching health. It is based on the idea that when all stakeholders and their patterns of interactions are considered as a whole, we can comprehend health concerns more fully than when simply viewing each part in isolation. Such an approach means that we must consider economic, political, and social components, factors that might seem unrelated to health. Also, because health challenges are complex, and solutions differ depending on time and place, we cannot successfully impose a top-down plan of action and consistently achieve predictable, positive results. Instead it is often best to facilitate environments where local individuals, agencies and communities self-organize to improve health. In many instances, such approaches can lead to innovative, beneficial results that health planners might never have imagined. Complex Systems Thinking provides the framework, principles and approaches to rethink our basic assumptions about health, increase local capacity, and unite to create the future we desire.



The factors that influence health are increasingly complex. Healthcare and public health workers struggle to address challenges such as obesity, malnutrition and heart disease that are multi-faceted, dynamic, and interconnected. These problems are often termed “wicked problems” because they are resistant to change; they have multiple possible causes, and solutions vary in place and time, depending on local context. When addressing such health challenges, policy makers hope that their actions have maximum impact while minimizing unintended consequences. Researchers aim to narrow the gap between experimental evidence and clinical application. And health educators aspire to facilitate the development of global citizens that cooperate to develop efficient and equitable health systems.

In this document we introduce Complex Systems Thinking, a promising approach to addressing health challenges in our complex world. We will explain basic concepts and share application questions. We also introduce “*Systems Thinking for Capacity in Health*,” an emerging network of professionals, students and citizens that are engaged in this topic. We hope to strengthen our global network and facilitate the formation of a community of practice - a virtual place where health professionals interested in applying systems thinking and complexity concepts can share and learn together. We hope you’ll join us!

- ### KEY CONCEPTS
- Complex Systems Thinking
 - Mental Models & Diverse Perspectives
 - Interrelationships
 - Boundaries
 - Shared Vision
 - Unintended Consequences
 - Emergence
 - Feedback Loops
 - Adaptability
 - Leverage
 - Transformational Leadership



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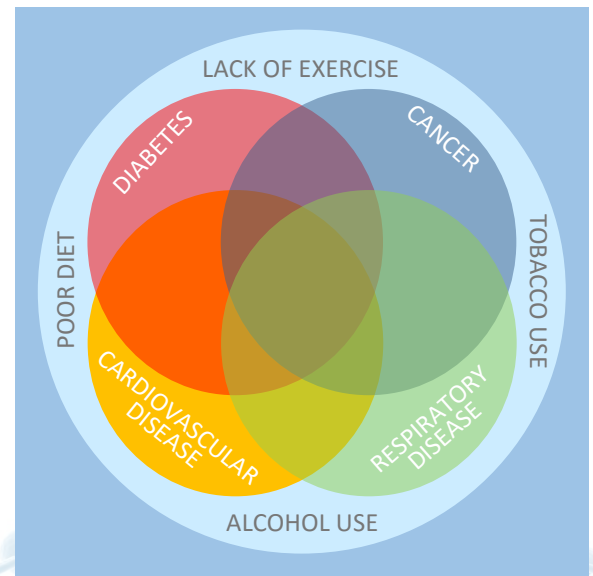
W e as a global community have witnessed tremendous successes in public health, including the eradication of smallpox, treatment of diarrhea with oral rehydration solutions, and successful organ transplants. However, whether it be a specific patient, disease, project, or policy, these dramatic successes were often accomplished by focusing on singular solutions to individual problems.

Today's health dilemmas are increasingly complex, rendering approaches of the past inadequate. Consider obesity, for example. It is caused by multiple interacting factors including family history, socioeconomic status, lifestyle, diet, exercise habits, and culture. Given the complexity of these interactions, it isn't always clear how to intervene at a given time and place. Too often this fragmented approach, which has dominated our health promoting activities, results in unintended consequences such as dependencies, inefficiencies, and inequities.

Complex Systems Thinking acknowledges that a variety of diverse and complex factors influence the quality of health in a given community. To account for these influences, Complex Systems Thinking provides a way of looking at health that is focused on defining and understanding the dynamic interrelationships and forces that shape the structure and behavior of health practices. It provides a framework for facilitating cooperation among diverse stakeholders by "focusing on collaboration across disciplines, sectors and organizations; ongoing, iterative learning; and transformational leadership."¹

Complex Systems Thinking is not a well-defined plan, but a perspective that allows us to identify patterns, interrelationships, and boundaries; connect with and mobilize others; and recognize and exploit important leverage points, resulting in lasting, positive change.²

Complex Systems Thinking tools can lead to transformational changes in health practice, education, research, and policy.¹



Complex Systems Thinking is a perspective that allows us to identify patterns, interrelationships, and boundaries; connect with and mobilize others; and recognize and exploit high leverage points resulting in lasting, positive change.

