This is the Accepted Manuscript version. This version is defined in the NISO recommended practice RP-8-2008 http://www.niso.org/publications/rp/

Suggested Reference

Copyright
Items in ResearchSpace are protected by copyright, with all rights reserved, unless otherwise indicated. Previously published items are made available in accordance with the copyright policy of the publisher.

http://www.sherpa.ac.uk/romeo/issn/0277-9536/
https://researchspace.auckland.ac.nz/docs/uoa-docs/rights.htm
In 2011 the call for papers was issued for a special issue for *Social Science & Medicine* on complexity. This Special Issue has followed a rather unusual path. Instead of it being proposed by subject experts, this special issue had no specific academic sponsors. My involvement is as a former assistant editor for the ‘health policy’ desk of *Social Science & Medicine*. As part of this role, I was the handling editor for most of the contributions that appear in this Special Issue. My own exposure in complexity theory is, therefore, rather limited and relatively recent. In that sense, this introduction is written from the standpoint of someone who has recently discovered something that is interesting and potentially useful, and I am only half a step ahead of readers who are new to the approach themselves. One key purpose of this special issue introduction, then, is to invite other social scientists with an interest in health to explore the potential of complexity theory. The contents of this special issue provide readers with a gateway. However, readers who want to take things further will need to go back to some of key introductory sources such as David Byrne’s *Complexity Theory and the Social Sciences: An Introduction* (1998), and David Kernick’s *Complexity and Healthcare Organisation: A View from the Street* (2004).

Many readers, however, will have a far greater and deeper engagement in complexity theory, and will be looking to this Special Issue to see what its contributions add to the corpus of complexity-informed social science as applied to health. These readers are likely to find their own way through the contents, and this introduction does is not in a position to glean what is new and innovative from the contributions. What I am in a position to do, however, is to pose some questions and explore some tentative answers about the place of complexity theory in the study of health services and policy. These questions include ‘what can the complexity lens add?; what are some implications for health service researchers?; and what implications are there for health policy and management? The bulk of this introduction synthesises how these questions are answered explicitly or implicitly in the contributions to this Special Issue. Based on my position as a sympathetic outsider to complexity theory, the introduction finishes with a question and challenge that clearly reflects my particular concerns as a political scientist and policy studies academic, and my own take on what the next frontier of complexity approaches to health services, management and policy could be.

**Complexity theory**

Providing a definitive account of complexity theory in social science is not possible, given that the sources of complexity concepts are themselves highly varied, with roots in physics, engineering, biomedicine in addition to a range of social science sources. Central themes of complexity approaches to understanding social phenomena include ‘non-linearity’, self-organisation’ and ‘emergence’. The following quote from Lesley Kuhn encapsulates the major insights of the complexity lens:

“(C)omplexity views individuals, organisations, populations and environments as interrelating, self-organising, dynamic and emergent; they are messy, unpredictable and small changes potentially have major consequences (2008: 11)”.
Kuhn’s account - many others would have served the purpose of exposition equally capably - is prescient however as she draws three key implications (2008: 12):

1) A complexity lens ‘removes simplistic hopes of an ordered and controllable existence’
2) It (nevertheless) provides a way of ‘discerning and identifying underlying patterns of order’
3) It introduces ‘potentiality’ (possible future emergences). Understanding potentiality unlocks the possibility of harnessing it to some extent, not forgetting that any such interventions are themselves likely to generate ‘unexpected self-organising behaviour’.

**Complexity: The Health Context**

Complexity concepts have been applied to social scientific studies of health in a number of ways. The most fertile ground for research has been health service delivery, and the contributions to this special issue reflect that emphasis. The health services context, as one in which clinical autonomy is a crucial contextual feature, is one in which the potential for both inter-organisational co-ordination and fragmentation abound.

A much-cited article published in the *British Medical Journal* in 2001 by Paul Plsek and Trisha Greenhalgh provided a powerful impetus for the application of complexity theory to health. This introductory article concluded with the following clarion call for complexity thinking in health services:

“This introductory article has acknowledged the complex nature of health care in the 21st century, and emphasised the limitations of reductionist thinking and the “clockwork universe” metaphor for solving clinical and organisational problems. To cope with escalating complexity in health care we must abandon linear models, accept unpredictability, respect (and utilise) autonomy and creativity, and respond flexibly to emerging patterns and opportunities”

This quote clearly encapsulates what advocates of complexity theory in a health care context see as the central problem that has befallen health services and systems, a point to which I will return towards the end of this introduction.

