SYSTEMS TOOLS FOR COMPLEX HEALTH SYSTEMS: A GUIDE TO CREATING CAUSAL LOOP DIAGRAMS
Five sessions

1. An introduction to Systems Thinking
2. Developing a Rich Picture
3. Creating Interrelationship Digraphs
4. Surfacing Causal Loop Diagrams
5. Applying Systems Thinking Tools
SESSION ONE
INTRODUCTION TO
SYSTEMS THINKING
Five sessions

1. An introduction to Systems Thinking
2. Developing a Rich Picture
3. Creating Interrelationship Digraphs
4. Surfacing Causal Loop Diagrams
5. Applying Systems Thinking Tools
Session outline

• The complexity of health systems
• Thinking about “systems”
• What is systems thinking?
• How can systems thinking help us address health system challenges?
• Introducing systems thinking tools
Session outline

• **The complexity of health systems**
  • Thinking about “systems”
  • What is systems thinking?
  • How can systems thinking help us address health system challenges?
  • Introducing systems thinking tools
• What is our current reality?

• How has this changed over time?
Current reality for health systems “practitioners”

Prior context
- Discipline-based expertise (e.g., epidemiology)
- Disease-focused initiatives
- Disease-focused teams and units
- Donors/agencies working in parallel
- Donor-driven programs

Current context
- Focus on Health system strengthening
- Inter- and multi-disciplinary teamwork
- Collaborative partnerships and joint planning
- Complex flows of funding, information and communication channels
- Increased use of technology
- Country-owned sustainable national health strategies
How do we understand our reality?

- Events and Symptoms
- Patterns
- Systems and Structure

What is happening now?
- Tasks
- Crises

How do patterns play out over time and space?
- Trends

What are the drivers and deep structures?
- What are the drivers and deep structures?
- How are they related?

- Patients: Habits, Norms, Expectations, Perceptions
- Information Flows
- Written Rules
- Unwritten Rules
- Quality improvement
- Health Workers: Values and Beliefs
- Political dynamics
- Control Mechanisms
- Laws, Regulations, Procedures, Policies
- Reward Systems
- Emotions, Work Processes

Hargreaves M, 2010
Session One
How do we respond to our reality?

- Fire-fighting
- Anticipating
- Designing

Events and Symptoms

Patterns

Systems and Structure

- Control Mechanisms
- Reward Systems
- Laws, Regulations
- Work Processes
- Emotions
- Expectations
- Perceptions
- Patients: Norms, Habits

Tasks

- Information Flows
- Written Rules
- Quality improvement
- Health Workers: Values and Beliefs

Crises

Trends

Unwritten Rules

Political dynamics

Hargreaves M, 2010
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Elements of a system

Components/Variables

Interconnections

Function
What is a system?

- **System**: an assembly of components connected together in an organized way
  - Components are affected by being in the system *and* are changed if they leave it
  - Assembly of components does something
    - Assembly has been identified by someone as being of interest
What is a system?

“The central concept “system” embodies the idea of a set of elements connected together which form a whole, this showing properties which are properties of the whole, rather than properties of its component parts.”

(Checkland, 1981)
Thinking about systems

• A system is more than the sum of its parts.
• How a system behaves and performs is determined by its components, the relationships amongst these components and resultant structure of the system.
• System behavior reveals itself as a series of events over time.
Thinking about systems

Distinguish between systems based on:

• degree of certainty about the link between cause and effect amongst variables in the system

and

• degree of agreement as to the best course of action in a situation in order to produce a consistent outcome
Thinking about systems

- Complex systems
- Random systems
- Simple systems

Degree of certainty

High

Low

Degree of agreement

High

Low

Session One

Mills A, 2010
General types of systems

- Simple (puzzle)
- Complicated (problem)
- Complex (mess)
Following a recipe

- The recipe is essential
- Recipes are tested to assure replicability of later efforts
- No particular expertise required; knowing how to cook increases success
- Recipe notes the quantity and nature of “parts” needed
- Recipes produce standard products
- Certainty of same results every time
Sending a rocket to the moon

