

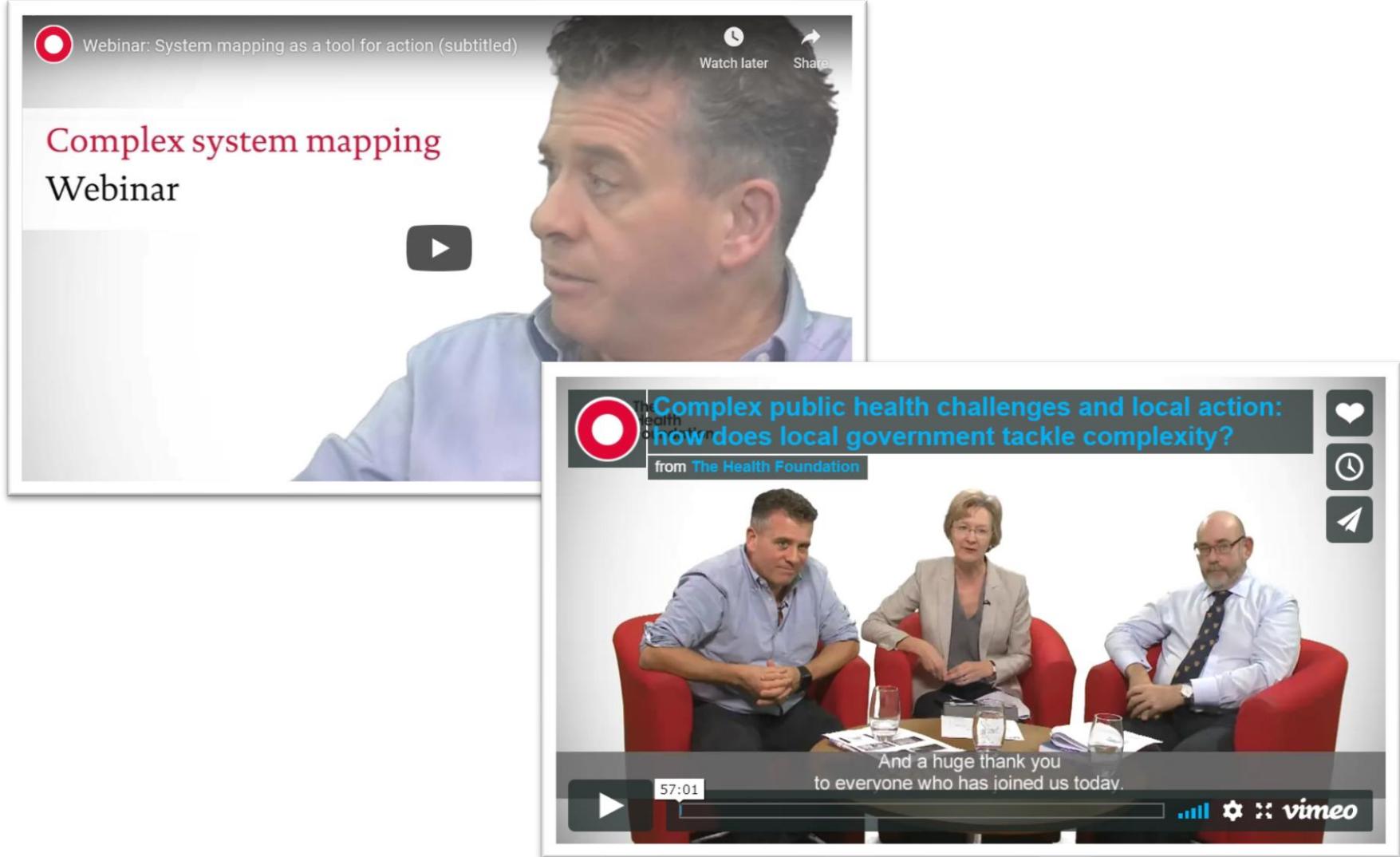
Evaluating complex systems approaches to improving health

20 March 2020

Louise Marshall, Senior Public Health Fellow,
The Health Foundation



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Webinar: System mapping as a tool for action (subtitled)

Watch later Share

Complex system mapping Webinar

Complex public health challenges and local action:
how does local government tackle complexity?

from The Health Foundation

57:01

And a huge thank you
to everyone who has joined us today.

vimeo



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- We will address a selection of the pre-submitted questions
- Submit technology questions via the box on your screen
- Join the conversation on Twitter #THFcomplexsystems

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Moving towards a complex systems approach to population health intervention research

