Evidence & Policy • © Policy Press 2016 • #EVPOL
Print ISSN 1744 2648 • Online ISSN 1744 2656 • http://dx.doi.org/10.1332/174426416X14712553750311

debate

Mobilising knowledge in complex health systems: a call to action

Bev J Holmes, Michael Smith Foundation for Health Research, bev.holmes@telus.net;
Allan Best, InSource Research Group, allan.best@in-source.ca;
Huw Davies, University of St Andrews, hd@st-andrews.ac.uk;
David Hunter, Durham University, d.j.hunter@durham.ac.uk;
Michael P Kelly, University of Cambridge, mk744@medschl.cam.ac.uk;
Martin Marshall, University College London, martin.marshall@ucl.ac.uk;
Joanne Rycroft-Malone, Bangor University, j.rycroft-malone@bangor.ac.uk

Worldwide, policymakers, health system managers, practitioners and researchers struggle to use evidence to improve policy and practice. There is growing recognition that this challenge relates to the complex systems in which we work. The corresponding increase in complexity-related discourse remains primarily at a theoretical level. This paper moves the discussion to a practical level, proposing actions that can be taken to implement evidence successfully in complex systems. Key to success is working with, rather than trying to simplify or control, complexity. The integrated actions relate to co-producing knowledge, establishing shared goals and measures, enabling leadership, ensuring adequate resourcing, contributing to the science of knowledge-to-action, and communicating strategically.

key words knowledge-to-action • complexity • health systems • knowledge mobilisation

Introduction

Worldwide, policymakers, health system managers and practitioners are challenged by how best to use evidence to improve policy and practice. The relevant field of enquiry – known variously as knowledge mobilisation, knowledge translation, research utilisation and knowledge-to-action, among other terms – has increased understanding about this challenge over several decades. The very meaning of evidence is now the subject of lively debate. However defined, the emerging consensus is that evidence is not a thing apart, generated in isolation and then passed on to those who will use it (Davies et al, 2009). It is clear that evidence alone does not solve problems (Kelly and Moore, 2012; Ogilvie et al, 2005), and that myriad elements of context – including different professional, organisational and sectoral cultures (Lorenc et al, 2014) and the

role of power and politics (Contandriopoulos et al, 2010; Frost et al, 2012; Hunter, 2015) – are critical considerations.

Despite this progress in understanding, those involved in health system improvement still struggle with how to make best use of evidence-based knowledge. There is growing recognition that the struggle has a lot to do with complexity (Best and Holmes, 2010). Commentators refer to healthcare as a complex adaptive system (Plsek and Greenhalgh, 2001), and to health system problems as wicked (Rittel et al, 1973). The word complexity appears increasingly in journal articles and health system documents, and in the discourse of health system stakeholders.

Unfortunately, acknowledgement of complexity does not necessarily lead to practical ways of dealing with it (Riley et al, 2015). More people acknowledge that complexity-informed approaches to health system improvement are needed, but what they comprise, and how to initiate and manage them, is not sufficiently understood for people to draw on in their daily work. In many cases, approaches that acknowledge complexity are being used, but not optimally. For example, developing shared goals and measurements is not a new idea, but rarely are such goals and measures developed in ways that take into account critical contextual factors, or that acknowledge how those factors interact and change as an initiative unfolds.

The authors argue that most health system change initiatives mistakenly attempt to control or manipulate context, rather than foster emergent solutions. Therefore, this paper proposes how we can act in ways that acknowledge the complex systems within which we work. By 'we', the authors mean those leading health or health system improvement initiatives as well as those who can influence the context in which those initiatives are undertaken. For example, leaders of academic and healthcare organisations, funding agencies, professional organisations, charities, patient groups (Burton and Rycroft-Malone, 2015) and government can support complex system change.

The authors propose actions specific to these stakeholders based on our respective work on health system change in several countries. This work includes initiatives featured as case studies for the purposes of this paper, as well as a workshop where invited colleagues (policymakers, researchers and practitioners with an interest in complexity) critiqued our ideas in preparation for this debate paper.

We begin with a rationale for this paper and summaries of those case studies. A description of the workshop is provided, followed by thematic areas and related proposed actions developed by the authors. Our conclusion reiterates the importance of knowledge-to-action related to complexity, and invites commentary from the growing community of people committed to this important area of study and practice.

Why do we need another knowledge-to-action paper now?

In the last 15 years, literature on the use of evidence for improved health and healthcare has proliferated. There is increasing interest in related theories, frameworks and models, and tools (Davies et al, 2016). Much of this work is based on that of influential figures such as Everett Rogers (2003) and his study of more than 500 diffusion projects in a range of sectors. Others include Ronald Havelock (1969) and his three models: the problem solver model (in which the user's need is the starting point), the research, development and diffusion model (in which the research product is the starting point), and the social interaction model (in which there is a movement

of messages and innovations from person to person and from system to system); and Carol Weiss with her frequently-cited paper, *The many meanings of research utilization* (1979), in which she attributed lack of evidence uptake in part to the ambiguity of the concept of research use.

