Using complexity theory to analyse the organisational response to resurgent tuberculosis across London

Susan Trenholm*, Ewan Ferlie

Department of Management, King's College London, 150 Stamford Street, London SE1 9NH, UK

ABSTRACT

We employ complexity theory to analyse the English National Health Service (NHS)'s organisational response to resurgent tuberculosis across London. Tennison (2002) suggests that complexity theory could fruitfully explore a healthcare system's response to this complex and emergent phenomenon: we explore this claim here. We also bring in established New Public Management principles to enhance our empirical analysis, which is based on data collected between late 2009 and mid-2011. We find that the operation of complexity theory based features, especially self-organisation, are significantly impacted by the macro context of a New Public Management-based regime which values control, measurement and risk management more than innovation, flexibility and lateral system building. We finally explore limitations and suggest perspectives for further research.

© 2012 Elsevier Ltd. All rights reserved.

Introduction: complexity theory and the organisational response to resurgent TB across London

This descriptive study uses complexity theory to examine the organisational response to a resurgent TB epidemic across London. Authors assert that complexity theory could fruitfully analyse both a complex and emergent health *phenomenon*, like a TB epidemic (Agar, 1999), and the *organisational response* to it (Byrne, 1998; Tennison, 2002). We explore this second claim (our particular interest) by examining the multi-component system responsible for managing resurgent TB across London.

Despite much theoretical work, scholars note the need to apply complexity theory in real-life settings outside laboratories or computer-generated simulations (Houchin & MacLean, 2005). We add to the modest body of empirically informed research, specifically to an emergent literature combining complexity theory and public management (Rhodes & MacKechnie, 2003; Rhodes, Murphy, Muir, & Murray, 2011; Teisman, van Buuren, & Gerrits, 2009). Brown and Eisenhardt (1997) and Chiles (2004) are useful guides for us as both use longitudinal case studies, while high-lighting the importance of context, time and relationships. In our research, the macro organisational and policy context proved highly significant and need to be accorded full attention.

Complexity theory offers a novel perspective on healthcare organisations and systems (Anderson, Crabtree, Steele, & McDaniel, 2005; Plsek, 2001). We seek to operationalise in empirical analysis key features of complexity theory. All these complexity-based characteristics surfaced in the case, but their impact was intriguingly variable. Further analysis revealed that embedded New Public Management reforms significantly impacted how complexity-based features manifest themselves, hampering efforts at addressing the city's TB problem. Our initial research question is specified as follows:

What is the contribution of complexity theory in analysing the organisational response to resurgent TB in London?

The paper is organised as follows. First we outline the context of our research. Then we review complexity theory literature, highlighting its application within healthcare, and also outline New Public Management principles found in the field. Then we describe our methods and data sources. Next, we present a narrative of the organisational response to TB across London, including vignettes which illustrate aspects of complexity theory and New Public Management processes. After discussing key findings, along with theoretical implications, we outline limitations and possible future research.

While our findings should prove useful to healthcare managers and TB specialists, our prime audience is scholars of healthcare systems and organisations. The case reinforces the importance of organisational contexts in complexity theory research, in this case, the legacy of healthcare macro reforms.

Context and setting: the resurgent TB epidemic in London

London TB rates reached their lowest recorded levels in 1987 (Pearson, Hamilton, Healing et al., 1996), after which they

* Corresponding author.
  E-mail address: strenholm_2000@yahoo.com (S. Trenholm).

consistently increased (see Fig. 1). Between 1999 and 2009, London TB cases increased by 50% (NHS, 2012), despite global incidence peaking in 2004 (WHO, 2010, p. 32).

The rate of new TB infections in London (incidence) was 44.8/100,000 in 2009, with some boroughs exceeding 100 cases/100,000 (Health Protection Agency, 2011a). Amongst other European cities, only Brussels (30.5/100,000) comes close to London (Health Protection Agency, 2011b). Tuberculosis poses significant public health challenges in stopping latent infections becoming active and controlling onward transmission. The challenge lies with improving diagnosis and screening and with treating active TB disease, and the illness is compounded by economic and social factors — patients are often poor, with substance abuse issues, homeless, migrant and living in crowded quarters (Collinson & Ward, 2010; Gandy & Zumla, 2002). Promoting disease awareness, encouraging marginalised individuals to seek diagnosis and treatment, and linking to primary care are challenging and involve many players. Collinson and Ward (2010), Craig, Booth, Story et al. (2007) and Story, Murad, Roberts et al. (2007) provide more detail regarding TB in modern London.