- Formulae are critical and necessary
- Sending one rocket increases assurance that next will be ok
- High level of expertise in many specialized fields + coordination
- Separate into parts and then coordinate
- Rockets similar in critical ways
- High degree of certainty of outcome
Raising a Child

- Formulae have only a limited application
- Raising one child gives no assurance of success with the next
- Expertise can help but is not sufficient - relationships are key
- Can’t separate parts from the whole
- Every child is unique
- Uncertainty of outcome remains

Complex (mess) systems

Freedman, 2008
Simple, complicated or complex?

- Collaborating with partners?
- Implementing a supply chain system?
- Strengthening adherence to anti-retrovirals?
A complex adaptive system is a collection of individual actors with **freedom to act** in ways that are **often not predictable**, and whose actions are **interconnected**, so that one agent's actions **changes the context** for other agents.

(Plesk 2001)
Observance of health systems – including findings from failed interventions – tells us that a health system is a complex adaptive system

BUT

Methods for addressing health system problems are designed as though the health system is merely complicated
Session outline

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What is systems thinking?

“Systems thinking is a discipline for seeing wholes, recognizing patterns and interrelationships, and learning how to structure those interrelationships in more effective, efficient ways.”

(Senge & Lannon-Kim 1991)
It is a way of thinking in approaching problems and in designing solutions that appreciates the very nature of complex [adaptive] systems as:

- **dynamic**, constantly changing,
- governed by **history** and by **feedback**, 
- where the role and influence of **stakeholders** and **context** is critical, and 
- where new policies and actions (of different stakeholders) often **generate** **counterintuitive and unpredictable effects**, sometimes long after policies have been implemented – **policy resistance**.

(Adam 2012)
What is systems thinking?

It is a way of thinking in approaching problems and in designing solutions that …

…allows the identification of solutions that simultaneously address different problem areas and leverage improvement throughout the system.
Systems Thinking moves from this...

- Events and Symptoms
- Tasks and Crises
- Patterns
- Trends
- Systems and Structure
- Unwritten Rules
- Reward Systems
- Control Mechanisms
- Laws, Regulations, Procedures, Policies
- Emotions, Work Processes, Expectations, Perceptions
- Patients: Habits, Norms, Expectations, Perceptions
- Information Flows, Written Rules
- Health Workers: Values and Beliefs
- Quality improvement
- Political dynamics

What is happening now?
How do patterns play out over time and space?
What are the drivers and deep structures? How are they related?
... to making sense of the dynamics

Events and Symptoms

Patterns

Systems and Structure

Tasks

Crises

What is happening now?

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How are they related?

Hargreaves M, 2010

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• **How can systems thinking help us address health system challenges?**
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Applying systems thinking to health system helps to:

- anticipate synergies
- mitigate negative emergent behaviours, policy resistance and unintended consequences

when

- designing changes in the health system
- evaluating these interventions
How can “Systems Thinking” help to understand health systems?

Practitioners need to:

• **SEE** differently

• **THINK** differently

• **ACT** differently
SEE differently
Expanding our vision of health systems

From

• Understanding individual health systems building blocks

To

• Understanding the relationships amongst building blocks
Expanding our vision of health systems

From:
• Patients

Towards people:
• who are consumers, taxpayers, citizens and co-producers of health
  and
• who interact with each other and their environment in complex, adaptive ways
Expanding our vision of health systems

From

• a sole focus on health outcomes

Towards

• emergent properties that serve to strengthen the health system including:
  • Equity
  • Trust
  • Responsiveness
  • Social and fair financing protection
  • Efficiency
Expanding our vision of health systems

From
• technical interventions

Towards
• understanding implementation within an enabling environment
THINK differently
Think differently

“

We cannot solve our problems with the same thinking we used when we created them.

”

(Albert Einstein)
Think differently

Systems thinking is an ordered, methodological approach to understanding problem situations and identifying solutions to these problems.