**A tour through the Special Issue**

The opening article in this special issue by Alexander Clark explores the relationship between the *components* of systems, the *whole* of systems and *emergent* properties through the lens of complexity theory. He proposes a definition of *complex interventions* along the following lines:

*Complex interventions are formed of parts that can be material, human, theoretical, social, or procedural in nature, stratified into higher and lower realms, that exercise power individually, in combination or as emergent properties either as parts or through the powers of the parts and the whole of the intervention.*

Clark contrasts a complex-adaptive systems perspective with alternative ways in which the relationship between system parts (components), wholes and interventions are juxtaposed and understood. His preferred model is one which ‘recognizes that
the power of (an) intervention results from either or both the actions of its parts (whether higher and/or lower order) and also from the whole of the intervention'. Using the example of cardiac rehabilitation programs, he argues that an intervention 'that provides support for psychosocial wellbeing and physical activity (the components) may offer added benefits over two separate interventions that address these factors.'

The next two articles give rich accounts of health service improvements that, according to the authors, can be best understood using a complexity theory lens. Holly Lanham and her colleagues investigate two successful instances of ‘scale-up and spread’ of improvement initiatives – the use of mobile phone messaging to improve adherence to anti-retroviral treatment for HIV in Kenya, and measures to reduce the incidence of MRSA infection in hospitals in the United States. Lanham et al are particularly concerned with the question of how to achieve scale-up and spread across a range of organisations and settings with a wide variety of local contextual features. For these authors, ‘understanding self-organization is critical to understanding variation across local contexts’, and understanding the role of interdependencies within and between organisations, and the sensemaking of participants are crucial features of what they term ‘productive self-organisation’.

In the third article, Anna Essen and Staffan Lindblad provide a rich account of the 'nationwide spread of and continuous re-invention of an IT-based quality-registry and associated re-invention of rheumatologist practice in Sweden' over a twenty year period. The authors make use of concepts associated with a particular branch of complexity science known as ‘dissipative structures model’ to examine the non-linear processes at the heart of this case. They focus on fluctuations, amplifying reactions, recombination dynamics, and stabilizing mechanisms. On the basis of this account they argue that ‘organic change, which starts out small, can escalate into system-wide changes within the healthcare structures that prevail today.’

The next pair of articles use complexity theory to understand the development of unintended consequences in the implementation of initiatives intended to improve health service quality and access. Ben Hannigan traces the introduction of ‘crisis resolution and home treatment’ (CRHT) teams that were designed to prevent hospitalisations in a local mental health service in Wales. By examining the inter-relationships between nested systems at the micro, meso and macro levels he shows how the positive impact of the intervention, as perceived by practitioners and clients, needs to be considered in connection with associated negative impacts for vertically and horizontally related systems. For example, experienced professional mental health staff were attracted to work in the new teams, such that there was a significant loss of expertise and experience among mental health professionals in the hospital.

The second ‘cautionary tale’ contributed by Yue Xiao and colleagues investigates the implementation of much larger-scale initiative of an essential drugs policy in China and focus on three specific sites of implementation. They draw from complexity theory the importance of adaptive and self-organisational behaviours and the role of non-linear feedback loops as part of the process. Different local authorities made different decisions about how many distributors would be involved
in distributing publicly funded drugs. Local authorities that chose a single supplier experienced feedback loops in which health centres in more remote townships were not well-served. In these cases, distributors sent few stocks to places where the costs of distribution exceeded what they were paid for distribution, creating a feedback loop in which local dispensers and residents learnt not expect a reliable supply, and adapted their behaviour accordingly.

In the sixth article, Susan Trehnolm and Ewen Ferlie investigate health system responses to the increased prevalence of tuberculosis in London in the 1990s and 2000s. They deploy five ‘vignettes’ regarding London TB services to illustrate the ways in which the macro context of health services based on New Public Management principles and procedures serves to enable and/or in most cases inhibit the opportunity for productive self-organisation to occur. In this way, they attempt to explain ‘the London TB control system’s (in)ability to respond’ to the epidemic.

The seventh contribution from Tracey O’Sullivan and colleagues draws from complexity theory to adopt a more prescriptive approach regarding preparation for disasters. Instead of describing and/or explaining stories of emergence and implementation of health service initiatives, their research is concerned with describing the complexity of local, ‘micro’ responses to disasters in order to develop a prescriptive model ‘to identify potential points of intervention to promote population health and resilience.’ Using a community-based participatory research design, they extracted some key principles to inform local responses to disaster that eschew a ‘one size fits all’ approach, and advocates the development of flexible, adaptive intervention designs which ‘must emerge from the complexity of the situation and be tailored to the community context at any point in time.’