A Complex Systems Thinking perspective “considers aspects of systems that are overlooked by traditional scientific approaches.”³ Instead of viewing systems as predictable, with linear causes and effects, systems are viewed as unpredictable, nonlinear and adaptable. Complex Systems Thinking assumes that each agent within the system acts independently based on individual understanding and motivation and all interact together, adapting to their environment.³ Such a perspective involves looking beyond isolated actions to consider the perspectives of diverse stakeholders including program designers and administrators; governments and policy makers; healthcare providers, workers and volunteers; healthcare recipients, and community members at large; and the patterns of their interactions over time. When these interactions are considered as a whole, we can understand complex health problems better than we can when viewing fragments, such as diseases, patients, or policies, in isolation.

Complex Systems Thinking facilitates environments in which local people and communities are empowered to self-organize to improve health, leading to positive actions and results that might otherwise be unanticipated. However, the ways in which Complex Systems Thinking is implemented will vary depending on the number of influences intrinsic to a particular system.

Here we list a few of the concepts, definitions and examples related to systems thinking and complexity science. While this list is far from comprehensive and simplifies the rich and diverse disciplines that lie at its foundation, we hope to promote a common vocabulary that will allow for increased understanding and discussion of this promising application in health.



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Mental Models and Diverse Perspectives

Mental models are the lenses through which we interpret reality,⁴ and involve deeply ingrained beliefs, assumptions and generalizations that direct our understanding. Similarly, the way we understand health systems is affected by our diverse perspectives.² Complex Systems Thinking takes into account these diverse perspectives and challenges our mental models on a regular basis.

Examples

- Traditionally, curative medicine receives more funding and attention than preventative medicine. Is this an effective use of health resources?
- Some countries have state-sponsored health coverage, while others depend on the private sector. Should governments be responsible for providing or regulating health activities? If so, to what extent?
- Mothers have a tremendous impact on the health of their families. However, local influences, such as inequitable gender roles, can create health systems that divert resources from households to medical facilities.⁵ How can we challenge mental models so that resources are used where they are needed most?

Application Questions

- How might an approach to a health challenge change if viewed from the perspective of a villager? A physician? A social advocate? A historian? A politician?
- What is your current personal mental model, or that of your community or organization, regarding health and its delivery?
- What mental models, biases, or subtle cultural messaging may be hindering successful health promotion activities in your practice or community? How can you challenge them?



Mental models shape the way we approach health problems. Diverse perspectives, differing priorities, and divergent cultural norms all contribute to assumptions about health solutions which may be inaccurate, inefficient or ineffective.



Interrelationships

All of the properties of a given system cannot be determined or explained by its individual parts in isolation. Interrelationships are the patterns of interactions between individuals, communities and organizations over time. These patterns of interactions must be examined because systems are interconnected and interdependent.⁶ Such interrelationships are dynamic, unpredictable, continuously adapting and self-organizing.¹ They can range from simple, to complex, to chaotic and exert varying degrees of influence on a situation of interest depending on context, purpose, and information flow.

Examples

- A tobacco control program engages with community members as equal partners, including teachers, parents, and government leaders to reach all who can affect, and are affected by tobacco use.
- The Thai health system establishes a National Health Assembly to facilitate inter-organizational collaboration and local participation.¹
- A general practitioner, meeting resistance to change in her department, successfully implements a policy change when she acknowledges the diverse perspectives of her colleagues and the impact of change on all stakeholders.

Application Questions

- What is the nature of the interrelationships within health situations you observe?²
- How do your health activities affect others? How do others' health activities affect you? Why?
- What are key social patterns, processes, roles, or activities that are affecting health? Are they being adequately addressed?



Every health intervention, from the simplest to the most complex, has an effect on the overall system. Understanding interrelationships and patterns of interactions over time increases the effectiveness of a given health initiative or intervention.



Boundaries

Boundaries frame situations and separate what is important to the system from what is not. They are created, sometimes unknowingly, by members of communities, organizations, and social networks. These boundaries determine the choices that actors make within a system and influence policy and practice.²

Examples

- A health education department which dismisses input from outside of the department will likely miss opportunities for innovation because of groupthink.
- Physicians and nurses train, educate, and practice in silos without valuable interactions.
- Disease-specific global health initiatives have separate reporting requirements, limiting the scope of the big picture for all.
- Social norms of policy makers make them nearly inaccessible to health advocates.

