

The use of systems thinking in public health strategy design

Joslyn Trowbridge
PhD Candidate
Social and Behavioural Health Sciences Division
CIHR Health System Impact Fellow
Dalla Lana School of Public Health
Joslyn.trowbridge@mail.utoronto.ca

What do I mean by 'systems thinking' (in public health)?

System - “a set of relationships between discrete things that together form some kind of coherent pattern and/or whole that is capable of maintaining itself through time” (Hammond 2010a, p. 17)

Systems thinking is a theoretical framework that posits that disease is “multifactorial, dynamic, and non-linear” and should be studied holistically (Lieschow et al. 2008, p. S197)

“a general conceptual orientation” (Trochim et al. 2006, p. 538)

“a paradigm or perspective” (Lieschow & Milstein 2006, p. 403)

“a family of analytic approaches” (Lich et al. 2013, p. 280)

“an organizing rubric for a confluence of trends” (Lieschow et al. 2008, p. S196)

Fundamental Premises

- Reality is seen in terms of wholes where the environment is an essential component. The environment is considered an essential factor that interacts with organisms in a living system, and it can both change and be changed by these organisms (Hammond 2010; Mabry, Olster, Morgan & Abrams 2008; Trochim et al. 2006).
- We can't understand the behaviour and characteristics of the whole system by studying its component parts in isolation (Leischow et al. 2008; Lich et al. 2013; Mabry et al. 2008).
- The study of relationships at multiple levels, from cell to society, is at the heart of systems science. The study of relationships is considered a distinct and legitimate form of inquiry (Lieschow & Milstein 2006; Mabry et al. 2008; Trochim et al. 2006).

Early debates

Reductionism vs. Holism in science and philosophy

Mechanicism vs. Vitalism in physics and biology

Open vs. Closed systems in biology

Etiology vs. Teleology in biology

Darwinian Evolutionary Biology vs. Ludwig Von Bertalanffy's Organismic Biology (led to General Systems Theory, 1968)