The final article in the special issue on complexity has a rather different conceptual heritage, and a different empirical focus. Aziza Mahmoud and colleagues apply a systems dynamic modelling (SDM) framework to model the impact of a range of interventions that aim to address social determinants of health status in Toronto. As Mahmoud et al point out, SDM shares a conceptual ancestry with complexity theory. This contribution is notable for its incorporation of positive feedback loops into predictions regarding the efficacy of policy interventions and combinations of these interventions.

What does the complexity lens add?

There are many other approaches in social science that take aim at reductionism, linearity, and top-downism. Indeed there are many that arguably encapsulate complexity concepts in different theoretical terms, such as John Kingdon’s ‘multiple streams’ approach to explaining policy processes (2004), or the use of network theory in health services and policy research). Many researchers using complexity concepts have also drawn from these kindred approaches. Given the existence of alternative and/or supplementary conceptual frameworks, what is it that the complexity lens can add specifically?

Contributions to this special issue show that complexity theory can definitely be used to build satisfyingly rich and nuanced stories of health service and policy
innovation. Essen and Lindblad’s use of DSM provides a very sophisticated account of the development of the Swedish rheumatology registry. Trenholm and Ferlie’s innovative use of distinct but related vignettes serve to make connections between aspects of London responses to tuberculosis that may otherwise have remained hidden.

Two of the contributions to this volume, (Hannigan; Xiao et al) are examples of case studies that could be readily interpreted in terms of other commonly applied theoretical and conceptual frameworks. The use of complexity concepts in these articles make a distinct contribution by highlighting certain features that may receive less attention in other accounts (feedback loops, horizontal interdependencies). Of all the empirical contributions, only Lanham et al explicitly compare complexity accounts with other social science theoretical frameworks (diffusion theory and social normative theory). Clark’s theoretical contribution is useful in providing a conceptual framework for comparing complexity accounts with other ways of understanding the relationships between parts, wholes and emergent properties.

It is this detailed and expanding stock of concepts, images and metaphors that best illustrate the added value of complexity theory, rather than any superior status as an ‘explanatory theory’. Indeed, complexity approaches are not, by their nature, well-suited to the task of explanation, because explanation, as conventionally understood, requires a Newtonian social science in which the capacity to predict is paramount. Complexity theory explicitly sets itself against such ambitions.

**Complexity theory and the role of health services and system researchers**

The two contributions from the UK (Hannigan; Trenholm & Ferlie) regard the value of a complexity lens as fundamentally one of understanding the impacts of initiatives and new interventions. Hannigan argues that complexity theory provides a very suitable way of enabling a systems view to be built from in-depth case studies of a particular intervention, by facilitating the examination of horizontal and vertical connections. Trenholm and Ferlie argue that a complexity lens can be useful in understanding ‘perpetuation of the status quo’ as well as novelty and innovation. For these authors, the priority for researchers is to be sophisticated observers and chroniclers of systems and processes.

In contrast, two of the contributions from North American authors (Lanham et al, O’Sullivan et al), push the role of researchers much further. In one of the examples provided by Lanham et al, researchers were themselves part of the process of diffusion of innovations through the use of regular meetings between researchers and practitioners. According to Lanham et al ‘(t)hese activities enabled SUS efforts that helped hospital staff look for, detect and respond to unpredictable circumstances during the interventions.’ O’Sullivan et al’s methodology required key participants in communities to generate the raw empirical material for the analysis of complexity through the use of the ‘structured interview matrix’.

**Complexity theory and the role of policy and health service management**

A key question that arises with the application of complexity theory to health services and policy is that if improvement can come from ‘self-organising, emergent
processes’ (eg Essen and Lindblad; Lanham et al) then is it possible that the ‘potentiality’ for ‘scale-up and spread’ be harnessed more effectively?

One possible response to this question is that harnessing is simply not possible because of the unpredictability of complex systems. One particular interpretation of complexity is that self-organisation is antithetical to intentionality and planning (Paley 2010). None of the contributions in this special issue subscribe to that particular interpretation which regards complexity concepts as incompatible with social science questions. However, the contributors do vary in their judgement of the extent to which complexity-based insights can be intentionally harnessed by health service managers and policy actors.

A minimalist position, exemplified by Hannigan is that these key actors in health services appreciate ‘the value of carefully considering the possible reverberations of innovation in order that the previously unanticipated becomes expected and planned-for’. Similarly, Xiao et al highlight ‘the importance of performing real-time monitoring and evaluation, with a focus on learning and adjusting policies rather than focusing on simply punishing failure or rewarding success’. All contributors posit some version of the argument that decision-makers need to ‘plan to be adaptive’, emphasising the provisional nature of any planning process.