Application Questions

- Whose interests are being served and whose interests should be served?
- Who controls what resources, and who should control what resources?
- Whose expertise is needed to accomplish the system's goals?
- Are certain individuals, groups, or interests being excluded that are relevant to the system?



“While systems can be broken down into parts which are interesting in and of themselves, the real power lies in the way the parts come together and are interconnected to fulfill some purpose.”⁷



Shared Vision

A shared vision is one that is owned by all who are affected by, or invested in the current system.⁸

A shared vision provides a common set of goals, mutual understanding, and shared expectations for all participants. It is created through collaboration between diverse stakeholders who develop interactive models and consider future scenarios by challenging basic assumptions.

Examples

- In India, community members, local leaders, and health experts met to discuss their goals for improving health, creating a shared vision for the community. Personal priorities were redefined as all contributed. This shared vision led to drastic improvements in health through the creation of the Village Health Worker Program and a variety of other projects.⁹
- University departments collaborate around interdisciplinary research.
- Policy makers engage community members to address public health challenges.
- Physicians, nurses, and technicians in a clinic unite around a common goal.

Application Questions

- What are the goals and priorities of your organization?
- Do these goals reflect the goals and priorities of the community?
- How can you contribute to a shared vision among diverse stakeholders?
- How can individuals in your community come together to create a shared vision for health?



A shared vision encourages participation at all levels — from community members, to local leaders, to external experts — allowing them to pool resources and work together as they strive to improve community health.



Emergence

Emergence is the creation of order without central control. Systems without central control can still be orderly.⁷ Patterns, entities and regularities emerge as smaller or simpler entities interact or self-organize through collective behaviors. Such emerging patterns are more complex than the sum of the parts, and are often surprising and unexpected.¹¹ Emergence best develops when creativity and diversity are encouraged across disparate platforms and contributors, self-organization is promoted, and all stakeholders are open to the influence of random resulting opportunities.³

Examples

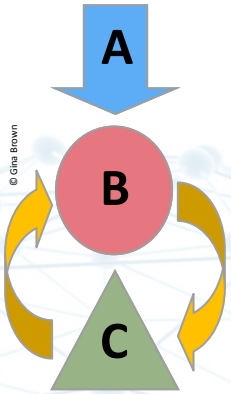
- Informal health providers form organizations to protect trade practices.
- Medical providers suddenly go on strike.
- Community health workers self-organize to implement an innovative, locally-relevant approach to health improvement.
- Academic faculty members self-organize to bring about curriculum reform.
- Research approaches locate successful organizations and then examine individual agents' actions in order to determine which rules are being followed that result in superior outcomes.

Application Questions

- Is your organization or practice facilitating or hindering emergence? How?
- What are some examples of emergent processes, roles, and interrelationships in your environment?
- How could noticing and fostering emergence in your community lead to improved outcomes?



Emergence is caused by the interactions and collective behaviors of smaller entities, which spontaneously create order. Self-organization and self-control are important components of emergent behaviors, allowing individual entities to act according to their own best interests.



Feedback Loops

Feedback loops provide results about existing policies back to the original decision makers. Consequently, subsequent decisions are influenced by an improved understanding which then further influences ensuing decisions and actions.¹² Such feedback allows for self-correction and can reduce the discrepancy between actual and optimal outcomes. Feedback from diverse stakeholders provides novel information which leads to improved understanding and can be crucial to the success of future outcomes.

Examples

- Medical providers and public health workers improve their performance after frequent feedback from community members.
- Policy makers request feedback from citizens.
- Tobacco product consumption was monitored, showing a decline resulting from increased tobacco taxes.¹³
- Health educators adjust their content and methods based on student and community feedback.

Application Questions

- How does your organization or community gather and respond to feedback?
- Do you receive feedback from those who influence health in the community?
- Do you seek feedback from those whose health is influenced by the actions of others?
- Do you request feedback evaluations from those not directly related to health?
- Do you consciously solicit feedback from diverse stakeholders who may hold views different from your own?



Feedback loops from diverse stakeholders provide information which leads to improved understanding and can be crucial to the success of future outcomes.



Adaptability

Adaptability is the ability to change and respond to dynamic and sometimes unpredictable social, political, or environmental events and contexts.⁷ Adaptation occurs when individuals or organizations within systems respond to opportunities or challenges by fitting behavior to both internal and environmental changes. By adapting in positive ways, stakeholders respond more effectively to complex challenges and rapid changes. Positive adaptation, as a response to unexpected opportunities or difficult disturbances, improves efficiencies and resilience.

