

Quality improvement science

Systems and spread

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ABSTRACT

This is the fifth in a series of papers about the science of quality improvement. In this paper, we explore the issue of healthcare as a system and how this contributes to our understanding of how to spread improvement.

Keywords: general practice, primary care, quality improvement collaboratives, quality improvement, systems

Introduction

This, the fifth in our series of papers on quality improvement tools and techniques, focuses on healthcare as a system and how to spread improvement. Previous papers in the series have considered: frameworks for improvement,¹ understanding processes and how to improve them,² leadership and management,³ measurement, and commissioning for quality.⁴ We begin by describing systems, how they work, why they respond to change in complex and unexpected ways and how this knowledge can be used to bring about and spread improvement.

Healthcare systems

A system is a set of interdependent and interacting elements or actors, together with the context in which they operate, which seek to achieve a common aim. In broad terms, healthcare systems may be considered in terms of size and complexity as macro-level (healthcare organisations interacting at a geographical, regional or national level), meso-level (healthcare organisations themselves) or the micro-level (groups of clinical and/or non-clinical staff working together within an organisation or a healthcare setting) – so-called clinical microsystems.

Clinical Microsystems comprise groups of clinicians interacting to provide specific types of care for

patients. The actors in the system, how they relate to their patients and each other, and the context in which they do this constitute the clinical microsystem. Contextual factors include regulation, payments and resources, leadership, culture, training, capability and aims or targets.⁵ The design of the healthcare *system* can profoundly affect quality of care, more so than the individuals or elements of care from which the system is formed.

This leads to the oft-repeated adage of health systems experts, that ‘every system is perfectly designed to get the results it achieves’.⁶ Much more than individual workers in the system, it is the design of the health system that is critical to its success or failure – and for improvement to occur attention needs to be paid to the system and its (re)design.

Interactions within these complex sociotechnical (human–behavioural–health technology) systems are an important feature and these are governed by mathematical laws: the laws of natural networks.^{7,8}

Networks and complexity

Natural networks can be conceptualised as a web, with individuals or organisations as vertices (the points where lines intersect) and social interactions as edges (of these lines). The model states that networks expand

continuously by adding new vertices, and these new vertices attach preferentially to others that are already well connected, so-called nodes; with very large numbers of connections these nodes are termed hubs. Healthcare and other groups of interacting actors are predicted to develop as a characteristic of these principles.⁹

Natural networks often behave in unpredictable ways: the boundaries of these networks are vague or fuzzy because members of a network often interact or are associated with other groups or organisations; the individuals and groups adapt and co-evolve with others in response to a variety of stimuli; their actions are often based on tacit internalised rules as well as explicit ones.

The complex interactions within and between natural networks can also lead to novel behaviours in response to external forces. This is because responses to various stimuli are often non-linear and unpredictable rather than a simple linear cause-and-effect reactions.¹⁰ Different types of intervention (tools, communication, behaviours, etc.) rather than simple levers need to be employed to influence networks: these are sometimes called ‘attractor patterns’ because they involve more subtle efforts at attracting rather than directing behaviour change.^{11,12}

The characteristics of networks within complex systems, which include aspects such as self-organisation, weak interactions and informal communications, are beginning to be understood.¹³ The central nodes or hubs in natural networks are opinion leaders: these key individuals are often, but not always, in leadership positions, but they are always better connected, have greater influence on others and are therefore important as change agents. Communication in natural networks is predominantly informal rather than formal: messages that are heard and conveyed by recipients are those that have natural appeal and are termed ‘sticky’.

For more complex information to be accessible and sticky, it needs to be organised and simplified into natural categories or maps. Such information eventually becomes part of the collective knowledge reaching a natural ‘tipping point’ where it is so well diffused that it becomes sufficient to be acted on.⁷

There are various barriers and facilitators to communication between networks and their members such as professional identity, organisational culture, homophily (attraction to those that are similar to us in various attributes) and communication style.¹⁴

An example of a healthcare network is a clinical community focused on quality improvement such as the quality improvement collaborative. The ideas of complex systems and natural networks help to explain why some collaboratives work better than others in bringing about improvement and innovation.¹⁵

