See the Bigger Picture: A True Systems Approach to Healthcare

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A True Systems Approach to Healthcare

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ASSISTANT PROFESSOR, LIU POST
Agenda

- What is Systems Theory
- General Approaches to Systems Theory
- Current Approaches of Applying Systems Theory to Healthcare
  - Similarities
  - Shortfalls
- A Proposed Approach: A True System’s Approach to Healthcare
What is a System?

- A system is a set of objects or elements that interact to achieve a specific goal.

- A system is more than the sum of its parts; its properties emerge from the relationship among its parts and from the system's relationship to its environment.

- Systems are arranged hierarchically:
  - Every system is a super system for systems contained within it and a subsystem for systems containing it.
The Purpose of a System

What do systems do?

- The function of a system is to convert information, energy, or materials into a planned outcome or product for use within the system, outside the system or both.

Basic System Components

- Goal
- Environment
- Control
- Input
- Process
- Output
- Feedback
Types of Systems

- Systems differ from each other related to degree of self-sufficiency, complexity, and adaptability.
- **Closed systems** have fixed relationships among system components and no interaction with the environment. Not really of concern to IT.
- **Open systems** interact with their environment, have dynamic interaction of components, and can be self-regulating.
  - Human organisations are open systems; boundaries are permeable, continually engage in importing, transforming, and exporting matter, energy, information, and people; Human organisations are at the high end of the complexity scale due to these characteristics.
Properties of Systems

- Equifinality
- Balance (Equilibrium)
- Change & Adaptability
  - Progressive Segregation
  - Progressive Systemization
  - Progressive (De)Centralization
- Non-summativity (Synergy)
- Interdependence/Independence
- Boundary & Environment
- Interface
Properties of Systems

- Requisite variety
  - Organization has to be as complex as the environment it is in.

- Holism
  - System is more than the sum of its parts

- Negative Entropy
  - Ability to sustain and grow

- Complexity
  - The more a system grows, the more it develops

- Goal-seeking
  - They move in the direction of goal achievement.

- Cybernetics
  - For a system to work properly, it must have control mechanisms.

- Elaboration
  - When systems change, they tend to move in the direction of differentiation and elaboration
Systems Thinking Traits

Box 2.1 Common Systems Characteristics

Most systems, including health systems, are:

- Self-organizing
- Constantly changing
- Tightly linked
- Governed by feedback
- Non-linear
- History dependent
- Counter-intuitive
- Resistant to change

Compiled and adapted from Sterman, 2006 and Meadows et al, 1982 (32:42)
## Systems Thinking Traits

<table>
<thead>
<tr>
<th></th>
<th>Usual approach</th>
<th>Systems thinking approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static thinking</strong></td>
<td>Focusing on particular events</td>
<td>Framing a problem in terms of a pattern of behaviour over time</td>
</tr>
<tr>
<td><strong>Systems-as-effect thinking</strong></td>
<td>Viewing behaviour generated by a system as driven by external forces</td>
<td>Placing responsibility for a behaviour on internal actors who manage the policies and “plumbing” of the system</td>
</tr>
<tr>
<td><strong>Tree-by-tree thinking</strong></td>
<td>Believing that really knowing something means focusing on the details</td>
<td>Believing that to know something requires understanding the context of relationships</td>
</tr>
<tr>
<td><strong>Factors thinking</strong></td>
<td>Listing factors that influence or correlate with some result</td>
<td>Concentrating on causality and understanding how a behaviour is generated</td>
</tr>
<tr>
<td><strong>Straight-line thinking</strong></td>
<td>Viewing causality as running in one direction, ignoring (either deliberately or not) the interdependence and interaction between and among the causes</td>
<td>Viewing causality as an on-going process, not a one-time event, with effect feeding back to influence the causes and the causes affecting each other</td>
</tr>
</tbody>
</table>
### Systems Thinking Traits

<table>
<thead>
<tr>
<th><strong>Box 2.5 Systems Thinking Elements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systems organizing</strong></td>
</tr>
<tr>
<td>Managing and leading a system; the types of rules that govern the system and set direction through vision and leadership, set prohibitions through regulations and boundary setting, and provide permissions through setting incentives or providing resources</td>
</tr>
<tr>
<td><strong>Systems networks</strong></td>
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<tr>
<td>Understanding and managing system stakeholders; the web of all stakeholders and actors, individual and institutional, in the system, through understanding, including, and managing the networks</td>
</tr>
<tr>
<td><strong>Systems dynamics</strong></td>
</tr>
<tr>
<td>Conceptually modeling and understanding dynamic change; attempting to conceptualize, model and understand dynamic change through analyzing organizational structure and how that influences behaviour of the system</td>
</tr>
<tr>
<td><strong>Systems knowledge</strong></td>
</tr>
<tr>
<td>Managing content and infrastructure for explicit and tacit knowledge; the critical role of information flows in driving the system towards change, and using the feedback chains of data, information and evidence for guiding decisions</td>
</tr>
</tbody>
</table>
Approaches to Systems Theory