However, some contributors go a great deal further and attribute a more proactive role for health service managers and policymakers in applying complexity concepts. For example, in identifying interdependencies and sensemaking as key organisational factors that enhance scale-up and spread, Lanham et al outline a range of strategies for facilitating sense-making including “encouraging the inclusion of participants’ professional identities in group dynamics, viewing plans as tentative and open to new environmental cues and knowledge updates, encouraging mindful and critical reflection on previous events, and viewing surprises as opportunities to learn (23).” O’Sullivan et al go even further in providing action recommendations that they call ‘levers or intervention strategies to promote population health and community resilience’. To be sure, some of these ‘action recommendations’ could be more accurately labelled as general principles and intentionally paradoxical aphorisms (e.g. ‘invest time and effort in relationships…. with haste’, and ‘fine tune the guest list without ruffling feathers’).

One question that remains intriguing, however, is whether officials and managers with formal authority should even attempt to direct change ‘from the top’. Underlying many of the contributions is an implicit, and sometimes explicit argument that the only worthwhile health service and policy innovations are those that emerge from the self-organisation of health services and systems. Essen and Lindblad, for example, ‘Policy makers need to get better at monitoring, making sense of and supporting (amplifying) promising practice-driven changes rather than (emphasis added) initiating and imposing grand changes from above. Trenholm and Ferlie pick up on a metaphor of ‘gardening vs engineering’ provided by David Kernick (2002), suggesting that ‘managers in complex healthcare systems should be gardeners not engineers; preparing and nurturing fertile ground so innovation might emerge, rather than attempting to direct and control (p23)’.
Such advice, however, may prove problematic in any health system that is required to demonstrate democratic accountability where there are longstanding and legitimate expectations that key policy actors are required to make and implement policy (or at the very least appear that they are doing so). It also runs the risk of ignoring the possibility that ‘top-down’ initiatives may sometimes be successful and uncontentious. It also would need to address potentially problematic issues such as what happens when productive ‘bottom-up’ innovations are not forthcoming, or do appear but contradict each other. As Greenhalgh et al make clear in a reflection on their earlier BMJ piece, a complexity lens should not be equated with the contention that no-one should be in charge (2010: 115).

These issues and potential theoretical problems are not unique to complexity theory. Indeed they tend to crop up wherever the merits of activities that are not consciously co-ordinated (i.e. advocates of market mechanisms, networks, or any ‘bottom-up’ approaches to implementation) are juxtaposed against the merits of planning, control and hierarchy. In all these approaches there is a strong temptation to revert to a privileging of the natural and organic on the one hand, over the contrived and artificial.

There is, of course, a third possibility, that ‘top-down’ directives such as targets may actually be mechanisms for facilitating ‘productive’ self-organisation. After all, this is what some of the more sophisticated approaches to strategic planning and central policymaking in health services have been endeavouring to do for some time. This amounts to something along the lines of ‘we tell you what we want to achieve, you work out how to achieve it in ways that align with your local service context’. Of the papers in this volume, the contributions of Lanham et al, and O’Sullivan et al most actively and productively engage with this possibility.

Indeed, perhaps the most important conceptual issue for complexity theory seems to be the place of ‘top-down’ interventions in complex systems. Are they part of the landscape of complexity, or are they things that ‘impede’ the unfolding of self-organising, emergent phenomena? More sophisticated applications of complexity suggest the former answer, yet the will to control through linear, rational, prescriptive mechanisms remains an ever-present ‘shadow’ – something that should be minimised – because it this a defining trope of complexity theory applied to the social sciences. This theoretical challenge is perhaps most pressing in contexts in which health services are directly funded by citizens. The complexity-inspired frustration with attempts at central control appears to be stronger in jurisdictions in which there is more scope for it, and where there is a greater public expectation of it – i.e. those jurisdictions in which “the sound of a bedpan falling in Tredegar Hospital would resound in the Palace of Westminster”.

But can proponents of complexity theory actually afford to take such a normative stance without sacrificing one of its greatest strengths, namely the capacity to treat all phenomena as observable systems and/or parts of systems? Perhaps Clark’s suggestion that interventions that consciously attempt to integrate different components may be more powerful than one that focuses on the components in isolation has implications here.
Complexity theory has emerged as a stimulating and refreshing contribution to the social science of health and health services. From the contributions to this special issue, perhaps the next frontier of this theoretical approach could be a deeper engagement with the complex dynamics of the will to achieve and exercise formal, hierarchical authority in health systems.

References


\[\text{\footnotesize\textsuperscript{1} A quote attributed to Aneurin Bevan, that architect of the British National Health Service}\]