Examples

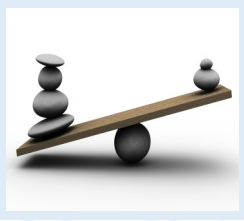
- Health leaders in Thailand implement context-specific programs and policies that lead to Millennium Development Goal successes.¹⁴
- Countries adopt different standards for health technology with the aim to increase health coverage while decreasing costs.¹⁴
- Successful health reform strategy in one country may not be successful in another.¹⁴

Application Questions

- How has your organization's vision changed over time? What has caused these changes?
- What incentives have you implemented in your organization to ensure adaptation?
- How does your organization examine the relevancy of your programs, approaches and policies over time?
- How do you tailor your programs or strategies to diverse situations and cultures?



Positive adaptation allows individuals, organizations and entire systems to respond to challenges and opportunities in beneficial ways, improving efficiencies and increasing resilience.



Leverage

Small actions and changes in structures at crucial junctures can lead to significant and enduring long-term improvements in the system.

Identifying and utilizing critical leverage points allows positive change to be implemented with greater efficiency. “Low-leverage policies often generate transitory improvement before the problem grows worse, whereas high-leverage policies often cause worse-before-better behavior.”¹⁵ High-leverage policies may not be easily identifiable, requiring that a comprehensive understanding be developed before decisions are made.

Examples

- In Jamkhed, India, mothers are educated by community health workers about healthcare treatment and strategies. Their children are healthier and able to obtain an education which allows them to learn and contribute positively to their community.⁹
- Health workers’ financial and behavioral incentives are aligned with the desired results.
- Existing mental models that impede progress are challenged.
- Implementing health curriculum reform.

Application Questions

- Do you understand the dynamic environment of your community or organization well enough to identify and implement high-leverage actions?
- What high-leverage actions have you seen that have significantly changed the way that health improvement is approached in your community?
- How can you work synergistically within your environments to collaborate around high-leverage activities that catalyze positive change?



Identifying and utilizing critical leverage points allows positive change to be implemented with greater efficiency.



Transformational Leadership

Transformational leaders create the conditions under which others flourish. They motivate and inspire; empowering others to see things differently, advance personally, and work together more effectively. “Visionary and courageous leaders are needed to challenge the prevailing paradigm; sacrifice personal and organizational interests for systemic benefit; enhance inter-organizational collaboration (Best and Holmes 2010); and advocate for change.”^{1,16} Such leaders need not be in traditional, formal leadership roles.

Examples

- A concerned citizen takes the initiative to organize a community group to advocate for local health policy change.
- Students join the school curriculum committee.
- A technician in an operating suite reminds the surgeon of best practices.
- A village doctor, voted chairman of the local school board, goes door-to-door in Indian villages urging parents to send their children, both sons and daughters, to school. He convinces them that their daughters have the capacity to learn and contribute, just like their sons. As a result, thousands of girls receive education alongside their brothers.

Application Questions

- Are positive transformational leaders in your organization or community encouraged and supported, or dismissed and marginalized?
- In your community, do those in historically marginalized positions feel free to share their opinions and contribute?
- How could you be a transformational leader in your sphere of influence?



"It is more helpful to think like a farmer than an engineer or architect in designing a healthcare system. Engineers and architects need to design every detail of a system.... In contrast, the farmer knows that he or she can do only so much. The farmer uses knowledge and evidence from past experience, and desires an optimum crop. However, in the end, the farmer simply creates the conditions under which a good crop is possible."⁷

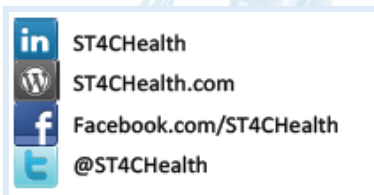
Join Us!

Complex Systems Thinking is a promising and potentially transformational way of looking at the world and our interactions with it. The concepts of Complex Systems Thinking can greatly enhance our capacity to develop and sustain effective policies and programs.

Systems Thinking for Capacity in Health (ST4C Health) is a network of people that are interested in understanding health from a Complex Systems Thinking perspective. The ST4C Health community hopes to increase global understanding of the potential for Complex Systems Thinking concepts in health. We hope that you will consider applying these concepts and principles to your health related goals. Please join us to help spread Complex Systems Thinking worldwide.

In addition to our website, we have created several different venues for exploration and learning, including Facebook, Twitter and LinkedIn. Please join us as we seek to develop our understanding of Complex Systems Thinking to more effectively improve the world in which we live.

We hope that you will share your experiences. We invite you to send us an email at cas4capacity@gmail.com or visit us on our social media sites.



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