Spreading innovation

Innovation in service delivery and organisation has been defined by Greenhalgh *et al* as ‘a novel set of behaviours, routines, and ways of working that are directed at improving health outcomes, administrative efficiency, cost effectiveness, or users’ experience and that are implemented by planned and coordinated actions’.¹⁶

We can spread innovation using passive approaches (diffusion), active efforts directed at a target group (dissemination), wider efforts covering entire organisations (implementation) and finally achieving normalisation where an innovation is so embedded that it is no longer an innovation but routinised into practice.¹⁶

The model of spread developed by Greenhalgh *et al*,¹⁶ and based on Rogers seminal work on diffusion of innovations,¹⁷ provides a comprehensive model of how spread can occur. It shows how innovations can spread depending on the innovation itself, organisational systems, the external context, individual actors and the interactions between these (communication, influence and linkages) and the consequences of adoption or assimilation.¹⁶

These ideas and principles can be used to further spread innovations including quality improvement initiatives. Spreading improvement from a successful local initiative to wider implementation involves careful preparation, agreeing aims, developing a spread plan and implementing it.¹⁸

Preparation involves understanding the system, its context and, in particular, the organisational leadership and its readiness for change. The aim for spread should include the organisations and people, the improvement goals and measures, and the period for implementation.

Implementation of spread needs consideration of the steps by which this will occur and what the facilitators and barriers may be, including existing organisational support, structures and culture for change, what changes need to be made to these to effect spread and how changes can be normalised into practice.¹⁸

Case study

An example of spread is shown through the impact of the work that we have previously undertaken to improve influenza and pneumococcal vaccination rates in at-risk groups.¹⁹

This began with work in a single general practice looking at facilitators and barriers of vaccination uptake.²⁰ The knowledge of these enablers and blockers,

together with evidence on what factors were most likely to lead to change (e.g. protocols, reminders to patient and staff, registers) were gathered from patient staff, and this was shared and applied in a large primary care organisation to an organisational collaborative involving 32 (of 39) practices. General practices were attracted to participate because there were national guidelines supported by good evidence for influenza vaccination, they were already undertaking a vaccination programme, there was remuneration for vaccination which compensated for the additional costs of improving the vaccination programme and there was support provided through a primary care organisation (the Clinical Audit Advisory Group).

This led to improvements in vaccine rates in patients with heart disease (19% increase in influenza vaccination; 15% increase in pneumococcal vaccination), diabetes (17% increase in influenza vaccination; 13% increase in pneumococcal vaccination) and those aged over 65 year (24% increase in influenza vaccination).²¹ We can calculate the likely benefits of this intervention. Assuming that 1000 patients were eligible for vaccination in each practice, with an average of three general practitioners (GPs) per practice, and a change of 20% in vaccination rate in 39 practices, this equates to an additional 6400 patients vaccinated, and over 60 GPs and their staff involved during the course of this study. The number needed to treat to prevent one death is 120 which meant that around 50 deaths would have been prevented through this intervention.

A further collaborative involving a similar organisational intervention in 22 of 105 practices in one county led to significant improvements in vaccine rates in patients with heart disease (11% increase in influenza vaccination; 28% increase in pneumococcal vaccination), diabetes (9% increase in influenza vaccination; 29% increase in pneumococcal vaccination) and patients with a splenectomy (17% increase in influenza vaccination; 16% increase in pneumococcal vaccination). There were again over 60 GPs involved, with approximately 4400 additional patients receiving influenza and pneumococcal vaccination, and the prevention of around 37 deaths, as well as hospitalisations.²²

The ideas were formally tested in a randomised controlled trial of a complex intervention to improve influenza and pneumococcal vaccination rates in 30 practices and this also showed positive effects for pneumococcal vaccination.²³ A subsequent cross-sectional study, investigating factors associated with the success of practice seasonal flu vaccination campaigns, showed strategies that, if widely implemented by general practices, would improve average flu vaccination rates by 7–8%.²⁴

These strategies have been spread more widely by being introduced into the national UK influenza vaccination campaigns of 2012/13 and 2013/14.^{25,26}

The mechanisms of spread have included small-scale testing, leading to large-scale collaborative interventions supported by education, audit and feedback, and national guidance.

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PEER REVIEW

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CONFLICTS OF INTEREST

None declared.

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