While there have been advances in the field, there is also much repetition. For example, the notion of push, pull and exchange in knowledge translation (Lavis, 2006) is similar to Havelock's model, which itself was based on a comprehensive review of then-existing scholarship on dissemination. The importance of having and exchanging knowledge for the advancement of civilization has been documented as far back as Aristotle (Rich, 1979); determinants of knowledge use have been debated in various literatures for decades, including rural sociology, medical sociology, development studies, communications and marketing, technology transfer, evidence-based medicine and public health (Greenhalgh et al, 2004; Kelly et al, 2010; Scott et al, 2010).

Given the abundant literature, why do the authors feel another knowledge-to-action paper is needed? There are a number of reasons. First, we observe few discussions about how seemingly minor barriers interact in ways that are difficult to predict (Nilson, 2015). Secondly, rare is any discussion of complexity beyond the conceptual level (Levin, 2013) helping us determine what to do in practical terms. Finally, even in literature that adopts a complexity frame, the solutions that follow often tend to be simple and sequential actions that presuppose a high degree of rationality and linearity in the system. Many models describe a one-way process in which researchers produce new knowledge, which gets disseminated to end users, and then incorporated into practice and policy. In such models, knowledge is seen as a product, generalisable across contexts, whose use is dependent on effective packaging (Best and Holmes, 2010).

That said, determining how to act on complex problems is, perhaps obviously, no simple matter. In complex systems like health there is no single point of control. Health systems are composed of individuals with varying degrees of influence whose goals and behaviours are likely to conflict (Hunter, 2015; Rouse, 2000). Change occurs naturally and continuously as people within the system acquire new information that alters their understanding. Planned change in such a system is difficult because of these dynamic characteristics: nothing stands still while we intervene.

But observing how change occurs in complex systems can help us determine how best to manage such change. Critical to bear in mind is that the ongoing interaction between an intervention and its context determines the outcome (Pawson, 2013). The four initiatives described in text boxes 1 through 4 – selected by the authors as recent examples of their work on health system change – provided an opportunity to monitor and critique this interaction; their findings offer insights which in turn suggest a way forward for knowledge-to-action in complex health systems. Summary A describes an initiative to improve clinical care management through guideline implementation in the province of British Columbia (BC), Canada. Summary B discusses large-scale change aimed at improving the efficiency and effectiveness of health services across a National Health Service region in England. Summary C describes a National Institute for Health Research evaluation of Collaborations for Leadership in Applied Health Research and Care. Finally, summary D explores a programme to redesign care for a population of almost one million people in an area of East London facing significant health and social challenges.

Knowledge-to-action case study summaries:

Knowledge-to-action case study summary A: Clinical Care Management (CCM)

In the province of British Columbia (BC), Canada, the Ministry of Health's Innovation and Change Agenda includes an initiative to improve clinical care management (CCM). The CCM initiative includes 11 clinical guidelines in areas such as hospital service delivery for seniors, stroke, sepsis, surgical checklists, glycaemic control and venous thromboembolism.

The CCM project was designed to understand health system change by examining guideline implementation in the six health authorities across BC. A model of complex adaptive systems and two conceptual frameworks (realist evaluation and system dynamics mapping) were used to study enablers and constraints at the macro, meso, and micro levels, as well as the contextual factors that interact to determine implementation outcomes. Data collection included key informant interviews, focus groups, a provincial workshop and a web-based validation survey.

Critical success factors for guidelines implementation – and the system change that enables it – were seen to be adequate resourcing; appropriate leadership; front-line engagement; communication; accountability and measurement that allow for local variation and comparison; alignment of incentives, and 'support from the top' in the form of organisational culture.

Knowledge-to-action case study summary B: North East Transformation System (NETS)

The North East Transformation System (NETS) was conceived as a bold experiment in the adoption of large-scale change across a National Health Service (NHS) region in England. Although NHS North East performs well, exceeding performance measures set by government, the health of its population ranks among the poorest in the country. The NETS was developed to address this paradox through an ambitious change programme aimed at transforming how health services were provided, in order to improve their efficiency and effectiveness.

The National Institute for Health Research-funded evaluation over three-and-a-half years comprised 14 study sites across the region, and was designed to investigate the factors facilitating or acting as barriers to successful change. A 'compact' – to address deep-seated and enduring tensions between managerial and professional values, and establish a psychological contract between managers and professionals by articulating gives and gets – was a component of the initiative. NETS was a mixed-methods study: qualitative elements were interviews, focus groups, observation and document analysis; the quantitative method was an interrupted time series analysis of rapid process improvement events.