Observation vs. Experimentation as a research method

Tobacco Control Systems Model

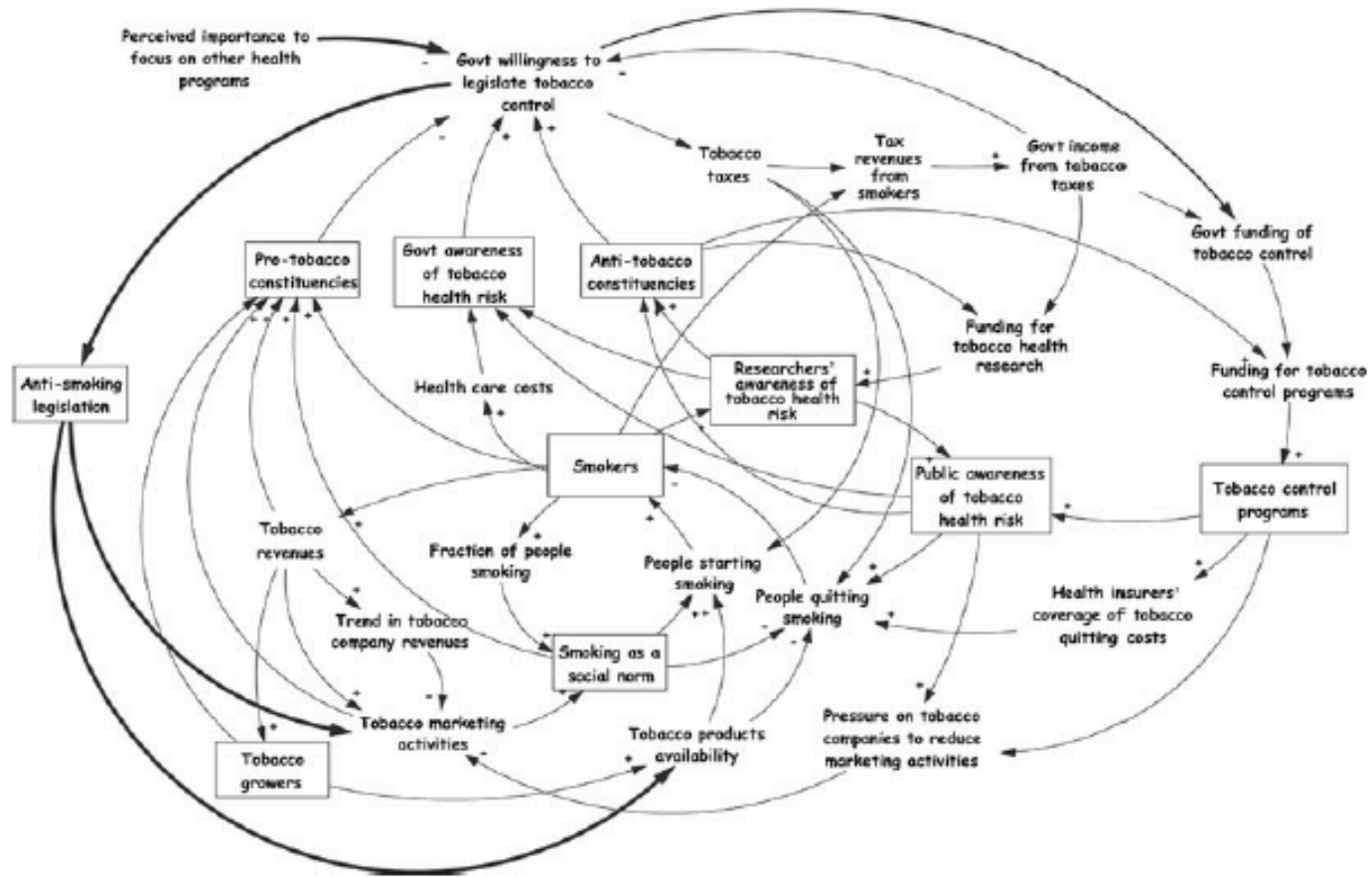


Figure 4

ISIS System Dynamics Model for Tobacco Control (112).

Properties of complex systems

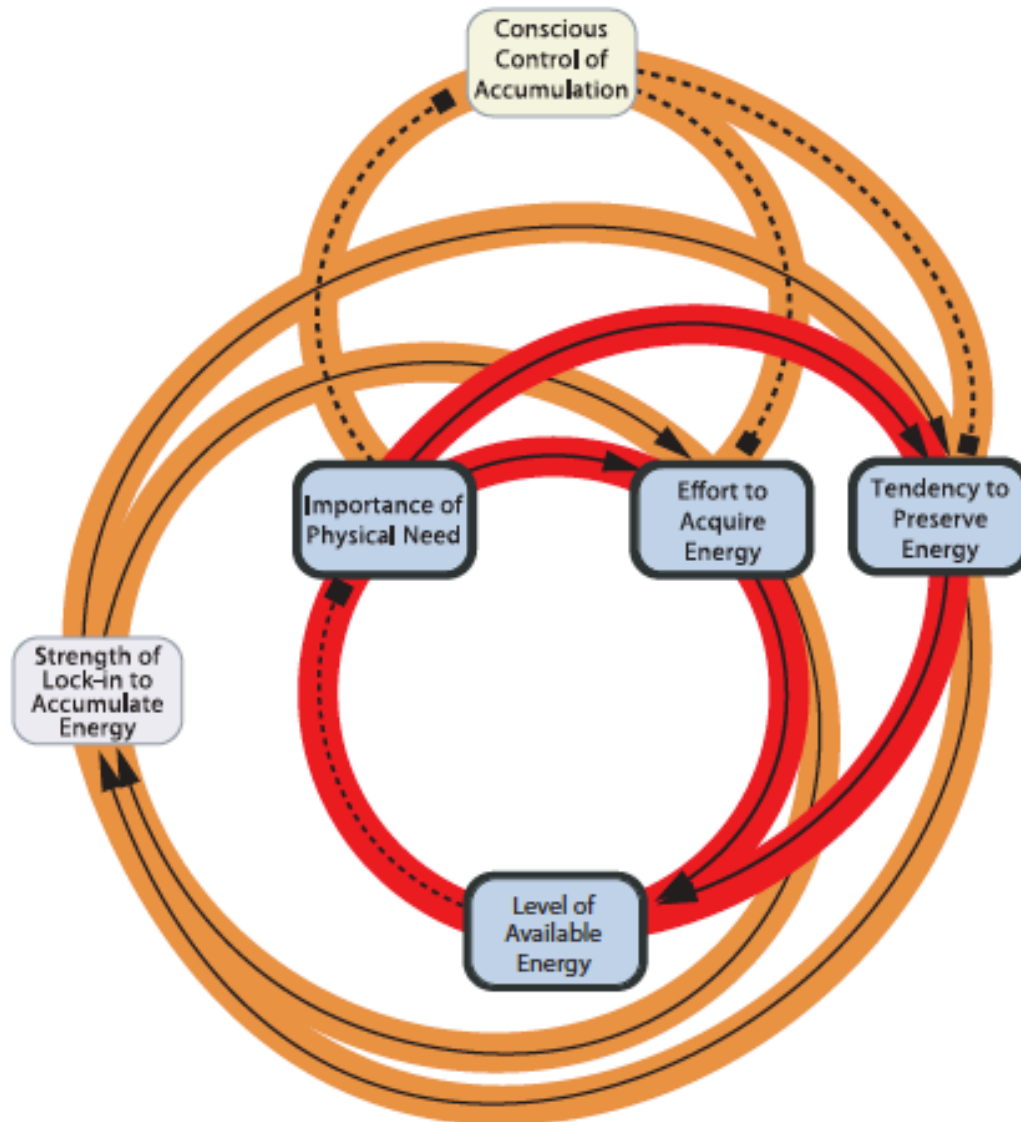
Heterogeneous	Contain many different structural units, such as subsystems, actors, environmental forces etc.
Dynamic and Interdependent	Elements interact with each other, making it difficult to predict what a change in one element will do to the other elements or to the system as a whole
Emergent	Interaction of elements produces emergent effects that can only be seen at the systems level
Nonlinear	The effect of a change in one variable is not proportional to the effect of change in another
Feedback Loops	Changes in elements in the system cause changes in other elements via closed chains or 'loops' of causal connections, with a stabilizing or destabilizing effect
Spontaneous Order	Can create new structures in response to the environment in which they are situated
Unpredictable	Randomness in systems change processes leads to a degree of uncertainty and unpredictability of the outcome
Embedded and Adaptive	Systems exist within other, larger systems and adapt to changing circumstances

