

Perspectives

Reducing social inequalities in obesity: complexity and power relationships

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Introduction

Over the past decade, the public health literature has tended to consider public health interventions as being implemented within a complex environment.^{1–4} This is especially true for obesity, where the evidence is compelling both in terms of the increasing levels of obesity and in inequalities in the burden of obesity. Indeed, the latest commentary on a World Health Organization (WHO) report on childhood obesity argues that it is a ‘multi-dimensional’ challenge.⁵ More broadly, some have argued that we need to conceptualize a ‘fifth wave’ of public health where we are now grappling complex issues that require very different methods and solutions to what have been tried in the past.^{6,7}

Increasingly more sophisticated frameworks describing the causes of the obesity epidemic are becoming widely accepted such as causal web or socioecological models that depict multiple causal factors and relationships. Among other things, these factors include the relationship between genes,⁸ environment *in utero*,⁹ individual behaviour,¹⁰ family behaviours and circumstance,¹¹ features of the community,¹² social networks and capital,¹³ national economic wealth¹⁴ and human rights,¹⁵ global¹⁶ and technological trends¹⁷ as well as the physical environment such as access to green spaces and proximity to healthy foods.¹⁸ The temporal dimension of these relationships is also gaining greater credence through life course¹⁹ and inter-generational perspectives.²⁰

Even with these shifts in knowledge, the obesity challenge is still frequently framed as an issue that is complicated, rather than complex.^{21,22} This paper argues that the significance of recognizing obesity as a complex issue is that causal interactions are non-linear and are driven by processes of emergence. Indeed an emergent outcome evident in the social patterning of the obesity epidemic is that social disadvantage is compounded for those also experiencing the greatest burden of obesity.

A crash course in the behaviour of complex systems

Complexity theory and other theories of complex adaptive systems have been widely utilized within the physical and biological sciences, where the study of interactions is commonplace. The social sciences have flirted with the use of these theories, particularly using dynamic systems modelling to explore the interactions of social variables. To date, however, work in understanding how the underpinning concepts of complexity translate to social systems has been limited.^{23–25} Interestingly, a number of influential social theorists have indirectly created ways of thinking about the problem of emergence—a central concept within complexity theory.^{26–28} And some have described complexity theory as providing more than merely a reformulation of other social theories which are ‘... *descriptive* theories of a particular phenomenon or of the *status quo*, rather than *prescriptive* of how to change ... [original emphases]’.²⁶

This prescription that complexity theory offers on ‘how to change’ sees systems as exhibiting behaviour that is independent of the qualitative nature of that system—for example, biological systems where cells interact through chemical signalling or weather systems driven by the interaction of water and temperature. Concepts such as emergence, feedback, self-organization, strange attractors and sensitivity to initial conditions are shared by, and between, biological, physical and social systems. However, it is the interaction between these system behaviours and the specific features of a system that drive the emergence of properties, patterns and structures.

Table 1 illustrates some of these independent behaviours and their implications for intervening to reduce social

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Table 1 Principles of 'system behaviour' and implications for interventions to reduce obesity

<i>Principle of system behaviour</i>	<i>What it means for systems</i>	<i>What it means for obesity interventions</i>
Strange attractors	Systems overlap, interrelate and adapt to each other and have trajectories over time.	Makes explicit the uncertainty involved in achieving social goals in the long term. Even 'simple' interventions such as healthy food in schools or community exercise programmes need to also have a long-term system focus where they are connected to each other and able to adapt to changes in their surrounding environments.
Strong emergence	Highlights how systems relate and adapt to each other.	Puts an emphasis on relationships between local information and the actions of social agents from policy, political and economic sectors.
Self-organization	Emergent properties result from undirected actions.	Implies difficulty in controlling social actions and interactions. Problems and solutions at an individual and small group level are often unknowable and immeasurable. Suggests formative approaches to intervention at the local level might be important.
Sensitivity to initial conditions	Sensitivity describes the impact of initial conditions on a system trajectory.	Sensitivity can result in the reinforcing or compounding of disadvantage for a population. Suggests an approach to methods of intervention that is locally intensive but that considers wider system relationships as integral.
Feedbacks	Negative feedback reinforces the status quo. Positive feedback supports change processes.	For communities, there is feedback that is easily identifiable such as the formal mechanisms of organizations such as evaluations and contracting processes. But there is also feedback that occurs in less identifiable places such as informal relationships, the physical environment or information and evidence systems. Feedback processes can also be transformational for systems—highlighting the need for community empowerment that considers critical relationships from the local perspective.

inequalities in rates of obesity. Non-linearity, for example, is about the processes involved in strong emergence. Strongly emergent properties result from the interactions of large numbers of parts. This does not mean that things have just become more complicated with greater numbers but rather that the rules have changed, meaning that methods and theories of explanation must also change. In systems that exhibit strong emergence, there is a process of 'downward causation' where emergent properties impact on the micro-level interactions creating feedback which again influences the 'whole'.²⁹ Galea and colleagues¹ describe how individual exercise patterns are linked to the risk of obesity, but also that obesity is a determinant of individual exercise patterns. This type of emergence contrasts to weak emergence where there is only influence from micro levels to the whole.

