

The use of a complex systems perspective in public health process evaluation research: a systematic review protocol

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BACKGROUND

A scientific interest in describing and analysing complex systems is not new (1), although until recently the approach has been utilised largely by those in the natural sciences (2), or disciplines such as engineering and economics (1). Since the turn of the twenty-first century, however, there has been a large growth in 'systems research' within the social sciences (2-4). De Savigny and Adam (2009) have argued that more recently, the health sector has become interested in systems-oriented research and applied the perspective to the study of health systems and to health challenges that affect a range of sectors and stakeholders, such as obesity and tobacco control. For example, in the UK, a systems perspective has been utilised to map the determinants of obesity in the Foresight project by visually mapping a range of variables that affect obesity and by charting their relationship to other variables within the system (5).

While there is no single definition of a complex system, all descriptions underscore a group of elements who interact and influence each other. For example, Ackoff and Emery (1972) define a system as a "set of interrelated elements, each of which is related directly or indirectly to every other element, and no subset of which is unrelated to any other subset" (6 p.15). Rickles and colleagues (2007) have expanded on this definition, defining complex systems as "highly composite ones, built up from very large numbers of mutually interacting subunits (that are often composites themselves) whose repeated interactions result in rich, collective behaviour that feeds back into the behaviour of the individual parts" (7 p.933). This latter definition highlights a key feature of complex systems: the emergence of collective system behaviour that influences how individual elements within the system behave. Byrne and Callaghan (2014) argue in their recent book on the 'state of the art' in social science complexity theory that "when we talk about complexity we are talking about systems" (p.3) and that complexity theory is best conceptualised as a type of conceptual framework that is used to provide an ordering logic to the analysis of complex systems and the relationships between agents within the system that give rise to emergent system properties. In this perspective, the framework provided through complexity theory is used to generate "theoretical explanations" (8). That is, a complexity theory lens provides a means by which the researcher generates theory to describe and explain system characteristics, behaviour and emergent properties.

The systems perspective has been seen as particularly valuable within the context of intervention research as a means to move away from reductionist evaluative approaches (4) that focus on a small number of pre-defined outcomes (6). Advocates of applying complexity theory to studying interventions argue that this perspective can lead to more pluralistic, appraisals of how specific initiatives may impact across multiple outcomes and contexts (3, 4, 6, 9-12). Those who advocate a systems approach to conceptualising interventions have argued that reductionist analyses provide limited insights into dynamic systems. Complexity theory has been seen as an opportunity to create more holistic representations of dynamic systems, and to situate systems, their elements and relationships within broader historical, political and social contexts (1, 12, 13). The complex systems approach has been advocated as a framework that encourages researchers to unpack processes by which interventions may lead to a range of outcomes as they are introduced into a system that is

characterised by non-linear relationships, feedback loops, adaptation and emergent properties. In this sense, the complex systems perspective is a framework which can address the challenges in understanding what lies in the 'black box' between intervention outputs and changes within a system (1).

One challenge facing evaluators who study interventions implemented into complex systems is that quantified effect sizes stemming from the intervention may not be replicated in other settings due to differences in local context and the implementation of the intervention (14). As a result, the most transferable findings from an evaluation of an intervention within a complex system are likely the theories that seek to explain how the intervention can impact the system into which it is introduced, changing relationships between system actors and resulting in system-level changes.

Some researchers have also argued that more traditional evaluations, which focus on measuring the changes in a small number of pre-defined outcomes stemming from interventions, may produce misleading results because they fail to take into account the system into which interventions are introduced, and the system-wide changes that may occur following the introduction of an intervention. Proponents of this perspective have argued that utilising a systems lens to analyse system-level interventions means that researchers analyse effects on the system as a whole, relevant sub-systems and individuals (15).

Others, such as Diez Roux have argued that utilising a complex systems perspective is particularly applicable to public health research (10). One key characteristic of the public health approach is that individuals and environments interact with one another and influence each other's characteristics and behaviours. The complex systems approach therefore provides a theoretical framework for me to explicitly draw out how individuals and 'the system' interact and influence each other (10).

While there has been an increased interest in applying a systems approach to public health process evaluation, to date, no comprehensive review has been undertaken to take stock of the literature base. Such a review was recently conducted for health services literature (16), but a gap remains in the public health literature. As such, the aim of this review is to identify public health process evaluations undertaken to date in order to identify the characteristics of this literature, to understand how they utilise a complex systems approach within evaluation and to analyse the qualitative methods used to date. This review will both provide an up-to-date view of the use of systems thinking and complexity science in public health process evaluation and inform an on-going programme of evaluations of local-level alcohol interventions in the UK.

METHODS

1) Review questions

The review questions were developed in order to provide an overview of the current literature on the use of a complex systems approach within public health process evaluations, and to understand the qualitative methods which have been utilised within this field of research. The questions that this systematic review will aim to answer are:

1. In which fields of interest to public health has a complex systems approach to process evaluation been utilised?

2. What qualitative methods have been used in this body of literature?
3. Which aspects of systems thinking and complexity theory do researchers operationalise and how?
4. What are the disciplinary origins of these studies?
5. What does a good quality process evaluation with a complex systems lens look like?