(Finegood et al. 2014 and Luke & Stamatakis 2012)

Methods – ‘Hard’ and ‘Soft’ Modeling

- ‘Soft’ modeling uses systems concepts as an analytic and heuristic tool to map the system of the health issue
 - Participatory approaches, such as focus groups and stakeholder engagement, generate:
 - Structured concept maps
 - System maps
 - Causal loop diagrams of the elements and relationships in a system
- ‘Hard’ systems modeling refers to *simulation models* that “consist of a collection of mathematical equations that quantitatively map the relationships between a number of inputs and one or more outputs. Outputs from one set of equations can be used as inputs to a second set of equations” (Levy et al. 2011, p. 379)
 - Systems Dynamic Models
 - Agent-Based Models
 - Social Network Analysis

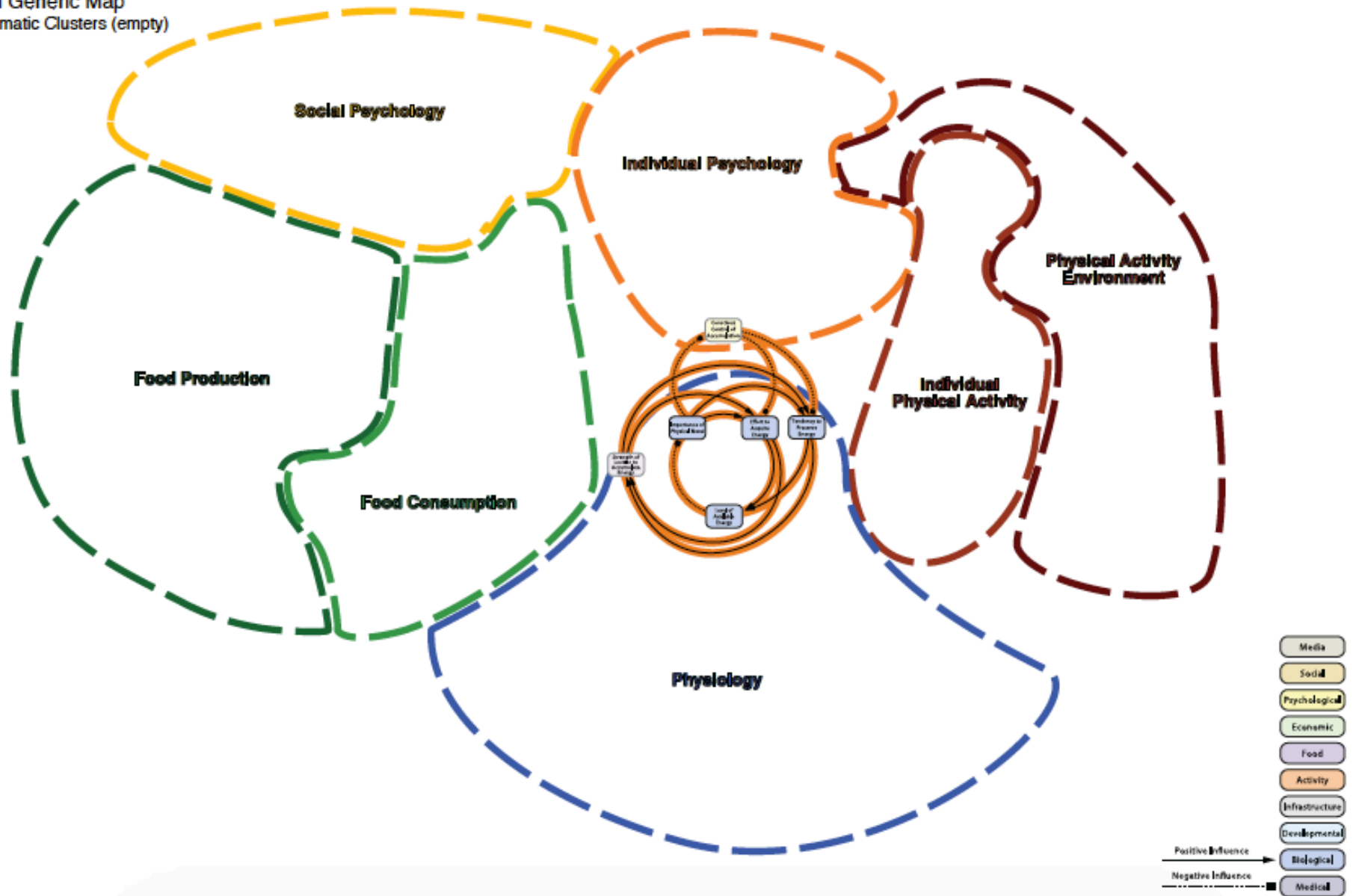
“System Engine” – Foresight Obesity System Map



