

How evidence informed decision-making can take a systems perspective: the implications of systems thinking for public health evaluation

Elizabeth McGill ^{1,2} and Mark Petticrew ^{1, 2,3, 4}

1. Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine (LSHTM)
2. NIHR School for Public Health Research, LSHTM
3. Policy Innovation Research Unit, LSHTM
4. Public Health Research Consortium



Outline

- Background to systems thinking and complexity theory
- Some shortcomings of traditional evaluation methods for generating evidence
- A few examples:
 - The late night levy
 - Alcohol advertising restrictions
 - (Sugar levy)
- Mapping complex systems perspective onto research questions and types of evidence



Systems

- Definition: “a system is a set of things – people, cells, molecules or whatever – interconnected in such a way that they produce their own pattern of behaviour overtime” (Meadows 2008, p.2)
- Roots:
 - Aristotle, Heraclitus and Lao Tsu
 - 20th century: Ludwig von Bertalanffy and Alexander Bogdanov:
 - Fields: approximately 50 different ones, including: management, organisational change, biology, economics, computer science, engineering, computer science, physics, mathematics, etc. (Allender et al., 2015)
 - Applications in health: health systems, primary care, tobacco control, obesity, infectious diseases
- ‘Systems thinking’ or ‘systems science’ or ‘a systems perspective’ or ‘a systems orientation’: “a sizeable and amorphous body of theories, methods and tools” (Peters 2014):
 - Relationships and interactions
 - Multiple perspectives
 - Boundaries



Complexity

- Complexity science is located within the wider field of systems thinking (Walton 2016; Midgley 2007)
- “When we talk about complexity we are talking about systems” (Byrne and Callaghan 2014)
- Like systems thinking, this is not a coherent body of thought (Walton 2014)
- “Within public health a trickle of interest [in complexity] has turned into a river” (Matheson and Walton et al, 2017)
- Complexity science/theories: ideas and theories to address non-linearity and dynamism of real world systems (Sturmberg and Martin 2013)
- Emphasis on:
 - Social phenomena that emerge from interacting elements within a social system (e.g. obesity) (Matheson and Walton et al, 2017)
 - Context in which the system is situated; context may change behaviour of system components (Anderson et al., 2005)
 - Relationships and interactions (Anderson et al., 2005)
- Useful as an *explanatory* theory, rather than a predictive one (Thompson et al., 2016)