Laurence Moore

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March 2020

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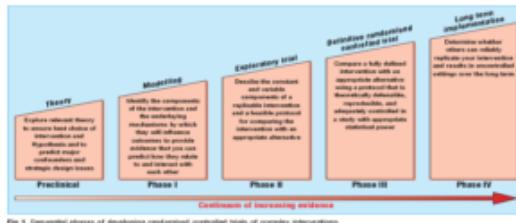
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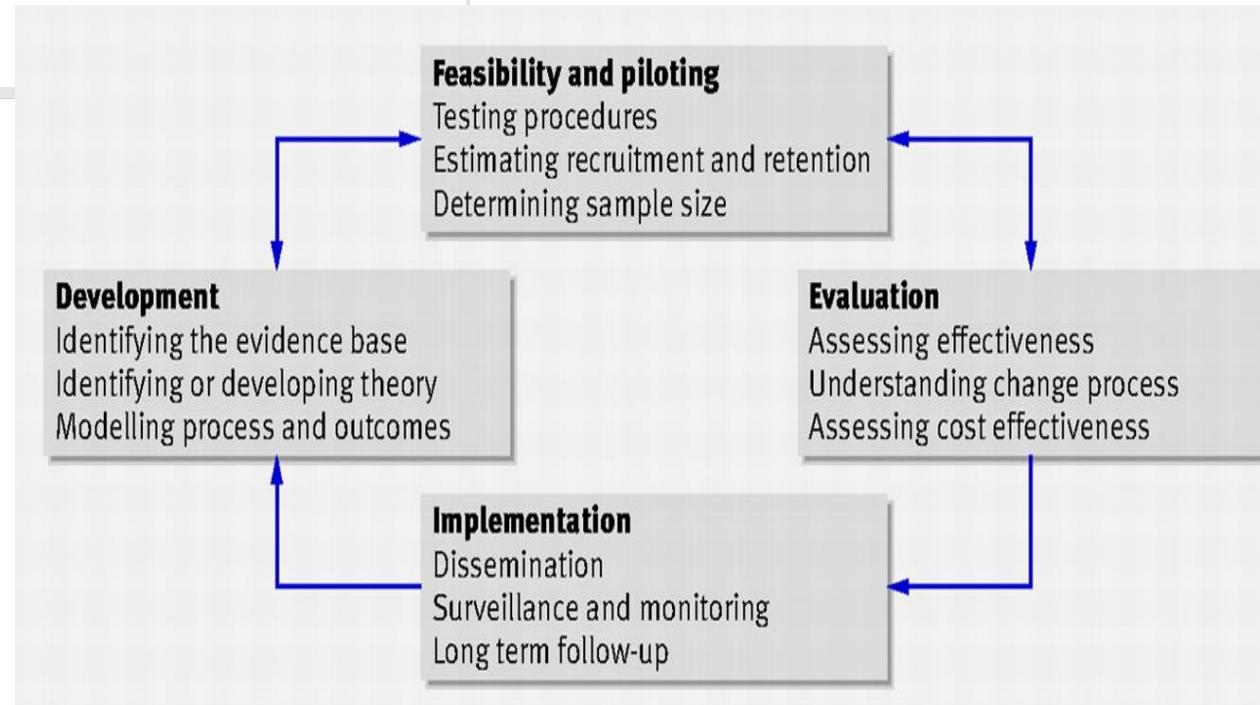
Framework for design and evaluation of complex interventions to improve health

Michelle Campbell, Ray Fitzpatrick, Andrew Haines, Ann Louise Kinmonth, Peter Sandercock, David Spiegelhalter and Peter Tyrer

BMJ 2000;321:694-696
doi:10.1136/bmj.321.7262.694



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Is this the effective solution?



- Many of the most promising interventions don't get / can't be evaluated in this way
 - Service and policy innovation
 - Complex population level policies
- Those that are identified as effective in a controlled trial then fail to replicate outcomes in the real world
 - Not implementable
 - Implementation failure
 - Not transferable across contexts
 - Wider system effects emerge
- Production line of 'effective interventions' that generally don't work!

Simple, complicated, complex...

Simple Flat pack furniture	Complicated Rocket to the moon	Complex Raising a child
The components and instructions are essential	Formulae are critical and necessary	Formulae have limited application. Adaptation and flexibility are key
If all the bits are there and instructions are followed in order, the result is consistent	Sending one rocket to the moon increases assurance that the next will be okay	Raising one child provides experience but no assurance of success with the next
No particular expertise is required but helpful to be good with an allen key	High levels of expertise in a variety of fields are necessary for success	Expertise can contribute but is neither necessary nor sufficient
Produces standardised furniture	Rockets are similar in critical ways	Every child is unique and must be understood and responded to as an individual
The designed furniture will be reproduced	There is a high degree of certainty of outcome	Uncertainty of outcome remains

Expanding on complexity

- Not just that interventions are complicated, with many components
- Complex interventions cannot be divided into discrete sets of actions with predictable, stable and linear consequences
- Rather they involve emergent, unpredictable, and non-linear associations between components and outcomes
- Complexity does not lie solely in the intervention, but crucially in its dependence on the wider system (health or education system, broader social systems)

Systems Approach

- A system: a set of things—people, cells, molecules or whatever, interconnected in such a way that they produce their own pattern of behaviour over time (Meadows, 2008)
- What works? → What contributes to improving the system in a positive way?
- Interventions conceived as interruptions in systems
- Outcomes emerge from the interaction of the parts of a system in ways that cannot be predicted from the properties of the individual parts; a system cannot be understood by breaking it down to its individual entities and studying each part separately.