It takes into account both the “forest and the trees” through a process of synthesis, analysis and inquiry.
Without Systems Thinking...

We risk doing the wrong things with greater and greater efficiency rather than establishing what is the right thing to be doing.

“It is better to do the right thing imperfectly than to keep doing the wrong thing better and better.”

(Russell Ackoff, 1995)
Without Systems Thinking...

We are at risk of committing a Type III Error - the right answer for the wrong question

(Schwartz 1999)

In other words we have the perfect solution for a problem that has not been adequately understood
ACT differently
“We need new ways of thinking and of working in order to accommodate the complexity of the challenges in and urgent need for health system innovation and change.”

(Herbert and Best, 2011)
Accept that systems thinking is about dealing with the inevitable lack of comprehensiveness, and is not the means to achieve comprehensiveness

(Midgley & Richardson, 2007)
We need systems thinking tools that will assist us to:

- Challenge assumptions
- Make sense of the complexity
- Model a situation over time
- Identify appropriate leverage points for intervention
- Mitigate policy resistance
- Enable collaboration and sharing
Act differently

Systems thinking tools enable three functions:

**Synthesis**: putting together, assessing the system as a whole in its environment/context e.g., *Rich Picture, Interrelationship Digraph*

**Analysis**: (combined with synthesis) – understanding the detail and how the components fit together within a context e.g. *Systems Map, Causal Loop Diagrams*

**Inquiry**: developing robust interventions through a systemic investigation e.g. *Systems Dynamic Modeling, Scenario Planning*
Systems thinking tools

**Synthesis**
- Understand Whole System Context
- Determine Boundaries

**Inquiry**
- Identify Leverage Points
- Develop Interventions through Systemic Investigation

**Analysis**
- Understand System Itself within Context
- Surface & Challenge Assumptions
Session Outline

• The complexity of health systems
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• What is systems thinking?
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• Introducing (a few) systems thinking tools
Useful systems thinking tools

- Rich Pictures
- Inter-relationship diagraphs
- Systems maps (causal loop diagrams)
- Systems dynamic modeling
- Agent based modeling
- Network analysis
- Scenario development
What we will do

Create and use our own causal loop diagrams
We need to first

• Define the boundaries of our system – seek to understand the big picture

• Identify the elements/variables in our system

• Understand how these variables might change over time

• Surface and test our assumptions (consider how our mental models affect our understanding of the current reality)

To do all of the above we develop a RICH PICTURE
Rich picture
Then we will

• Explore how these elements/variables relate to one another
• Resist coming to a quick conclusion and once again surface and test our assumptions
• Identify the major drivers and outcomes in our system

To do this we develop an INTERRELATIONSHIP DIGRAPH
Interrelationship Digraph

Prioritization of (Maternal) Health in Domestic Policy
- Amount of International Funding
- Government Financial Resources
- Level of Corruption
- Presence of Conflict
- Level of Infrastructure
- Availability of Medical Equipment, Supplies & Drugs
- Quality of Health Services
- Level of Function of Referral System
- Size of Health Workforce
- Time Until Effective Care (Third Delay)
- Availability of Medical Equipment, Supplies & Drugs
- Government Financial Resources
- Amount of International Funding
And only then…

… do we surface a CAUSAL LOOP DIAGRAM

• Informed by our Rich Picture, Interrelationship Digraphs
• Considering both short and long-term consequences
• Understanding the system structure to identify possible leverage actions
We use this causal loop diagram to:

- Understand the system structure giving rise to the system behavior
- Find where unintended consequences (policy resistance) emerge
- Explore consequences of proposed action
- Recognize impact of time delays when exploring relationships
- Identify possible leverage points for actions
Always remembering that

“All models are wrong, some are useful”

(Attributed to George Box)
References

- Adam T, de Savigny D. Systems thinking for strengthening health systems in LMICs: need for a paradigm shift Health Policy and Planning 2012;27:iv1–iv3
Thank you

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