An overview of complexity theory

Extending complexity theory to studying complex social phenomena is promising because of its focus on understanding relationships between and among individuals, organisations, and/or systems, and resulting collective behaviours and outcomes (Stacey, 2003a,b, p. 333). Within complex systems, these outcomes are unpredictable, often non-linear, and emergent, with their sum greater than their parts (Blaikie, 2007, p. 208). But complex systems, like all systems, may also perpetuate the status quo or suppress novelty and innovation (Boons, van Buuren, Gerrits, & Teisman, 2009, pp. 234–238). At the heart of complexity theory lies self-organisation (Rhodes et al., 2011, p. 14), "the process by which agents in a system interact with each other according to their own local rules of behaviour without any overall blueprint telling them what they are to accomplish or how they are to do it" (Stacey, 1996, p. 290). Complexity theorists argue that systems tend towards order (Kauffman, 1993), "a stable pattern of relationships among elements" (Rhodes & MacKechnie, 2003).

They recommend researchers "should look for the ways in which public service systems are creating 'order', what form/mode this order takes, and how this affects the overall performance of the system"(Rhodes & MacKechnie, 2003). The importance of order creation on system outcomes emerged as a key factor in this research.

In reviewing the literature, we identify five relevant aspects of complexity theory:
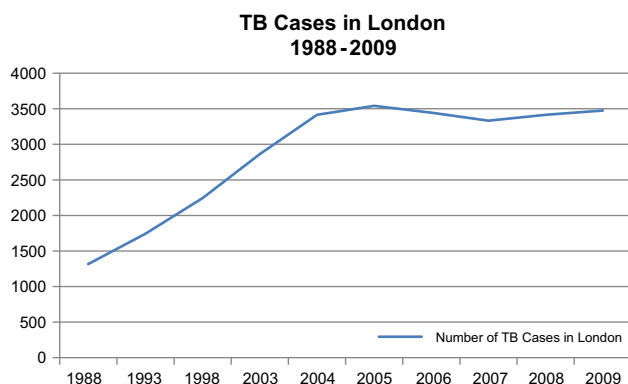

TB Cases in London 1988 - 2009

Fig. 1. TB cases in London (Source: various published HPA reports).

1. Self-Organisation

Self-organisation is a dialectical *process* of co-evolution among agents, comprised of relationships and behaviours. It has the capacity to create coherence and form patterns. The form which emerges is "radically unpredictable", explaining the relationship between self-organisation and causality (Stacey, Griffin, & Shaw, 2000, pp. 128–130). While the emergent outcome may transform an organisation, the consequence of self-organisation may also be to "resist externally induced change" because of "ambition or need to survive" (Boons et al., 2009, pp. 234–235). Agents in self-organising systems respond "according to their own capacity to respond" (Stacey, 2003a,b, p. 333), within various organisational "control parameters" including:

I. Rate of information flow
II. Degree of diversity
III. Richness of connectivity
IV. Level of contained anxiety
V. Degree of power differentials (Stacey, 1996, pp. 179–182).

The manner in which self-organisation occurs is debated. Some scholars argue that successful self-organising requires the "right" number of ties and informal connections among system members: too few ties and the system becomes moribund; too many ties and it becomes chaotic (Stacey et al., 2000, pp. 111–112). Others believe the intensity of the ties matters (Axelrod & Cohen, 2000). It is suggested that self-organisation occurs locally, at the micro level, later giving rise to meso and macro-level orders (Chiles, 2004). Finally, self-organisation may contribute to systems' abilities to balance "exploitation" (doing more of what they do well) and "exploration" (trying, discovering, or creating — e.g. innovating), and can trigger transformational change (Axelrod & Cohen, 2000, pp. 43–45; Byrne, 1998, pp. 32–33).

2. Emergence of Novelty, or Perpetuation of the Status Quo?

Novelty and the creation of "new properties" in response to environmental challenges might arise from self-organisation (Rhodes et al., 2011, p. 14), or not, as discussed above. Components of a self-organising system may be "often oriented at maintaining their position and stability" (Boons et al., 2009, p. 235), aided by constraints arising from control parameters. Where novelty does occur, it is, by definition, unpredictable, and history and context matter (Byrne, 1998, p. 47). The composition and/or past actions of the components of the self-organising system can determine the nature of the novelty (Rhodes et al., 2011, p. 14) "due to multiple nonlinear interactions and feedback loops among the parts" of a system and not as the result of a "big plan" (Begun, Zimmerman, & Dooley, 2003). Finally, novelty emerging from self-organisation is not always positive (Plsek, 2001), as when healthcare and other workers "game" the system to meet targets.

3. Non-linearity

An aspect of the unpredictability which arises from self-organisation are non-linear responses to change. Modest turbulence can produce an unexpectedly large impact, while large disturbances may be barely felt (Chiles, 2004; Plsek, 2001; Sarra, 2005). An epidemiological example is how introducing crack cocaine into the street heroin market changed the drug using population and the entire dynamic of the heroin market (Agar, 1999). Non-linearity can also be seen in the considerable resources invested in healthcare reforms with seemingly little system improvement (Plsek, 2001).