Critical success factors for large-scale system change, as identified through the NETS study, are adequate time; constancy of purpose and organisational stability; appropriate leadership style; training and development; local autonomy; passionate and committed change champions; and engagement at all levels. The compact was seen as critical for this intervention, as was flexibility with regard to the methods that had been determined up front. Ultimately, the NETS did not fully realise its ambition due to the impact of the wider turbulent NHS policy environment that caused serious disruption affecting relationships and structures, resulting in a loss of momentum and direction.

Knowledge-to-action case study summary C: Collaboration for Leaderhip in Applied Health Research and Care (CLAHRC)

From 2008 to 2013 in England a large investment was made in nine partnerships between higher education institutions and local health services. These Collaborations for Leadership in Applied Health Research and Care (CLAHRCs) were funded by the National Institute for Health Research (NIHR) to generate and implement research evidence through prolonged interactions between academia and health services. An NIHR-funded evaluation aimed to develop an explanatory theory to answer the question of the CLAHRCs: what works, for whom, why and in what circumstances?

The study was a longitudinal, multiple-method realist evaluation using formative and summative methods. Data were collected over four rounds through interviews, observations, feedback sessions and documents within three CLAHRCs with over 200 participants.

A key observation of this study was that a path once set can be difficult to alter, particularly in contexts where leadership teams are not reflective, there is a lack of attention to evaluation for learning, and the path is reinforced by funders' expectations. Another observation was that how things are structured can facilitate or impede progress. A strong, clear vision and thoughtful allocation of resources are important, and reflective central leadership, combined with distributed leadership, facilitates collective action on implementation. Some tension in the system, for example between collaboration and competition, can facilitate, but also inhibit, knowledge mobilisation activity. Because incentives and motivations for engagement can vary within and across individuals, professions and organisations, a critical success factor is to make them visible.

Knowledge-to-action case study summary D: Walthham Forest and East London Collaborative (WELC)

The WELC (Waltham Forest, East London and City) Integrated Care Programme in East London, UK, is a four-year £68m programme that aims to redesign care for a population of almost one million people in an area facing significant health and social challenges. It

is being designed and delivered by a partnership between the main commissioners and providers in the locality, as well as local government. Among the aims of the programme are to help people to live independently and remain socially active, to implement best evidence, to avoid duplicated effort in situations where patients have many people involved in their care, and to enable shared learning using new models of partnership.

A national summative evaluation of the WELC is comparing outcomes in East London with similar programmes across England, but in addition, East London stakeholders supported a local, more process-oriented and formative evaluation. Working with their local Academic Health Science Network, they commissioned a participative evaluation using a researcher-in-residence model. The model places the researcher as a key member of the delivery team, rather than an external observer of change who brings a body of academic expertise to the team. It also places a shared responsibility on the researcher for the successful delivery of the initiative. Drawing data from a range of sources – theoretical and empirical (individual and group interviews, documentary analysis, participant observation) – the researcher feeds insights back to the participants ongoing as the initiative progresses. This happens through a process of active negotiation between different ways of knowing and, where necessary, compromise on the way knowledge typically is construed by evidence-based medicine.

Observations from this evaluation suggest that the researcher-in-residence model is a useful way of putting academic expertise into practice. Researchers engage with the concept of being immediately useful to practitioners, integrating scientific knowledge with other types of knowledge. At the same time, however, they find the role demanding and are concerned about losing academic objectivity. In addition, the process of negotiation requires a significant amount of time and energy on the part of the researcher. These challenges are offset by the benefits of encouraging new ways of thinking and working as a consequence of the insights provided by the embedded researcher. For example, the researcher highlighted to the WELC team the disconnect between the strategy and the operational delivery of the programme, the lack of a convincing narrative for front-line staff, and the preoccupation of the WELC leadership with new structures and governance arrangements rather than with new ways of working. These findings were negotiated with the operational leads and have influenced the roll-out of the programme.

Knowledge-to-action: a workshop

A workshop in London, England in May 2015 assembled a group of invited policy, practice and academic stakeholders engaged in health system improvement. The purpose was to explore complexity in knowledge-to-action initiatives with a group of people the authors knew to be interested and involved in such work, and invite them to critique the authors' ideas about practical advice that those involved in health system improvement can draw on in their work.

Participants were provided with a background document in advance of the workshop that reviewed related literature, summarised the case studies, and proposed thematic areas. Over two days, participants debated the material through a combination of small group and plenary sessions; detailed notes were taken and a report produced (Knowledge to Action, 2015). By design, there was no attribution of specific viewpoints to certain stakeholder groups; rather the feedback overall was used by

the authors to revise the themes and propose related actions. Participant comments are referenced in the appropriate sections below.

Thematic areas: knowledge-to-action in complexity

The knowledge-to-action case studies described in text boxes 1–4 are very different from each other, but share high-level thematic areas as developed by the authors in the context of related literature, discussed in the workshop, and refined further for this paper. These thematic areas are the importance of: different types of leadership; organisational buy-in and support; letting change emerge; and co-producing knowledge. Elaboration on these is provided below, followed by proposed actions that were developed by the authors after the workshop for this debate paper.