... changes the focus of interventions

- From targeting individuals with interventions to bring about behaviour change
- To upstream action to create the conditions, contexts, relationships that support behaviour change

- From one-off brief interventions
- To systemic, sustained change in schools, workplaces, policy, culture

... changes the focus of evaluation

Is it effective?



Does it contribute?



Taking a systems perspective

- Implement 'complex systems approaches' to evaluation

'Rhetoric urging complex systems approaches is only rarely operationalised in ways that generate relevant evidence or effective policies.' (Rutter et al, 2017)

- Approaching all interventions through a **systems perspective** can encourage:
 - Researchers to develop research questions which take into account the wider contextual factors that influence an intervention.
 - Encourage researchers, funders, practitioners and policy makers to develop, evaluate and implement (whole) systems interventions.

Is it the intervention that's complex?



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Approach to evaluation

Approach	What does taking this approach look like for evaluation?
Efficacy	To what extent does the intervention produce the intended outcome in experimental settings?
Effectiveness	To what extent does the intervention produce the intended outcome in real world settings?
Theory-based	How do context and mechanisms interact to produce outcomes?
Systems	What contributes to changing the system (in a positive way)?

Is it the intervention that's complex? Or the evaluation perspective?

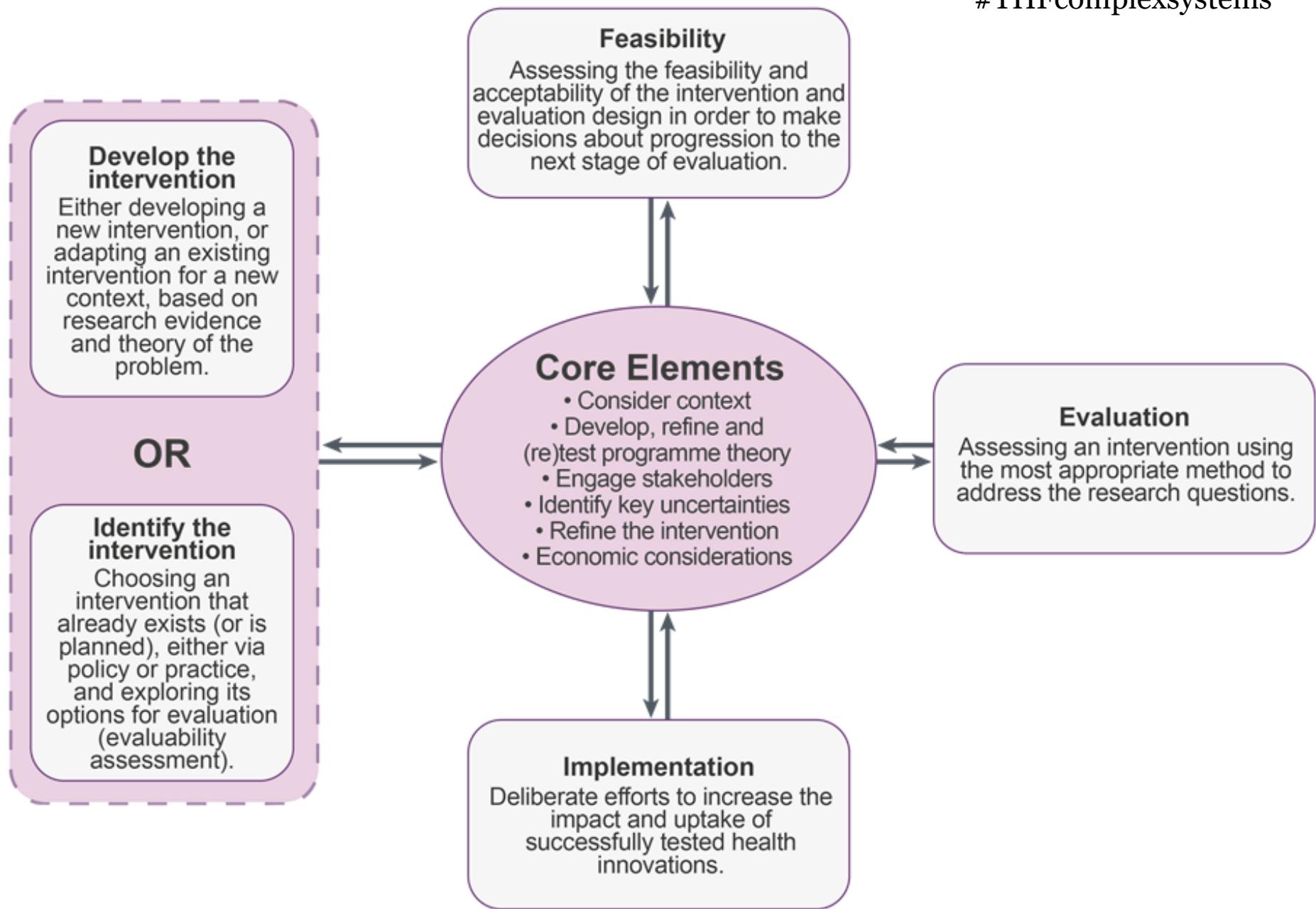
Evaluation Perspective	Intervention		
	Simple	Complicated	Complex / adaptive
Efficacy			
Effectiveness			
Theory / Realist			
Complex Systems			