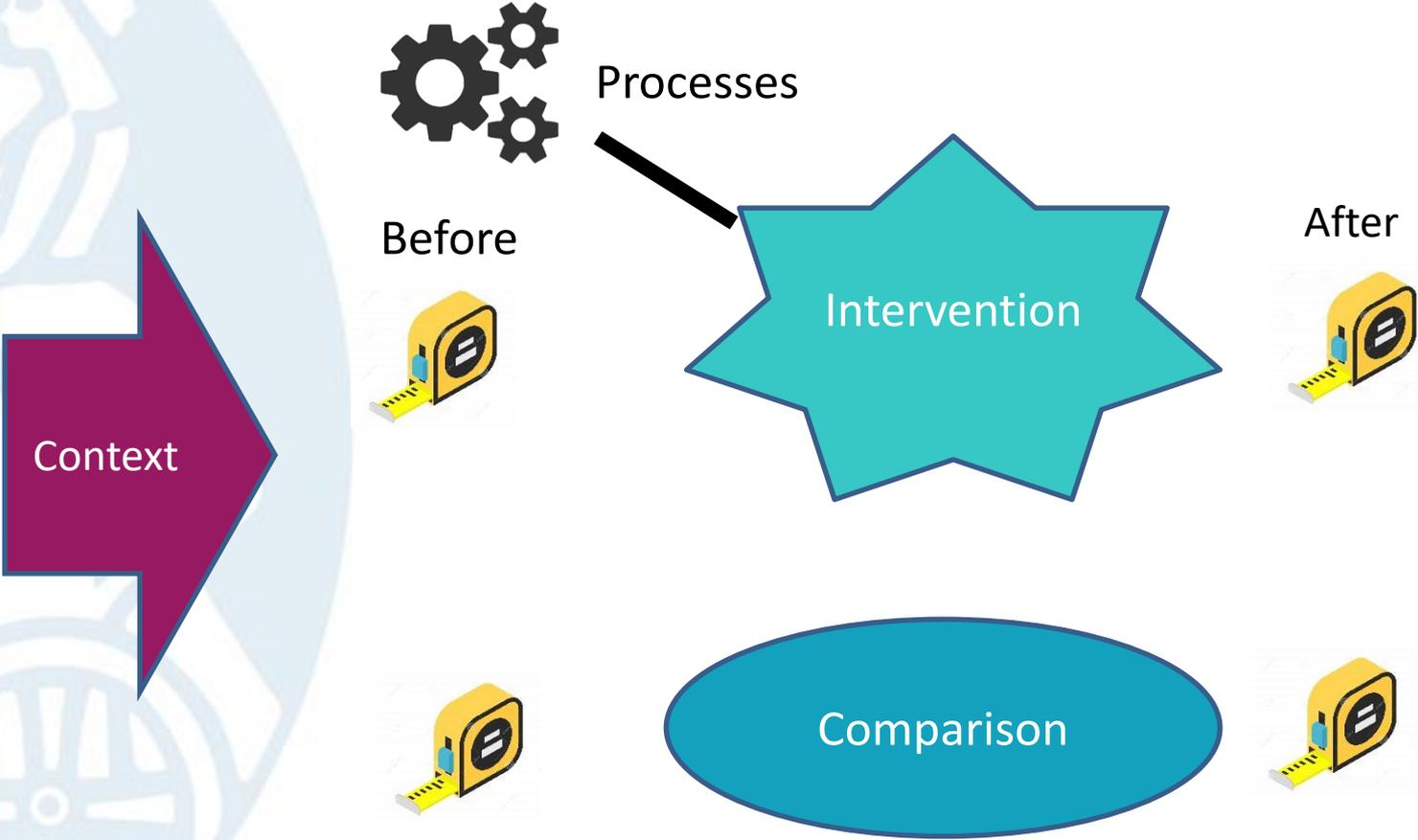


Complex (adaptive) systems

“Complex adaptive systems are composed of a diversity of agents that interact with each other, mutually affect each other, and in doing so generate novel behaviour for the system as a whole. But the pattern of behaviour we see in these systems is not constant, because when a system’s environment changes, so does the behaviour or its agents, and, as a result, so does the behaviour of the system as a whole. In other words, the system is constantly adapting to the conditions around it. Over time, the system evolves through ceaseless adaptation.” (Ragin and Lewis)

- Some key features (Finegood et al., 2014):
 - Non-linear
 - Feedback loops
 - Dynamic
 - Adaptive
 - Emergent properties

Evaluation



Is there a problem?

These kinds of evaluations, done well, minimise bias and can tell us:
how, why and what works

But there are *limitations...*

- The concept of **'the intervention'**
- **'Primary outcomes'** measured at **specific time points**
- Limited opportunity to test **alternative scenarios** linked to **incremental decisions or developments**
- **'Crisis of replicability'**—robust, narrow estimates of effects that, in a complex world, are not replicable



Evaluation in complex systems

- Past 10-15 years: “repeated appeals to the complexity sciences to inform evaluative practice” (Mowles 2014):
 - Assess multiple outcomes
 - Move away from linear thinking
 - Produce richer theories of explanation
- Evaluation using a complex systems lens (Finegood et al., 2014):
 - Involve range of stakeholders and different perspectives
 - Understand intervention and its context:
 - Involves understanding relationships, interdependencies and structures and feedback
 - Create non-linear theories of change
 - Conduct both process and outcome evaluations that draw on mixed methods
 - Should focus on contribution rather than attribution



What does a systems perspective add to evaluation? (1)

- **'System Map'**: how the different parts (people, organisations, interventions) of the system relate to each other and how those relationships can change
- Complex **causal pathways** and **alternative pathways**
- The **Big Picture**: e.g.
 - Activities that **'swim against the tide'**?
 - **Who's interests** are being served by specific approaches?
 - **Stepping stones** – small activities that could lead to larger initiatives
- **Trade Offs**
 - If you prioritise resourcing X, what has been deprioritised?



What does a systems perspective add to evaluation? (2)

- More comprehensive understanding of **impacts**
 - **Larger range** of impacts – both anticipated and unanticipated
 - Understanding what **amplifies** or **dampens** those impacts (feedback loops)
- Transferable **explanations**



Misleading simplicity: The Cochrane review of Alcohol Advertising restrictions

Alcohol industry: advertising does not increase consumption (“encourages choice between brands”)

Cochrane Review question:

“[Does] banning or restricting the advertising of alcohol in any form ...lead to people drinking less

alcohol. The form of the ban could include banning alcohol advertisements on television, the internet or billboards, or in magazines. We were also interested in the harms that banning advertisements may cause, such as reducing profits in the alcohol and advertising industries, and whether governments would lose taxes if alcohol purchases went down after a ban.”

Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents (Review)

Siegfried N, Pienaar DC, Ataguba JE, Volmink J, Kredo T, Jere M, Parry CDH



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2014, Issue 11

<http://www.thecochranelibrary.com>

LONDON
SCHOOL of
HYGIENE
& TROPICAL
MEDICINE



- **Results:** “We included one small RCT (80 male student participants conducted in the Netherlands and published in 2009) and three ITS studies (general population studies in Canadian provinces conducted in the 1970s and 80s)”.
- **Conclusion:** “The review cannot recommend for or against banning alcohol advertising. Governments that are considering implementing alcohol advertising bans would be advised to implement the ban in a research environment and monitor the effects over time to build the evidence base”.



Does restricting alcohol advertising reduce consumption?

- The review found few small outcome evaluations; no firm evidence
- However the review identifies just one part of the system, and a set of individual-level outcomes
- A system-level analysis (and many 100's of scientific analyses of advertising) tells us that advertising is *not only* about individual-level consumption; it is also intended to influence social norms, shaping individuals, communities, politicians

Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents (Review)

Siegfried N, Pienaar DC, Ataguba JE, Volmink J, Kredt T, Jere M, Parry CDH



THE COCHRANE
COLLABORATION®

LONDON
SCHOOL of
HYGIENE
& TROPICAL
MEDICINE



- Drinking outcomes are important; but also knowledge, awareness, and exposures in the alcohol environment
- Evidence of this alcohol **system** comes from qualitative studies, analysis of industry materials & advertising practices, marketing literature, extrapolation from other industries, annual reports
- All these tell us what we know about the nature, purpose, and effects of advertising (and indirectly about the potential effect of restrictions)
- We shouldn't make a large judgement about a system change (marketing restrictions) solely on the basis of a small number of small epidemiological studies

Alcohol advertising and public health: systems perspectives versus narrow perspectives

M Petticrew,¹ I Shemilt,² T Lorenc,³ T M Marteau,⁴ G J Melendez-Torres,⁵
A O'Mara-Eves,² K Stautz,⁴ J Thomas² *J Epidemiol Community Health* 2016



Two linear, non-systems perspectives on alcohol advertising and drinking

- **Industry:** Advertising → Brand choice
- **Academics:** Advertising → Drinking



- Restrictions on alcohol marketing are a system-level intervention.
- They aim to change the alcohol system (at many levels) – it is inappropriate and misleading to judge this policy intervention solely against behavioural outcomes (i.e., consumption)
- Same applies to many other PH interventions – they aim to create **systems, and system coherence, in order to shape health-promoting processes (and ultimately outcomes)**



Budget 2016

George Osborne unveils sugar tax in eighth budget as growth forecast falls

- Proceeds of levy on soft drinks to fund school sports
- Cuts to business rates, capital gains and corporation tax
- Income tax personal allowance increased
- Growth forecast down from 2.4% to 2%



This article is 1 year old

< 2,060 1,009

Katie Allen, Anushka Asthana and Rowena Mason

Wednesday 16 March 2016 14:58 GMT



Osborne announces soft drinks sugar tax and tax-free personal allowance - budget highlights video

George Osborne has unveiled a new tax on sugary drinks, such as Coca-Cola, Red Bull and Irn Bru, pledging to use the takings to provide more sports funding for schools.

The policy, described by Conservative colleagues as “nanny statism at its worst”, was a centrepiece of a [wide-ranging budget](#) in which Osborne cut key taxes but warned of slower economic growth.



Another example: Sugar levy on sugar-sweetened beverages (SSBs)



- **Individual-level perspective:** “Does it work?” (i.e. does it reduce consumption, and obesity), *versus (or as well as!)*
- **System perspective:** What happens within the system when a levy is introduced?



Some additional processes and outcomes to include from a systems perspective...

- Impact on consumption; obesity (Individual level outcomes)
- Inequalities in obesity
- Individual level substitution, from fizzy drinks to cheaper fizzy drinks; or to water
- Substitution within the overall diet (if you drink less sugar, do you compensate elsewhere in your diet?)
- Public acceptability of the levy, and of other taxes may change
- Norms around sugar consumption may change (e.g. fruit juices)
- Manufacturing and Retail System changes: Manufacturers and retailers may react by absorbing the tax, but increasing prices of other products; by reformulating to reduce sugar in drinks; by reducing sugar in other snack products (e.g. baked goods)



Finally

- Complexity is a perspective, not an inherent property of interventions – so there is usually no easy separation into complex/non-complex interventions
- Useful to start by asking what value it might add (if any) to an evaluation
- It is always useful to consider how any intervention fits with the wider system (how are its effects modified by the wider system?)
- Sometimes the ‘intervention’ is not externally applied – it may be the change within the system itself





Thank you!

Any questions?

elizabeth.mcgill@lshtm.ac.uk

mark.petticrew@lshtm.ac.uk

LONDON
SCHOOL of
HYGIENE
& TROPICAL
MEDICINE