Leadership is multi-faceted, and needs to be supported in all its forms

Each case study demonstrates that in a complex system no one person, group or organisation is able to exercise ultimate authority. A key feature of the case studies – and of health systems – is their multi-level, multi-stakeholder nature, requiring inter-organisational and often inter-sectoral cooperation (Barnes et al, 2015; Hunter and Perkins, 2014; Ward et al, 2012).

But because no one is in overall control that does not mean no one can lead. Indeed, both formal and informal leadership are critical for knowledge-to-action in complexity (Hannaway et al, 2007; Stetler et al, 2009), a fact underscored by all four case studies. The CCM study notes that leadership at all levels can be either an enabler or a constraint, depending on the commitment. For NETS, leadership style was a key factor in sites where improvement occurred. The CLAHRC case study notes the importance of strong central leadership combined with distributed leadership for collective action on implementation. The WELC case study highlighted the need for leadership that not only conveys vision and commitment but which also engages front-line staff with the practicalities of delivery.

A realist review of the health system transformation literature underscored the importance of both central and distributed leadership (Best et al, 2012); it is clear that effective knowledge-to-action on complex problems requires individuals at all levels to lead change efforts. Central leadership responsibilities include development of shared vision and values, and creation and maintenance of organisational cultures that support continuous learning and embrace change. Distributed leadership is critical to ensure that initiatives are managed appropriately at different levels. In CCM, the implementation plan was managed centrally but authority for decision making was distributed such that local priorities could be considered.

The topic of leadership received considerable attention at the workshop; participants discussed the need to understand more about what qualities are needed to gain trust and respect from different stakeholders while still being able to hold them to account. It was noted that these are often soft, non-measureable qualities whose importance is underplayed. Participants suggested there is too much focus on traditional competencies, a suggestion that echoes Edmonstone (2013), who emphasises capability as opposed to competencies:

> the extent to which individuals and groups can adapt to change, generate new knowledge and continue to improve their performance in situations where there is little certainty or agreement and where the challenges faced and the context in which they occur are both unfamiliar. (2013, 533–4)

Capability cannot be taught in a conventional sense but can be achieved through continuously adapting to changed circumstances. Finally, workshop participants emphasised the strategic use of opinion leaders – those who by virtue of their position or their personality are informal leaders and could influence the success of an initiative either positively or negatively (Stetler et al, 2014).

Drawing on a range of work on leadership, including adaptive leadership, engaged leadership, collaborative leadership, servant leadership and quiet leadership (Hannaway et al, 2007), a clear challenge for successful knowledge-to-action in complex systems will be how best to create and sustain appropriate leadership.

Organisational facilitation of knowledge-to-action is key

For planned change to occur in a complex system, the actors within the system must play their part. For better or worse, all of these actors have a range of accountabilities and responsibilities, allegiances and loyalties, and power and influence. There may be good intentions on the part of these actors, but perverse incentives and power dynamics often interfere (Atkinson et al, 2015; Greenhalgh and Weiringa, 2011; Hunter, 2015).

Formal organisations are one obvious mechanism to enact planned change because of their governance arrangements and accountability relationship with the actors described above. In many ways the command and control nature of organisational structures – in place to enact such accountability – runs counter to how successful knowledge-to-action would work best in practice (Greenhalgh and Weiringa, 2011; Ward et al, 2012). People may have job descriptions that limit their responsibilities, or suffer punitive measures for not following rules.

In other ways, though, organisational structures can facilitate knowledge-to-action on complex problems. Shared values, visions and goals at the organisation level are key to transformation. Indeed, effective knowledge-to-action requires that strategy is aligned with broader organisational improvement processes (Best et al, 2012). Organisations can also create a culture that binds the values and attitudes critical for development of trust and shared learning, which are foundational to improvement initiatives (Mannion et al, 2009; Mannion et al, 2011). Reviews of large-scale organisational change highlight the role of culture in facilitating and mediating improvements consistent with a complexity view of knowledge-to-action (Best et al, 2012; Lukas et al, 2007; Willis et al, 2016). Finally, organisations have resources to support change initiatives directly, and to build capacity among their members to do so. Workshop participants encouraged the development of dedicated research functions within health organisations (Ellen et al, 2013), and the consideration of incentives and inhibitors that both inspire collaboration and manage dissent. It was pointed out though that these incentives and inhibitors must be developed within the context of where people are working, understanding that they are under immense pressure to get things done and often do not have the capacity to introduce change that is not required, enabled and resourced.