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Complex Systems intervention example

- Assets based approaches to community development and place based intervention
 - A set of processes to engage with public and key stakeholders, identify their priorities, develop shared trust, identify key actions and take forward in partnership
 - Ownership, embedded, sustained
- Specific targets, actions, health outcomes cannot be prespecified and will vary across communities
- Continual adaptation, responsiveness, revision required
- Delivered intervention and achieved outcomes emergent

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Systems approaches to public health evaluation: What are they and how are they applied?

Vanessa Er

London School of Hygiene and Tropical Medicine



Acknowledgements

Work

- NIHR SPHR Guidance on systems approaches to local public health evaluation, Part 1 and 2.
- Evaluation of public health interventions from a complex systems perspective: a critical review of methods and findings

People

- Matt Egan, Elizabeth McGill, and Tarra Penney
- Systems Guidance Team: Mark Petticrew, Natalie Savona, Karen Lock, Steve Cummins, Richard Smith, Dalya Marks, Martin White, Margaret Whitehead, Jennie Popay, Rachel Anderson de Cuevas, Lois Orton, Frank de Vocht, Petra Meier, Harry Rutter and others.

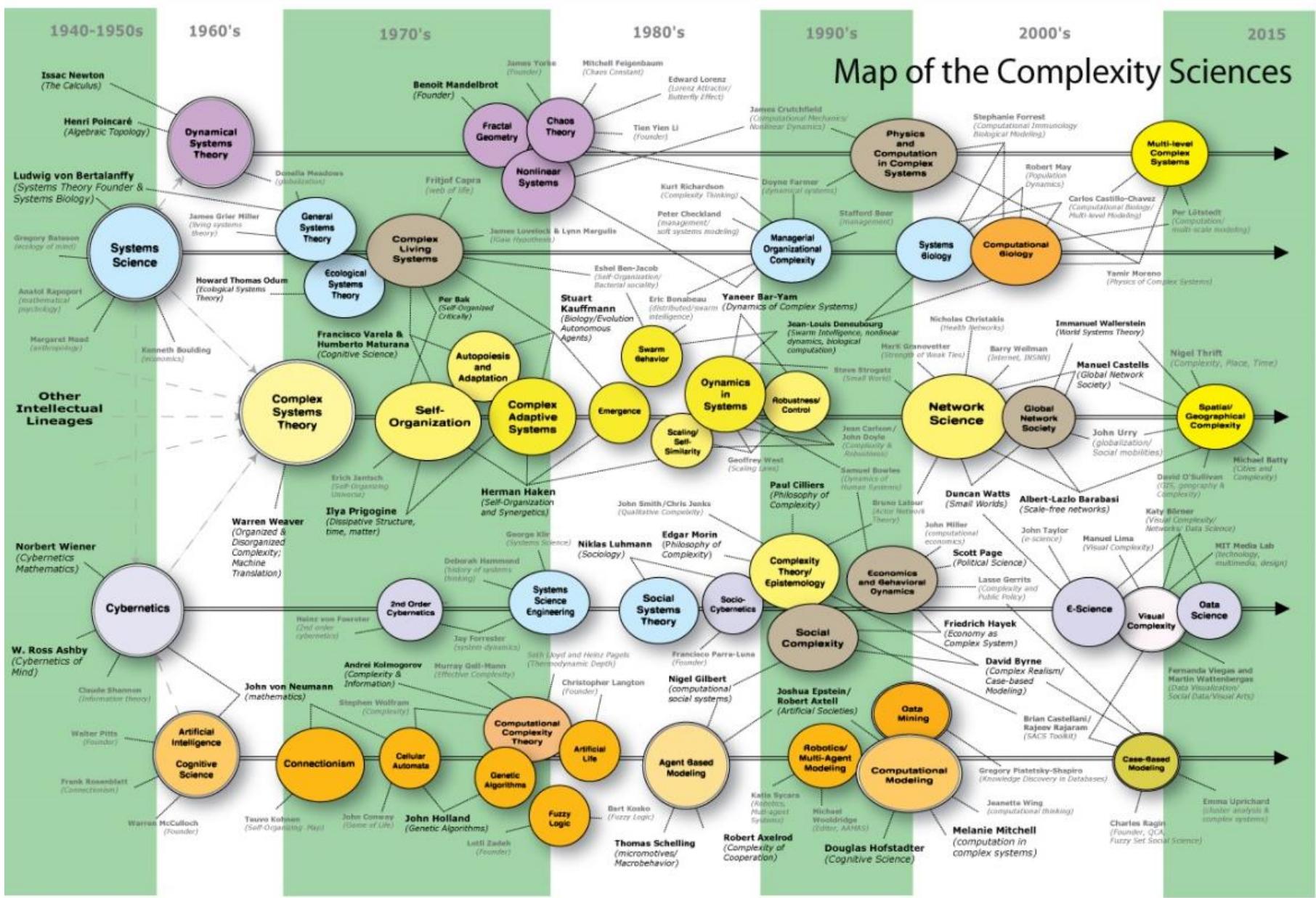




Outline

- Appreciate different schools of thoughts in the study of complex systems
- Recognise different methods to evaluation of public health interventions from a complex systems perspective
- Describe how these methods are applied





Brian Castellani (2019) Map of Complexity Sciences

Complex systems: Two traditions

See: Gates, EF (2016) Making sense of the emerging conversation in evaluation about systems thinking and complexity science. Evaluation and Planning.

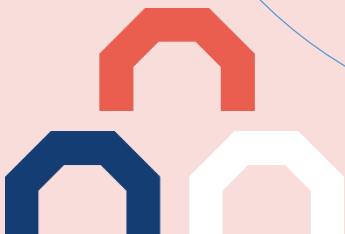


Systems thinking

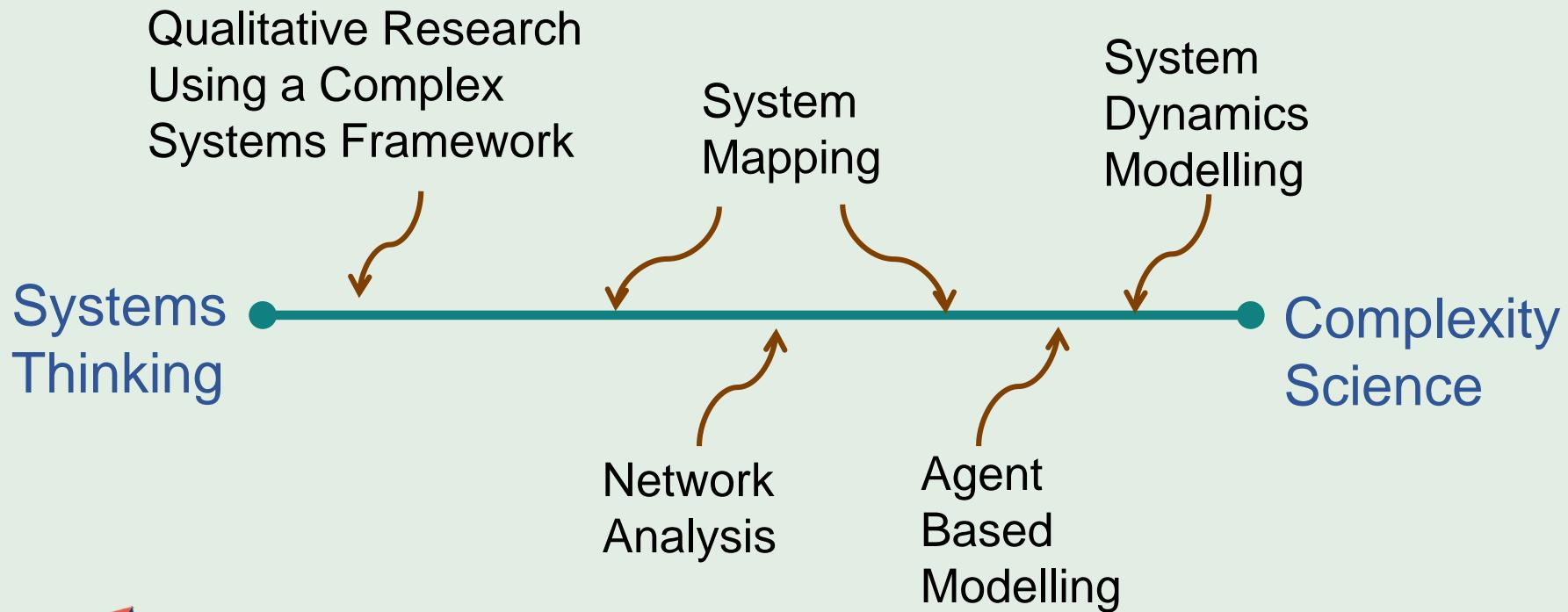
- Has much longer roots going back to Ancient philosophy: Aristotle, Heraclitus and Lao Tsu
- A collection of theories associated with different disciplines
- Including more qualitative approaches.