2) Searching

- Systematic reviews:

Walton 2014 and Carey et al. 2015 published reviews relevant to this body of work. This review will utilise the Walton and Carey et al.'s reviews as a starting point. Walton's review aimed 'to identify themes to be considered in applying a complexity frame of reference to evaluation' (17 p.120). His review drew on complexity theory, although he also incorporated a limited number of systems terms. The review was restricted to evaluations, or theoretical articles about the value of applying complexity theory to evaluation. Carey and colleagues conducted a systematic review that aimed to '(1) explore how systems methodologies are being applied within public health and (2) identify fruitful areas of activity' (18 p.2). The review utilised mostly 'systems' terms, including specific systems methodologies; however, 'complexity science' was also included as a search term. The review searched both academic databases and grey literature sources, including public health conference proceedings. Carey and colleagues included all types of public health studies, including some public health evaluations.

- New searches:

Databases: Scopus, Medline, Web of Science; search 2014 – present (September 2019)

Scopus:

1) Complex systems:

"system theory" OR "system thinking" OR "system science" OR "complex system" OR "system* modeling" OR "system dynamics" OR "system approach" OR "system lens" OR "system perspective*" OR complexity OR "complexity theory" OR "complexity science*" OR "complex adaptive system"

2) Evaluation:

evaluation OR evaluating OR evaluate

3) Health

"public health" OR "health promotion" OR "health inequality" OR "health inequity" OR "health behavior" OR "well being" OR wellbeing OR nutrition OR obesity OR "fast food" OR sugar OR salt OR tobacco OR smoking OR cigarette OR alcohol OR "illegal drug" OR "illicit drug" OR "recreational drug" OR "social determinant" OR crime OR "community safety" OR transport OR planning W/3 town OR planning W/3 city OR planning W/3 neighborhood OR planning W/3 urban OR renewal W/3 town OR renewal W/3 city OR renewal W/3 neighborhood OR renewal W/3 urban OR redevelopment W/3 town OR redevelopment W/3 city OR redevelopment W/3 neighborhood OR redevelopment W/3 urban OR regeneration W/3 town OR regeneration W/3 city OR regeneration W/3 neighborhood OR regeneration W/3 urban OR revitalization W/3 town OR revitalization W/3 city OR revitalization W/3 neighborhood OR revitalization W/3 urban OR "urban health" OR housing W/3 improvement OR home W/3 improvement OR rehousing OR "housing refurbishment" OR "home refurbishment" OR "housing modification" OR "home modification" OR "healthy home" OR

“healthy housing” OR “affordable housing” OR “affordable home” OR “housing intervention” OR education OR “whole school” OR school W/3 environment OR greenspace

MEDLINE

1) Complex systems:

“system* theory” OR “system* thinking” OR “system* science” OR “complex system*” OR “system* model?ing” OR “systems* dynamics” OR “system* approach” OR “system* lens” OR “system* perspective” OR complexity OR “complexity theory” OR “complexity science*” OR “complex adaptive system*” OR systems Theory/ OR systems Analysis/ OR nonlinear dynamics/

2) Evaluation:

Evalat* OR “policy evaluat*” OR “prog* evaluat*” OR “formative evaluat*” OR “process evaluat*” OR “outcome evaluat” OR context evaluat* OR evaluation studies as topic/ OR programme evaluation/

3) Health

"public health" OR "health promotion" OR "health inequality*" OR "health inequalities*" OR "health inequity" OR "health inequities" OR "health behavio?r" OR "well-being" OR wellbeing OR nutrition OR obesity OR "fast food*" OR sugar OR salt OR tobacco OR smoking OR cigarette* OR alcohol OR "illegal drug*" OR "illicit drug*" OR "recreational drug*" OR "social determinant*" OR crime OR “community safety” OR transport* OR planning ADJ3 town OR planning ADJ3 city OR planning ADJ3 neighbo?rhood OR planning ADJ3 urban OR renewal ADJ3 city OR renewal ADJ3 neighbo?rhood OR renewal ADJ3 urban OR redevelopment ADJ3 town OR redevelopment ADJ3 city OR redevelopment ADJ3 neighbo?rhood OR redevelopment ADJ3 urban OR regeneration ADJ3 city OR regeneration ADJ3 neighbo?rhood OR regeneration ADJ3 urban OR revitali#ation ADJ3 city OR revitali#ation ADJ3 neighbo?rhood OR revitali#ation ADJ3 urban OR “urban health” OR housing ADJ3 improvement* OR home* ADJ3 improvement* OR rehousing OR “home* refurbishment” OR “housing modification*” OR “home modification*” OR “healthy home*” OR “healthy housing” OR “affordable housing” OR “affordable home*” OR “housing intervention*” OR education OR “whole school” OR school ADJ3 environment OR greenspace OR housing/ OR public housing/ OR crime/ OR city planning/ OR urban renewal/ OR education/ OR schools/ OR urban health/ OR fast foods/ OR tobacco/ OR smoking/ OR electronic cigarettes/ OR substance-related disorders/ OR street drugs/ OR alcohol drinking/ OR alcoholism/ OR “social determinants of health”/ OR public health/ OR health promotion/ OR health status disparities/ OR health behavior/ OR obesity/ OR smoking cessation/