Workshop participants acknowledged that organisations do not exist independently of the people involved in them. They also acknowledged that system change initiatives do not stop at organisational boundaries. Beyond one organisation may be higher-level authorities such as governments – both the public service and elected officials – as well as extra-organisational stakeholder groups on which success depends, but with which there may be no formal reporting relationship. These groups – which may include partners in the initiative, other bodies to which organisational members also have accountabilities (for example, professional organisations), advocacy groups, media and so on – are a critical part of the context in which action on complex problems is undertaken. Despite these acknowledgements, it was agreed that the formal structure enacted by people working collectively in an organisation offers tremendous potential for health system change more broadly.

Change is emergent

Expectations of health system change – related to how quickly it can happen, and how it should be managed – vary widely among stakeholder groups. With regard to how quickly, governments and often those who are accountable to them demand rapid change, while those involved in system change know that it takes time. With regard to how it should be managed, deliberate strategy – where outcomes are pre-determined, action plans are developed and followed, and only summative evaluations are conducted – is the method of many organisations and cross-organisation initiatives. The CLAHRC case study is an example of how a deliberate path that was set from the outset, based on the funders' expectations (Rycroft-Malone et al, 2013), was hard to change.

In a complex system, however, it is not possible to predetermine what steps will bring about positive and long-lasting change. Complex problems are similar to complex systems. The components within the problem are in synergistic multiple interaction with each other and cannot be solved in a step-by-step linear manner. Multiple interactions mean that outcomes are not easily predictable but are emergent. The rate of change cannot be known a priori. Complexity is not simply about there being many moving parts: it is about what happens when these parts interact in ways that cannot be predicted but that will nonetheless heavily influence or shape the probabilities of later events (Chapman, 2003; Nilson, 2015).

A systems approach rejects the notion of 'flawlessly preplanned change based on accurate predictions of the consequences of action' (Midgely, 2003, 77). Learning and adaptation must be enabled ongoing, and evaluation systems are needed that both support this learning and adaptation at the application level, and collect evidence across contexts (Holmes et al, 2012a). The growing consensus is that indicators and accountability frameworks are best if built from the front-line up (Roth, 2013; Zimmerman et al, 2013). With WELC, a process evaluation provided insights to the participants iteratively to help increase their chances of achieving the objectives. A finding from the NETS case study was the importance of not becoming fixated on the method – in this case Lean thinking – but rather to view it as a means to an end.

A promising shift in health system thinking that supports emergence is away from pilot projects and towards prototypes (Riley et al, 2015). Well-designed pilot projects serve important functions, including testing of innovations before widespread implementation, and making a case for organisational investments. However, in

complex systems, it is not likely that a pilot can offer much in the way of guidance for the next implementation: the determinants of success shift with every new context; it is the interaction between the intervention and its context that determines outcome (Pawson, 2013).

The logic of prototyping is to test a small-scale innovation and then iteratively, with evaluation and feedback, refine and improve it until it is ready for large-scale application and a more definitive form of evaluation (Parry et al, 2013). This logic is compelling, but is often at odds with the approach of policymakers and managers who prefer to know up front – and are often held accountable for knowing up front – "what is the problem and how do we fix it?" Workshop participants pointed out that it is also at odds with the lack of importance accorded to evaluation, which is often not included in programme design. This gap was attributed to factors such as limited evaluation skills, methodological challenges, perception of evaluation as optional, or lack of funding.

A critical question is how organisations and systems can scale up from individual prototypes to design and adapt, implement and continuously improve strategy so that the sum is greater than the parts (Best et al, 2007). Interest in such scale-up, particularly from a complexity perspective, is increasing (Lanham et al, 2013; Norton et al, 2012; Paina and Peters, 2012), and many organisations, including the World Health Organization, Institite for Healthcare Improvement and Public Health Agency of Canada, are producing models and guides that provide considerations for related work (Hunter et al, 2016; McCannon et al, 2008; PHAC, 2013; ExpandNet, 2013).

More co-production of knowledge is needed

Many people view research as a distinct activity, important but not integral to the delivery of services (Barnes et al, 2015; Rycroft-Malone, 2014). This view is held within many healthcare organisations, where research is often perceived as detracting from care and competing for funds within tight budgets (Walshe and Davies, 2013). The perception also holds within academia, where research funding mechanisms, incentives and academic priorities perpetuate independent knowledge creation, or what has been called Mode 1 research:

> conventional scientific research, driven by curiosity and dispassionate inquiry, which produces evidence that is taken up and applied – or not – by decision-makers who had no influence on its focus or approach. (Greenhalgh and Weiringa, 2011, 507)

While Mode 1 research will and should continue, there is a need to rethink the current division of research and practice or policy. Ideally, research and practice would not be seen as separate activities undertaken by distinct groups of people (researchers and practitioners or policymakers), but would be conceptualised as an overall approach to linking the generation and use of evidence (Holmes et al, 2012a).