Complexity Science

- Developed in the twentieth century
- Strongly influenced by mathematics and uses computational modelling
- Applied to lots of other disciplines like biological sciences, physics, engineering, and social sciences.



What are the main methods?



How are they applied?

Qualitative Research
Using a Complex
Systems Framework

Systems Thinking

System Mapping

-
- The diagram illustrates a process flow. It starts with 'Systems Thinking' on the left, represented by a blue hexagon icon. A solid blue arrow points from 'Systems Thinking' to 'Qualitative Research Using a Complex Systems Framework', which is represented by a green hexagon icon. Another solid blue arrow points from 'Qualitative Research' to 'System Mapping', represented by a teal hexagon icon. A dashed blue line extends from the 'System Mapping' icon upwards and to the right, ending in a teal circle.
1. Starting point often the intervention
 2. Sampling wider group of stakeholders
 3. Could involve mapping the system
 4. Analysis may refer to specific systems theories and frameworks –e.g. Westhorp, Meadows, Finegood - or more adhoc
 5. Compare stakeholder perspectives
 6. Focus on events over time
 7. Adapt the evaluation over time

Example 1: Qualitative Research

Aim

Evaluate Connecting Communities (C2), a learning programme designed to create transformational community change

Intervention

C2 aimed to create the context for service providers to consult with their communities and ensure that service provision adequately responded to community needs.

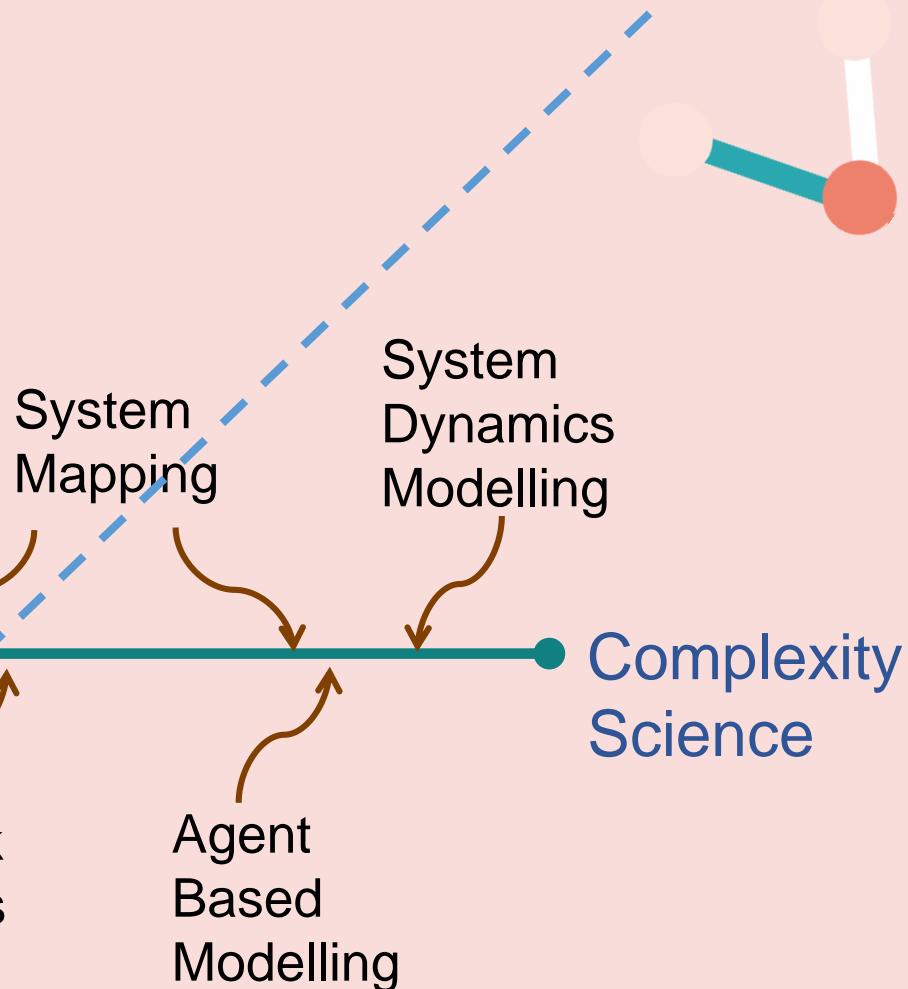
Case study design that used several qualitative and participatory research methods.

1. Semi-structured interviews with a range of actors in the system
2. Non-participant observation during course delivery, listening events and community partnership meetings.
3. Participants provided input into findings

Underpinned by Complexity Theory

1. dynamics of the system overtime as they changed and evolved in response to the intervention
2. relations between those living and working in the community

1. Starting point often an initial definition of the system and its boundaries
2. Formally structured mapping process – e.g. Group Model Building
3. System map made up of variables and causal relationships (e.g. stock and flow diagram).
4. Model the map. Use assumptions or data to give values to each part.
5. Run the model. Try varying specific values to simulate the effect of an intervention or a change in context.