- General Systems Theory
- Systems of Profound Knowledge
- Contingency Theory
- Weick’s Theory of Organizing
- Cybernetics Systems Theory
- New Science Systems Theory
- Complex-Adaptive Theory Approach
- Integral Theory Approach
- Congruence Model
- V Model

Methods for studying organizational systems
- Modeling techniques
- Network analysis
  - Properties of networks and links
  - Network roles-more than one role in a network

Each theory has different:
- Components
- Focus (foci)
- Applications
- Limitations
Current Approaches of Applying Systems Theory to Healthcare

- Yassan’s Theory*
- Chuang & Inder*
- WHO*
- NAE/IOM*
- Chronic Care Model
- Coffey’s Theory
- Healthcare Complexity Model*
- WHO-P4P

Each theory has different:
- Components
- Focus (foci)
- Applications
- Limitations
Current Approaches of Applying Systems Theory to Healthcare

- Dr. Yaseen Hayajneh (2007)
  - (Management for Health Care Professionals)

- Hospital Point of View.

- Focuses on:
  - Hospitals
  - Insurers
  - Inputs
  - Outputs
  - Feedback (I/O Link)
  - Individual Providers
  - Clinics
Current Approaches of Applying Systems Theory to Healthcare

- Chuang and Inder (2009)
- Hospital Point of View.
- Focuses on:
  - Providers
  - Inputs
  - Outputs
  - Feedback (I/O Link)
  - Accreditation System
  - Quality Measurement
  - Quality Reporting

*I – Input, P – Process, O - Output
Current Approaches of Applying Systems Theory to Healthcare

- World Health Organization (2009)

- Hospital Point of View.

- Focuses on relationship of 6 building blocks with goals outcomes in order to improve:
  - Access Coverage
  - Quality
  - Safety
Current Approaches of Applying Systems Theory to Healthcare

- National Academy of Engineering & Institute of Medicine (2005)
  - Committee on Engineering and the Health Care System

- 4 Levels:
  - Patient
  - Care Team
  - Organization
  - Environment

- Focuses on:
  - System Design
  - System Analysis
  - System Control

FIGURE 2-1 Conceptual drawing of a four-level health care system.
### Current Approaches of Applying Systems Theory to Healthcare

- National Academy of Engineering & Institute of Medicine (2005)
  - Committee on Engineering and the Health Care System

<table>
<thead>
<tr>
<th>TABLE 3-4 Systems-Analysis Tools</th>
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<tbody>
<tr>
<td><strong>Tool/Research Area</strong></td>
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<td>Modeling and Simulation</td>
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<tr>
<td>- Queuing methods</td>
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<tr>
<td>- Discrete-event simulation</td>
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<tr>
<td>Enterprise-Management Tools</td>
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<tr>
<td>- Supply-chain management</td>
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<tr>
<td>- Game theory and contracts</td>
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<tr>
<td>- Systems-dynamics models</td>
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<tr>
<td>- Productivity measuring and monitoring</td>
</tr>
<tr>
<td>Financial Engineering and Risk Analysis Tools</td>
</tr>
<tr>
<td>- Stochastic analysis and value-at-risk</td>
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<tr>
<td>- Optimization tools for individual decision making</td>
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<tr>
<td>- Distributed decision making (market models and agency theory)</td>
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<tr>
<td>Knowledge Discovery in Databases</td>
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<tr>
<td>- Data mining</td>
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<tr>
<td>- Predictive modeling</td>
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<tr>
<td>- Neural networks</td>
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</table>
Current Approaches of Applying Systems Theory to Healthcare

- National Academy of Engineering & Institute of Medicine (2005)
  - Committee on Engineering and the Health Care System

<table>
<thead>
<tr>
<th>TABLE 3-1 Systems-Design Tools</th>
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<td>Concurrent engineering and quality function deployment</td>
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<td>Human-factors engineering</td>
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<tr>
<td>Tools for failure analysis</td>
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<thead>
<tr>
<th>TABLE 3-5 Systems-Control Tools</th>
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<td>Tool/Research Area</td>
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<tr>
<td>Statistical process control</td>
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<td>Scheduling</td>
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</table>
Current Approaches of Applying Systems Theory to Healthcare


- Focuses on individual and enterprise through the following:
  - Information
  - Interaction
  - Process flow

FIGURE 1 Overview of the Healthcare Complex Model.
Current Approaches of Applying Systems Theory to Healthcare


- Focuses on individual and enterprise through the following:
  - Information
  - Interaction
  - Process flow
# System Theory Approaches & Healthcare “Systems” Models

## How Healthcare “Systems” Models Align With System Theory Approaches

<table>
<thead>
<tr>
<th>System Theories</th>
<th>Yassan’s Theory</th>
<th>Chuang &amp; Inder</th>
<th>WHO</th>
<th>NAE/IOM</th>
<th>Chronic Care Model</th>
<th>Coffey's Theory</th>
<th>Healthcare Complexity Model</th>
<th>WHO-P4P</th>
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### How Each Healthcare “Systems” Model Addresses System Theory Properties

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<th>System Properties</th>
<th>Yassan’s Theory</th>
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# Healthcare “Systems” Models & Systems Theory Thinking Traits

## How Each Healthcare “Systems” Model Addresses System Theory Thinking

<table>
<thead>
<tr>
<th>System Thinking Traits</th>
<th>Yassan's Theory</th>
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</table>
Shortfalls of Current Strategies

- Traditionally → “healthcare system” is synonymous with “healthcare delivery”
  - Most approaches focus on the delivery of healthcare and do not always account for the support systems.
  - Too focused on “healthcare delivery” (inpatient and outpatient).