Mode 2 research offers another way. It is problem-based and collaborative, with questions framed by those who plan, deliver and receive services working with researchers to co-produce and implement knowledge (Barnes et al, 2015; Greenhalgh and Weiringa, 2011; Marshall et al, 2014; Riley et al, 2015; Ward et al, 2012). In studying complex problems Van de Ven (2007) uses the term 'engaged scholarship'

to describe 'a participative form of research for obtaining the different perspectives of key stakeholders' (2007, 90).

Workshop participants discussed co-production, emphasising the importance of capitalising on the unique knowledge of stakeholders such as clinicians and management. They also noted that in medical education, students are not taught to develop knowledge with others, but rather encouraged, if not explicitly, to contribute to and protect a specific knowledge base. The question was raised: "How well are the ideas of a complexity lens for health systems aligned with the current culture of health professionals?"

Beyond individuals, a related issue is the need to integrate co-production into organisational structure and strategy (Barnes et al, 2015; Marshall et al, 2014; Riley et al, 2015). A recent review found that organisations in which the research is fully integrated with structure and processes can outperform those that pay less attention to the contribution research has to offer (Hanney et al, 2013). One example of such integration is described in the WELC case study: a researcher-in-residence or embedded researcher model as a way to support co-production of knowledge (Lewis and Russell, 2011; Marshall et al, 2014; Marshall et al, 2016).

While Mode 2 research seems increasingly attractive to those in all stakeholder groups, there is work to be done to create situations in which academic and health system partners – as well as others who are becoming involved in health research, including patients and the public – understand and trust each other, and are motivated and supported to work towards shared goals while respecting the differences in their roles (Rycroft-Malone, 2014).

Action on complex systems: Who should do what ?

The above thematic areas are drawn from the authors' experience, the case studies and related literature, and refined in the workshop with a view to proposing actions that people working on health system improvement can take – or advocate that others take – to address the issue of complexity. It was acknowledged at the workshop that people working on health system improvement vary widely, including in areas such as the extent of power and influence, degree of interest and intent, and – perhaps most importantly – level of awareness that they are in fact involved in health system change. Many of those involved, acknowledged workshop participants, are "just doing their job," and need to be supported to do it as well as they can.

This acknowledgement prompts the authors to note an action that is often encouraged but that we feel is *not* necessary: raising awareness of complexity *per se*. Complexity does not need its own marketing campaign. Awareness of complexity, including its terminology and the concepts behind it, will not necessarily help those "doing their job" to do it better (Holmes and Noel, 2015). It will not stop politicians from desiring fast action and immediate results, or from asking for simple key messages about that action and those results. Although there is no reason to ignore opportunities to discuss complexity, we suggest that taking action on it, and communicating instead about the work we do and what it takes to be successful, will both advance understanding and increase awareness about what can be done and perhaps what cannot be done.

Based on our analysis of the case studies, literature and workshop discussions, we propose six actions. These actions are aimed primarily at those responsible for

knowledge-to-action at the initiative level. However, recognising that complex initiatives do not have neat boundaries – that by their very nature their success relies on factors beyond themselves – the actions are secondarily aimed at those who can influence these factors. Academic leaders and healthcare organisational leaders, for example, can instigate culture change within their institutions, challenge each other's assumptions and ways of working, and collaborate to start changing deeply entrenched ways of being and mechanisms that ultimately can trump any improvement effort, for example professional power and reward systems. Funding agencies can also be influential, through the programmes they offer, their conditions for awards and their advocacy for related needed change in academic and practice settings (Holmes et al, 2012b). Workshop partcipants urged journal editors to call for more papers or even special issues on knowledge-to-action in complexity. Professional organisations, charities and patient groups, as well as government, can also play a role. Given the political realities with which they work, especially in government, it will likely be individual champions – opinion leaders who do not follow the pack but who exercise positive deviance – to lead the charge. However, since all of these stakeholders are increasingly called to account for the impact of research in society, there are many reasons for us to work together to overcome barriers.

The six actions, noted below with who is well placed to take them, are:

Action 1: Co-produce knowledge

Co-production of knowledge was a major topic of discussion at the workshop. It is also gaining momentum in the peer-reviewed and grey literature, where it is argued that researchers and research users need to be supported to co-create solutions to healthcare challenges based on the best available contextualised evidence (Kitson et al, 2013).

At the initiative level

Initiative leaders could use an existing co-production model, or adopt the approach in general, which sees researchers and research users working together to co-create, refine, implement and evaluate the impact of new knowledge that is sensitive to the context in which it is created and used (Kitson et al, 2013). 'Research users' depends on the initiative, and could be practitioners, policymakers, community representatives and others. Public and patient involvement in health research is a growing trend and should be considered at the initiative level. Co-production is challenging, and requires role clarity, attention to power imbalances, difficult discussions about research rigour versus research relevance, and constant monitoring. Specific resources should be directed towards co-production in the initiative budget, for example expert facilitation, mentoring for participants, and skill building. Attention should also be paid to encouraging the development of soft skills such as political astuteness, negotiation and managing conflict.