Example 2: Agent-Based Modelling

Aim

Model the impact of sugar-sweetened beverage (SSB) warning labels on overweight and obesity prevalence among adolescents in three U.S. cities.

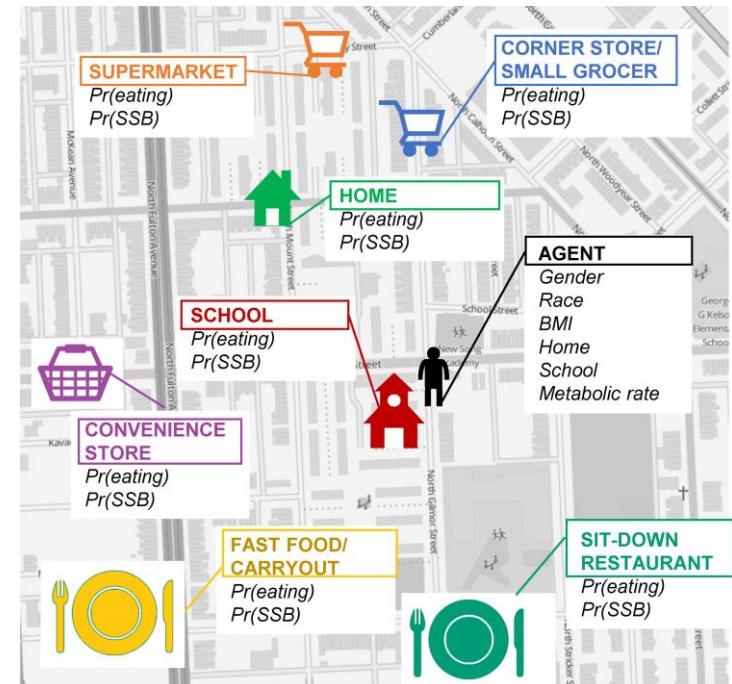
Intervention (Scenarios Modelled)

1. different levels of efficacy for a food labelling intervention,
2. compliance of food retailers,
3. compensatory eating, and
4. population characteristics such as illiteracy rates and socio-economic status.

Data

National Health and Nutrition Examination Survey for height, weight, and SSB consumption and purchasing habits

U.S. Census Bureau for sociodemographic characteristics and sources for the location of food retailers.



Summary

Stages of evaluation	Aim	System mapping	Qualitative systems evaluation	Network analysis	Agent based modelling	System dynamics modelling
Theorising	Identify and compare stakeholder understandings of a system.	•	•			
	Identify and compare stakeholder understandings of how a planned intervention might interact within a system.	•	•			
Prediction	Hypothesise and simulate how the intervention may impact on and interact with the system					•
	Hypothesise and simulate how agents within the system might react and interact in response to an intervention				•	
Process evaluation	Understand how an interaction has impacts within the system in the real world, including impacts of variation in local context		•	•		
Impact evaluation	Quantify the impact of the intervention on key system parameters in the real world					
Further prediction (extension of impact evaluation)	Hypothesise and simulate how the intervention may impact the system over a longer time horizon or in a different context.					•
	Hypothesise and simulate how agents within the system might react and interact in response to an intervention over a longer time horizon or in a different context.				•	