The processes involved in emergence encompass concepts such as strange attractors—organizing principles that depict complex, non-linear motions in systems and show their long-term behaviour.²³ Society can be viewed as diverse 'attractors' that interact with each other and thus change shape.³⁰ Self-organization describes the inner workings of a system where parts or components interact in non-linear ways.³¹ Self-organization in social systems ensures that real systems

are often unknowable and immeasurable suggesting intervention approaches that are adaptive and locally intensive.²⁴

Self-organization resulting in complexity relies on large numbers of interacting lower level parts, will usually exhibit a number of levels of emergent 'wholes' and is made up of positive and negative feedbacks. Negative feedback in social systems can be seen in societal institutions operating in ways that reinforce social norms, limiting the opportunity for adaptation that could shift the circumstance of a community from the status quo. Positive feedback, on the other hand, occurs when a change is reinforced rather than mitigated. For example neighbourhood renewal interventions aim to increase social capital and improve the ability of communities to adapt.³² However, this ability to adapt can still be inhibited—and communities 'locked' into their current circumstances—if surrounding systems, and in particular, the policy organizations that fund and evaluate the interventions do not respond appropriately to information that they produce.^{24,25,33}

The temporal dimension of complex systems is captured through sensitivity to initial conditions which describes the relationship between initial conditions and the whole system. While short-term system behaviour may be accurately followed, prediction of the longer term behaviour of system

trajectories becomes impossible. Therefore, even if we know the state of the system very precisely at a particular moment, its future trajectory cannot be predicted. This makes explicit the uncertainty involved in achieving social goals in the long term.³⁴ Implications for reducing rates of obesity include avoiding long-term unintended consequences such as increasing inequalities and being cognizant that initial conditions can be, and often are, compounded at the local level—resulting in the compounding of social circumstances. Thus, sensitivity is an important challenge for interventions.⁴

Transforming social systems?

What does understanding that systems exhibit ‘behaviour’ say about how we might mitigate the compounding of disadvantage that occurs for some groups and communities? Within social systems what happens to the adaptive ability of communities if systems are shaped by the qualitative features of human subjectivity and agency?

Social systems are hierarchical only in the sense that humans subjectively value some systems over others—exemplified in the perpetuation of social norms and the marginalization of difference. A deeper understanding of the concepts involved in emergence highlight that it is the type of relationship that matters. This suggests that it is more than just relationships between specific people, groups and organizations that are important. The inherent features of the systems these agents are part of also matter especially where information, resources and human capital are destined to flow away from the local. It is this subjectivity that holds the key to transforming our systems. It is not just that disadvantaged communities require empowering. It is more than that. It is rather that the ‘local’ in general is in need of empowering, with historically little serious attention given by policy and other decision-makers as to what constitutes critical external systems—and particularly how power relationships manifest—from the perspective of the local. It is why community focused and multi-level/-dimensional approaches to obesity interventions make a lot of sense, but it is also why attempts at intervention have largely failed to reduce obesity levels, particularly in disadvantaged communities.

‘Simple’ interventions are still necessary: healthy food in schools, nutrition education for pregnant women, social marketing aimed at increasing exercise levels and the regulation of industries that are influential within local environments. But it is essential to the long-term goal of reducing rates of obesity to ensure that political and private agents are responsive to local information. Of course, it would be easier if divergent interests—such as significant industries—could come on board with the collective conscious goal of reducing obesity.^{5,6,35}

However, their collaboration should not be necessary given that we have policy, legal and political processes that can force their hand as well as enabling local communities to better determine their own environments.

As Morrison suggests, theories of complex systems provide a way to understand how to prescribe change—rather than just describing it.²⁶ Innovative community interventions grounded in complex systems approaches hold promise for impacting obesity trends, but only as long as they too tackle the more difficult relationships impacting communities.³⁶ This paper argues that the transformational potential of complex systems theories lies in their ability to prescribe processes of change through an understanding of system behaviour that advocates a ‘whole system’ perspective. For interventions to be effective in the long term, it is the qualitative features of real interactions—in particular the manifestation of power relationships—that matter.

Authors’ contributions

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