- Not Knowing All Stakeholders or sub-systems.
  - Missing stakeholders.
  - Focused on sub-systems.
  - Missing linkages/interdependencies of stakeholders.
  - Lack of understanding/education of relationships of all stakeholders.
Shortfalls of Current Strategies

- Disparate Data & Metrics
  - Too little data (or none) for some stakeholders.
  - Too much data/metrics for some other stakeholders.
    - Don’t effectively use the data at their disposal
  - Data is not:
    - Clean.
    - Commonly shared amongst stakeholders.
    - Timely to make effective/rational decisions.
    - In a format the receiver(s) can use to make effective/timely decisions.
Shortfalls of Current Strategies

- Not knowing impact on larger system view of healthcare
  - Not knowing/planning for risk/cause & effect to sub-systems and high order systems.
  - Not understanding the chain reaction of a decision throughout all impacted parties.
  - Not planning for bullwhip effect (variability) throughout all the system participants.

- Disparate Communication
  - Lack of communication/integration of sub-systems into high-order systems.
A True System’s Approach to Healthcare

Healthcare Provider(s)

Accreditation Agencies
State Regulations
Healthcare Reforms
Federal Regulations

Health Plan Insurers
CMS

Healthcare Delivery

Inpt Healthcare Provider(s)
Outpt Healthcare Provider(s)

Payers

Research Institutions
Academic Institutions

Regulatory/Legal

Manufacturing/Supplies

Medical Supply Mfg/R&D
Medical Device Mfg/R&D
Pharma Mfg/R&D
Nutra Mfg/R&D

Research/Teaching

EMR Providers
Provider IT Systems

Society

Patient & Family
Global Society
US Society

HIT/HIM
A True System’s Approach to Healthcare

All of the components of the proposed model would have the following foundational supports:

- **Linkages** between all stakeholders and sub-systems to share data.
- **Transmit data** in a user-friendly and **real-time** manner.
- **Linkages** between all stakeholders and sub-systems to have real-time communication.
- All stakeholders understand the role of each stakeholder in the sub-system and system as a whole.
- **Feedback loops** established and maintained between all stakeholders.
- **Collaborative planning** between all stakeholders to plan and minimize risks and “chain reactions.”
- **Able to zoom out/zoom** into a particular section of the system in order to understand a specific scenario and see the bigger picture and the “in the weeds” picture as needed for the scenario at hand.
A True System’s Approach to Healthcare

- **Data governance and transmission.**
  - Need to **establish clear channels to transmit data/metrics** between stakeholders.
  - Need to **establish a structure of shared data governance** to ensure proper volume, velocity, and variety of data and metrics.
  - Establish a standard structure for data and metrics to ensure **data and metrics are “clean” and “user friendly.”**
  - **Feedback loops** that can be used for stakeholders to provide feedback to transmitters of data and metrics.
A True System’s Approach to Healthcare

- **Understand the linkages and chain reaction of decisions** and changes throughout the larger system.
  - For example: a change to FDA regulations impacts Pharma manufacturing, which in turn impacts healthcare delivery in any form which in turn impacts health plans and reimbursement.
    - If change is not communicated timely, then it can ripple out to the entire system and many stakeholders.
  - These chain reactions happen so often and while they cannot be prevented, we need to have a system view that enables the stakeholders to proactively plan and prepare for these reactions.
A True System’s Approach to Healthcare

- **Collaborative planning & communication** of all stakeholders would enable:
  - Needs to be established AND maintained.
  - Proactive risk planning/mitigation.
  - Improved:
    - Communication
    - Governance and transmission of data/metrics
    - Continuous improvement in the system
    - Feedback loops for data, information, changes, decisions, metrics
  - Better ability to zoom in/zoom out in the system.
  - Understand the roles and linkages of all stakeholders.
  - Minimize impact of “chain reactions” and different level changes.
Systems Theory has a place & value in healthcare.

There are/have been many approaches of applying systems theory to healthcare, each with pros and cons.

To truly apply systems theory to healthcare:
- An approach that can see into the weeds and also the bigger picture.

The approached outlined here is a more holistic approach of applying system theory to healthcare.
- Needs to further be defined and validated through testing and inclusion of feedback from industry experts.
Thank You!!!

Any Questions?
References


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