Introduction to Complex Adaptive Systems

Session 5

November 13, 2019

CAS APPROACH: IMPLICATIONS FOR CANCER CONTROL

CAS Characteristics	Implications for Cancer Control
They are *nonlinear and dynamic* and do not inherently reach fixed equilibrium points. As a result, system behaviors may appear to be random or chaotic.	System responses often seem unpredictable and disproportionate to interventions. For example, enormous efforts are often needed to achieve small changes, while at times small improvements in treatment might lead to significant changes in clinical care.
They are composed of *independent agents* whose behaviors are based on physical, psychological, or social rules rather than the demands of system dynamics.	Stakeholders (patients, families, clinicians, suppliers, payers, regulators, etc.) respond based on their perceptions, values, and priorities, which are seldom aligned (e.g., payers might try to constrain short-term costs even when long-term health and economic benefits are easily projected).
Because agents' needs or desires, reflected in their rules, are not homogeneous, their *goals and behaviors are likely to conflict*. In response to these conflicts or competitions, agents tend to adapt to one another's behaviors.	Goals and behaviors of stakeholders often conflict. They may perceive these conflicts and adapt their strategies to counteract their impacts. For example, enormous resources might be devoted to advertising to convince patients of their need for products or services with questionable benefits.

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Agents are *intelligent.* As they experiment and gain experience, they learn and change their behaviors accordingly. Thus overall system behavior inherently changes over time.	As the rules of the system evolve and stakeholders understand the impacts of those rules, they might develop strategies to circumvent these rules, including lobbying to avoid rule changes or to change the rules to their benefit.
Adaptation and learning tend to result in *self-organization.* Behavior patterns emerge rather than being designed into the system. The nature of emergent behaviors may range from valuable innovations to unfortunate accidents.	Stakeholders adapt to the changing environment, learning what works and does not. These behaviors often surprise other stakeholders, who then also need to adapt. For example, industry agents might just pay penalties rather than change behaviors in response to rules in the system.
There is *no single point of control*. System behaviors are often unpredictable and uncontrollable, and no one is "in charge." Consequently, the behaviors of complex adaptive systems can usually be more easily influenced than controlled.	The health care system is a federation of millions of entrepreneurs with no one in charge. No single entity can command change. A portfolio of motivations, incentives, and disincentives is needed but would be difficult to design and deploy, particularly if stakeholders game the process.