Beyond the initiative level

Research funders can offer co-production awards and support awardees in their endeavours. Health system leaders can adopt co-production as "the way we do

things," starting with embedding researchers and supporting the initiatives on which they can work, including training staff. Academic leaders can begin to explore how formal education of researchers and practitioners can build capacity for new ways of working with stakeholders. Academic and health system leaders could partner to create new types of positions for knowledge-to-action; academic leaders and funders could also continue the discussions that have started in many places about traditional incentives – including the 'publish or perish' imperative for researchers – and the need for change in this area.

Action 2: Establish shared goals and shared measurements

Those who will play a significant role in sponsoring, leading, supporting and studying a knowledge-to-action initiative need to agree on what it will ideally accomplish at the highest level and how – also at the highest level – they will know it is on track. Workshop participants thought that such 'big picture' reflection could go a long way towards enabling successful knowledge-to-action. Unfortunately, the seemingly straightforward practice of goal setting is often mishandled in various ways, from failing to achieve buy-in from everyone involved, to assuming a clarity or shared understanding, to going too far too quickly into the strategies and tactics of implementation.

At the initiative level

Initiative leaders can facilitate shared goal setting at the outset. Focusing people on the shared 'what' – the common interests regardless of organisational or professional or personal attributes and affiliations – keeps people away from putting specific interests on the table in terms of *how* things will be done, the tactics. Keeping similarly high-level on shared measurement allows for a range of evaluation metrics to be established where necessary, for example if there are other sites or organisations involved in the initiative. An expert facilitator can support goal and measurement setting among those with different accountabilities and motivations, capitalising on these differences (Van de Ven, 2007). Initiative leaders will also need to ensure that resources in the form of skills and systems are in place for ongoing evaluation, including data collection and analysis.

Beyond the initiative level

Organisational leaders can require shared goal and measurement setting, and offer training to key people within the organisation who can facilitate these activities for others. Funders can include shared goal and measurement setting as a condition of certain awards, and they can partner with academic institutions to nurture the skills of researchers in shared goal and measurement setting as part of their work towards enabling more co-production.

Action 3: Enable and support leadership

Workshop participants noted the difficulty of achieving lasting change in health systems when leaders do not stay in positions long enough to effect that change.

They noted that one of the case studies – NETS – attributed much of its success to continuity in leadership. Changes in leadership at the top are indeed disruptive and can take years to adjust to. It is not an area that most of us working on knowledge-to-action initiatives can influence directly, but that does not detract from the importance of the message about leadership. It is helpful to bear in mind that continuity of formal leadership is only one aspect of overall leadership that should be considered in knowledge-to-action initiatives.

At the initiative level

Those managing initiatives are encouraged to set objectives related to leadership specifically. Important leadership objectives are communicating a clear vision and plan, and creating and fostering a culture at the initiative level that encourages and supports emergent change. Enabling and supporting others to lead, by formally distributing leadership across an organisation, is key. 'Distributed' could refer to within different departments or sites or organisations, or it could be topic-specific leadership, for example evaluation or communications. Boundaries of authority for distributed leaders should be clear. Finally, informal leaders, as discussed in the themes section of this paper – those who command attention by virtue of positions and personalities – can be recruited to more formal leadership roles.

Beyond the initiative level

Healthcare leaders can invest in developing different levels of leaders through training and mentoring. Academic leaders could embed leadership training in professional education. Funders too, who have been at once applauded for providing grants for co-production and criticised for assuming it 'just happens', could work with academic and system leaders to offer training, and also to study leadership in practice. Different types of leadership – adaptive, engaged, collaborative, servant and quiet (Hannaway et al, 2007) – could be further studied and enabled.

Action 4: Ensure adequate resourcing

Adequate planning for the resources necessary to produce change, over and above 'business as usual' resources for service delivery, is key. Resourcing here refers not only to funding – which is acknowledged as in short supply – but also the right tools, the right expertise and skill set and enough time (both to do the work required and to support change over the longer term) and, as discussed above, the right leadership. Workshop participants noted the number of tools that are available and in development to support knowledge-to-action in complexity, and how important it will be to use these to support new ways of thinking and working. Much of what is proposed in this paper need not have significant resource consequences, but instead requires focused and intentional effort to use what is available in different ways.

At the initiative level

Initiative leaders can set realistic budgets, ensuring they are able to bring on the necessary expertise, for example expert facilitation and strategic communications

support (see action 6). They can also account in their budgets for the training and mentoring that will be necessary to help various stakeholders play their part. As mentioned above, bringing a range of appropriate tools to bear – system dynamic mapping, network analysis, developmental evaluation and others – will be an important part of any resource plan. Finally, resources may also be needed as incentives, for example compensation for public or patient members, or buy-out compensation for health professionals.