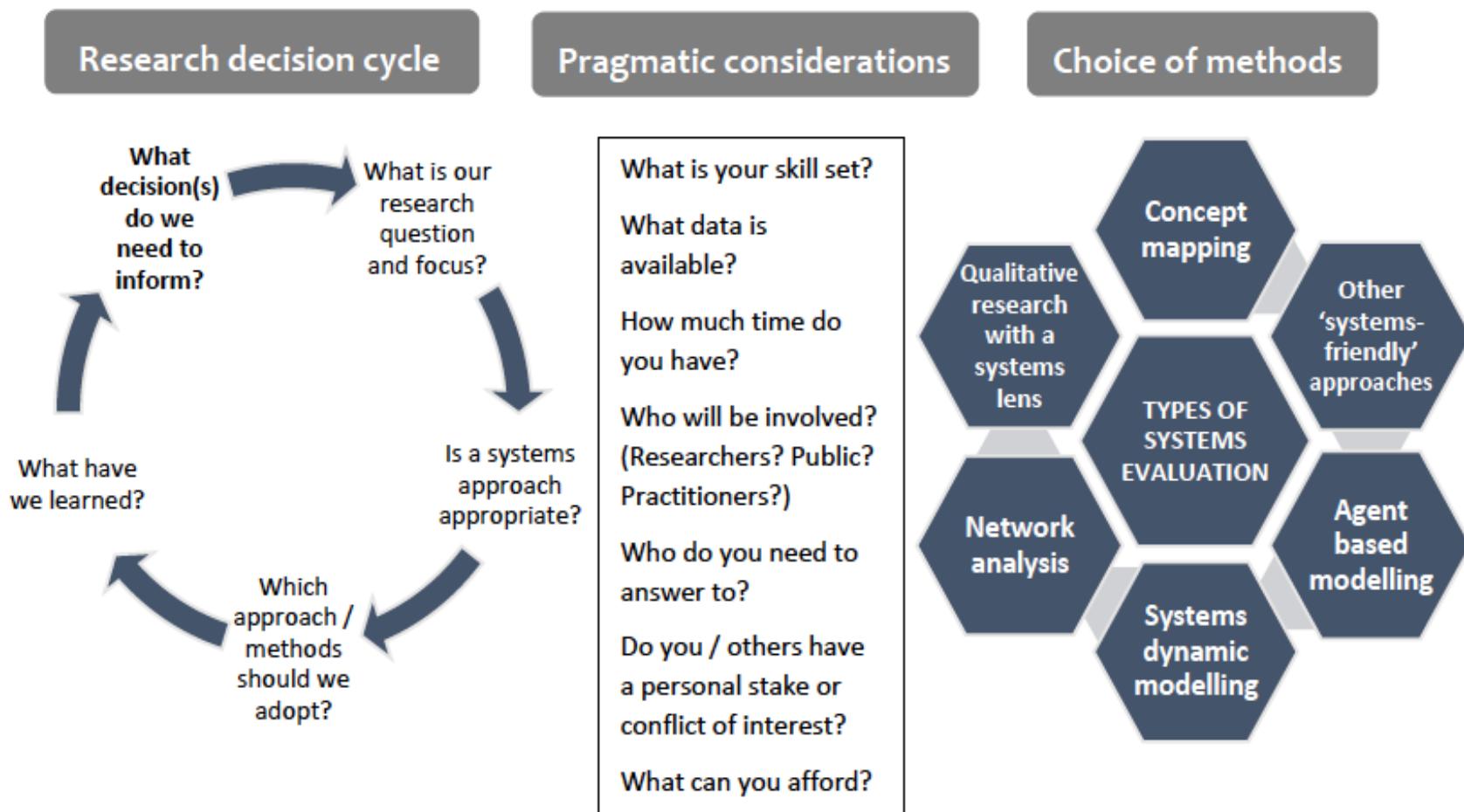
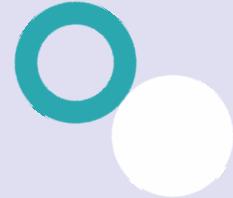
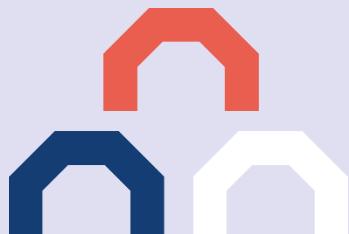


Figure 1: Planning a systems-informed evaluation: decision cycle, practical considerations and methodological choices.

Reflections



- Widen scope of evaluation – beyond the intervention
- Explicit about the approach taken and underpinning theory
- Room for development and innovation - theories and methods



Q&A

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Timescales

- How to meaningfully evaluate complex systems in the long term when planning and budgets are done on year-by-year base? (managing conflicting long term vs in-year priorities)
- How to navigate evaluations with politicians that are focused on seeing quick, clear change in mid/long term outcomes and/or the bottom line (e.g. reduced CVD and reduced spending)?

Inequalities

- Are systems approaches suitable for understanding health inequalities and how to change them at local, community levels, taking account of how they are situated more broadly?

Complexity and 'overwhelm'

- How do we achieve a balance between understanding the complexities of factors that contribute to public health issues (e.g. obesity), whilst not becoming 'overwhelmed' by the complexity of the problem? Both from a research and a policy/ practice perspective?

Theories of change

- How do theories of change or conceptual models fit into evaluating a systems approach?

Uncertainty

- How are you accounting for uncertainty and how it is impacting the effectiveness of your approaches and interventions in your assessment?
- Complex Systems are dynamic and adaptive, with unintended consequences of actions. How can you still define appropriate indicators/measurements for systems change a-priori, in particular when trying to measure systems beliefs or goals?

Method

- What are the strengths and limitations of using Agent Based Modelling (ABM)/ SD/ Bayesian approaches to help describe a system's behaviour?
- I would be keen to hear about the use of novel methods in evaluating change within systems approaches. I've read the SPHR document which eludes to novel methods, but doesn't provide too many examples for these.

Attribution / what can't be evaluated

- How can you isolate the impact of your actions when there are many other parallel or overlapping actions which may also impact on your measure of success?
- Are we clear on what elements of the approach can be evaluated and what elements are unrealistic to evaluate in practice?

Resource / skills

- How best can you undertake an effective whole systems evaluation with limited resources/funding?
- What skills are needed to do systems evaluations?

Stay in touch

Ways of staying involved / learning more:

- Register for updates:
www.health.org.uk
- Get in touch:
info@health.org.uk



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Thank you