Web of Science

1) Complex systems:

TS = (“System* theory” OR “System* thinking” OR “System* science” OR “Complex system*” OR “System* model\$ing” OR “System* dynamics” OR “System* approach*” OR “System* lens” OR “System* perspective*” OR Complexity OR “Complexity theory” OR “Complexity science*” OR “Complex adaptive system*”)

2) Evaluation:

TS = (Evaluat* OR “Policy evaluat*” OR “Prog* evaluat*” OR “Formative evaluat*” OR “Process evaluat*” OR “Outcome evaluat*” OR “Context evaluat*”)

3) Health:

TS=(“Public health” OR “Health promotion” OR “Health inequality” OR “Health inequalities” OR “Health inequity” OR “Health inequities” OR “Health behavio\$R*” OR “Well-being” OR Wellbeing OR Nutrition OR “Fast food*” OR Sugar OR Salt OR Tobacco OR Smoking OR Cigarette* OR Alcohol OR “Illegal drug*” OR “Illicit drug*” OR “Recreational drug*” OR “Social determinant*” OR Crime* OR

"Community safety" OR Transport* OR Planning NEAR/3 town OR Planning NEAR/3 city OR Planning NEAR/3 neighborhood OR Planning NEAR/3 urban OR Renewal NEAR/3 town OR Renewal NEAR/3 city OR Renewal NEAR/3 neighborhood OR Renewal NEAR/3 urban OR Redevelopment NEAR/3 town OR Redevelopment NEAR/3 city OR Redevelopment NEAR/3 neighborhood OR Redevelopment NEAR/3 urban OR Regeneration NEAR/3 town OR Regeneration NEAR/3 city OR Regeneration NEAR/3 neighborhood OR Regeneration NEAR/3 urban OR Revitalization NEAR/3 town OR Revitalization NEAR/3 city OR Revitalization NEAR/3 neighborhood OR Revitalization NEAR/3 urban OR "Urban health" OR Housing NEAR/3 improvement* OR Home* NEAR/3 improvement* OR Rehousing OR "Home* refurbishment*" OR "Housing modification*" OR "Home* modification*" OR "Healthy home*" OR "Healthy housing" OR "Affordable housing" OR "Affordable home*" OR "Housing intervention*" OR Education OR Whole school OR School NEAR/3 environment OR Greenspace)

- Expert consultation:

The search strategy will be complemented by consultations with a range of experts who have an interest and experience in the field of systems evaluation. These experts will be identified by the broad SPHR study team and then each expert will be contacted and asked for examples of what they consider to be important systems-level evaluations.

3) Study selection

All process evaluations that use qualitative methods and draw on a complex systems approach will be included in the review. A distinction will be drawn between evaluations of complex interventions, and studies that draw on complexity theory to evaluate either simple or complex interventions. The former will be excluded if complexity is only being used to describe the nature of the intervention; whereas the latter will be included within the review. Studies from any country are eligible for inclusion, although the search will be limited to English-language publications. Policy fields relevant to public health will be included as follows:

Included policy fields:

- Housing
- Policing, community safety, crime prevention
- Public health
- Health promotion
- Urban planning and regeneration
- Alcohol licensing
- Food licensing
- Community-based drug treatment and rehabilitation
- Trading standards
- Tobacco control
- Social welfare
- Employment
- Transportation
- Sexual health
- Built environment
- Education
- Environmental health

Excluded policy fields:

- Health care
- Health services

Included methods: any qualitative methods; and the evaluation must have a substantive qualitative component if it is mixed (qualitative and quantitative) methods.

Abstracts will be screened by a single reviewer (EM or TP). All full text references will be double-screened (EM, TP, VE or ME). Any disagreements will be resolved by discussion with the review team.

4) Data extraction and analysis

Data will be extracted from each study on the following:

- Study characteristics (authors, year, setting)
- Research question / aim
- Intervention details
- Disciplinary background
- Application of complex systems thinking
- Methods and analytical approach
- Types of findings

All included studies will have data extracted by one reviewer (EM) and double checked by a second (ME); any disagreements will be resolved through discussion with the review team.

The studies will be appraised based on the extent to which they apply concepts from systems thinking and complexity science – list to be developed. Studies will get a colour-coded mark; red means no application of the concept; amber means implicit application or done in a partial manner; green means full and explicit application. This will be done independently by two appraisers (EM, DM, and ME) – disagreements will be resolved through discussion.

The discussion will focus on the lessons that can be drawn from the current literature base in order to design future process evaluative that utilise qualitative methods and a complex systems lens.

DISSEMINATION

The review will be written as an academic article and submitted to a peer-reviewed journal. It will also form part of EM's PhD thesis as a framework for the case study work. The findings will also be disseminated through conference presentations and abstracts.

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