Cluster Concept Map – Foresight Obesity System Map

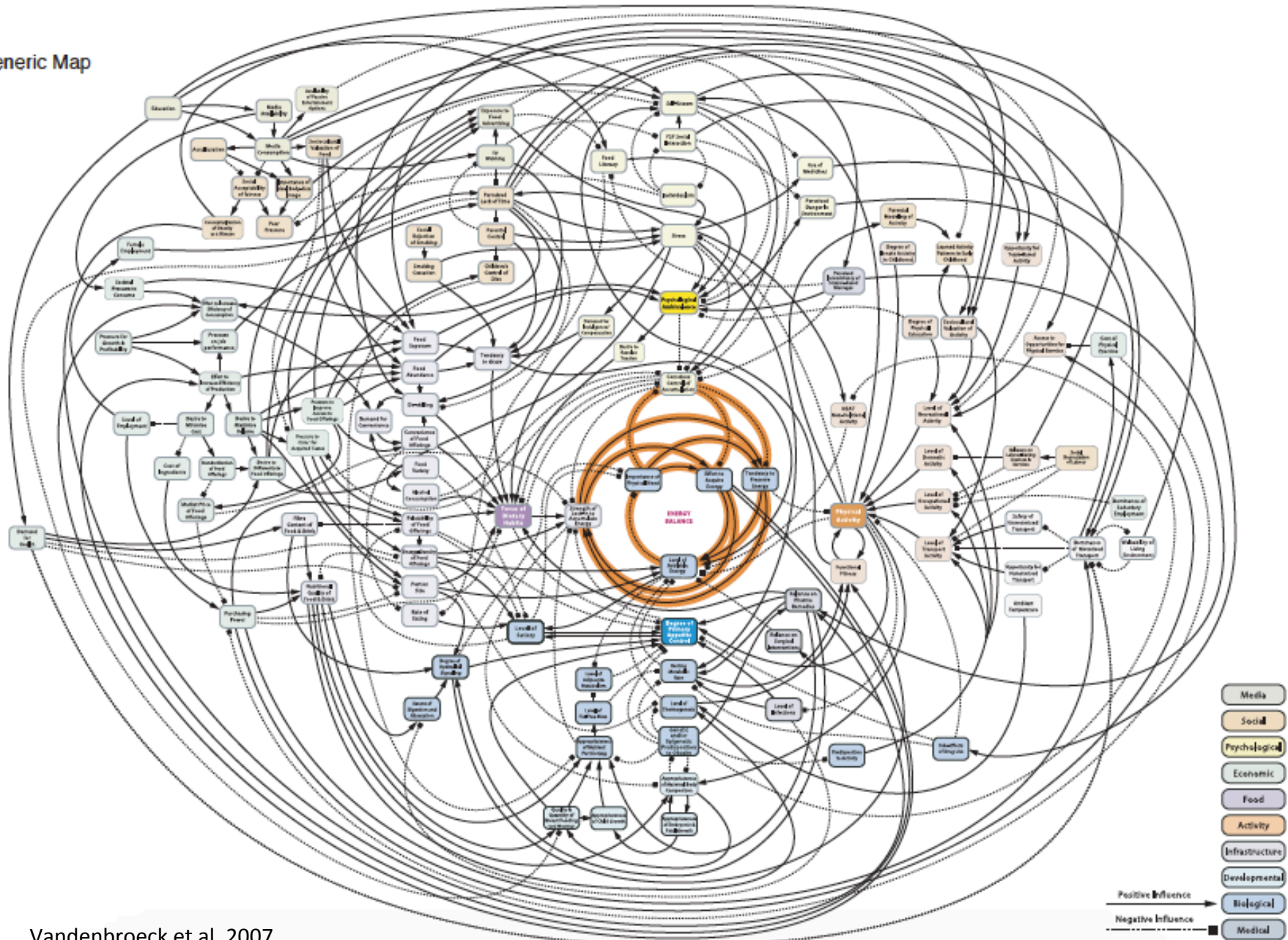
Map 4

Full Generic Map
Thematic Clusters (empty)



Full Causal Loop Diagram - Foresight Obesity System Map

Map 0
Full Generic Map



Where is systems thinking applied?

- 2006 – United States - *Systems Thinking in Tobacco Control* (National Cancer Institute 2007)
- 2007 - United Kingdom - *Foresight – Tackling Obesities: Future Choices* program (Vandenbroeck, Goossens, & Clemens 2007)
- Scoping Reviews:
 - Medical practice (Sturmberg et al. 2014)
 - Health services, organization and management (Brainard & Hunter 2016; Thompson et al. 2016)
 - Mental health (Langellier et al. 2019)
 - Adult and childhood obesity (Skinner & Foster 2013; Bagnall et al. 2019)
 - Chronic disease prevention (Littlejohns & Wilson 2019, Carey et al. 2015)

Why use it for designing public health strategies?

- To surface the need for coordinated interventions across multiple levels and sectors
- To overcome policy-resistance by illuminating where interventions may be defeated by the system's response to the intervention itself
- To respond to the complex interaction of social determinants
- **Not a silver bullet but a next step** in evolution of ecological approaches to health
 - Focus on interdependence of factors, feedback loops and emergent nature of system behaviour and thus causality
 - Includes individual at centre but looks at how far-away factors influence a) decision-making and b) the choices available

What do we know so far? A little bit about:

- How 12 obesity prevention strategies intervene on systems-level concepts – Intervention-Level Framework (Johnston et al. 2014)
- How systems approaches to obesity were theorized and translated into practice by staff across 9 sites of the “Healthy Towns” program in England (Sautkina et al. 2014)
- How staff (managers, leaders, and operational staff) interpreted and applied systems thinking concepts in one site of the “Healthy Together Victoria” program in Australia (Joyce et al. 2018)
- The thoughts of 62 policy makers, researchers and other stakeholders involved in health systems strengthening across 10 countries from the Eastern Mediterranean (El-Jardali et al. 2014)

Contextual factors influencing systems thinking uptake:

Barriers	Facilitators
Perceived costliness of methods and lack of funding	Willingness and interest to learn about systems thinking
Competing political interests and lack of accountability at different levels	Interest and ability to use new approaches for health system strengthening
Limited capacity to apply systems thinking concepts and tools	Technical and financial support for the broader application of systems thinking principles and approaches
Political instability and high turnover at government levels	Strong data sources and health information systems
Difficulty in coordinating and managing conflicts among health system stakeholders and procedural issues related to approvals across departments	Ability to act as “practice entrepreneurs” when given the freedom to use systems thinking concepts and methods (mapping, reflection) as they needed

Some potential issues:

“Despite having a general theoretical understanding of what [a systems] approach might entail, informants...instead described implementation in terms of delivery of a traditional multi-component approach, which excluded references to the key characteristics of systems, such as complexity. It was suggested that **a lack of clear and comprehensive guidance from central government** on how ‘systems-based’ environmental approaches should be designed and implemented partly contributed to this disconnection” (Sautkina et al. 2014, p. 62).

Skepticism about its value, seeing it as “a label given to a fairly commonsense approach to problem solving...that overintellectualised the process to the point of confusion” (Wutzke et al. 2016, p. 3)

Frustration at the **confusing language** associated with systems approaches and were unconvinced of the practical implications of translating systems thinking into “actions that are achievable and substantively different from current approaches” (ibid., p. 4)

Research underway:

- Whether, and how, government actors are using a systems thinking approach?
- Are there contextual factors that influence the uptake of systems thinking in policy environments?

Contact:

Joslyn.trowbridge@mail.utoronto.ca