Beyond the initiative level

Health system leaders can provide resourcing for specific initiatives, but they can also develop a structure that supports knowledge-to-action in general, including facilitating roles that promote research use; establishing formal ties to researchers and opinion leaders outside the organisation; a technical infrastructure that provides access to research evidence; and provision and participation in training programmes to enhance staff capacity building (Ellen et al, 2013). As mentioned above, health system and academic leaders can partner on dedicated positions such as embedded researchers, with the support of funders. For their part, funders could be more flexible with their grants, providing appropriate time for knowledge-to-action initiatives and flexibility with eligible expenses. Finally, access to peer-reviewed journal articles that provide evidence to help with the design of initiatives is a problem – ironically so, given the calls for more evidence-informed practice and policy; open access publishing should be encouraged and supported.

Action 5: Contribute to the science of knowledge-to-action

Workshop participants discussed the importance of ongoing monitoring and evaluation of specific initiatives, but they also stressed how critical it is to be able to apply what is learned from specific initiatives to new ones. Unfortunately the science of knowledge-to-action – which explores determinants of knowledge use and effective methods for promoting evidence uptake (Graham and Tetroe, 2009) – is paid little attention compared to the practice (Dobbins et al, 2009). Although knowledge-to-action in complexity stresses the importance of context, ideally we will not view initiatives as so constrained by context that we do not see any relevance beyond them.

At the initiative level

Leaders of initiatives can draw on the knowledge-to-action literature to plan their initiatives, capitalising on the increasing body of work that provides evidence for what may work in specific situations. However, they can also commit to the study of those initiatives for the benefit of the field overall. Moving beyond evaluation of the specific initiative to exploration of its findings in more general terms requires dedicated resources to plan, conduct and report on the study; there are several implementation science frameworks that can be used (see for example Damschroeder et al, 2009). The other actions offer a number of opportunites for study that would benefit the field greatly, including communications, leadership, organisational supports, and co-production.

Beyond the initiative level

Funders can contribute to the science of knowledge-to-action by developing granting programmes; research users should be involved in review committees for such grants. Health system leaders can also support the creation of more general knowledge beyond the initiative level through the organisational supports mentioned earlier (Ellen et al, 2013). Researchers can draw on the historical literature referenced above to ensure they are adding to – not duplicating – existing work, and can also look to different disciplines with well-established literatures that go back much farther than the relatively new knowledge-to-action field.

Action 6: Be strategic with communication

We conclude by suggesting that strategic communication is undervalued in knowledge-to-action (Holmes and Noel, 2015; Ogilvie et al, 2005), and emphasise its importance especially in complex system initiatives. As mentioned above, this communication will not necessarily be specifically about complexity and its terminology and concepts, but rather will address who needs to do, think, feel and believe what, for an initiative to be successful. The topic of communications came up a number of times in the workshop, with participants noting the importance of engaging with people in ways that are meaningful to them.

At the initiative level

Initiative leaders can ensure the development of a strategic communication plan that identifies audiences and sets objectives and strategies for each based on their respective priorities, motivations and other elements of the context in which they work. Stakeholder mapping and analysis are helpful tools here. Understanding different stakeholder groups is critical in order to provide them with appropriate information via the tools, formats and language that resonates. For example, decision makers at the highest level of government, who may be motivated by a desire for recognition, or re-election, do not necessarily need to understand and adopt systems thinking *per se*; as Holmes and Noel (2015) have pointed out, it is fruitless to try to overcome the quick-fix mentality, which will always exist for some stakeholders. But because those who think this way are in a position to facilitate knowledge-to-action, we need strategies to achieve their buy-in. Despite the well-observed caution about counter-productive attempts to simplify complexity, sometimes high-level presentations that provide straightforward key messages about issues and their resolution are beneficial. Some stakeholders prefer stories, others respond well to statistics; appeals to logos (reason), ethos (credibility) or pathos (emotion) (McNeill and Briggs, 2014) vary depending on the stakeholder group and the topic of communication. Always, it is critical to pay attention to the messenger as well as the message. Finally, communication strategies should include a range of ways to share the results of specific initiatives, as well as adding to the knowledge about what works in knowledge-to-action in complexity, as mentioned in action 5.

Beyond the initiative level

Health system leaders can require communication plans as part of organisational initiatives. Funders, too, could be more realistic about their expectations of awardees: grant applications require researchers to promise more by way of impact than it is reasonable or possible to deliver, and conditions of award – as well as academic leaders – hold researchers responsible for getting media attention for specific studies (as opposed to bodies of knowledge) whose results are far from having any impact on the public's health, and which paint a misleading, often simplistic picture of the complexities of research and its application. Strategic communication beyond the initiative can also be used to advocate for change: the champions mentioned above can play a role within their organisations, for example health professionals can engage their association peers and boards in a discussion of the often destructive (at worst) and unhelpful (at best) effects of politics and power, the over-inflated importance of 'academic neutrality' and the need to change deeply-entrenched ways of working that reinforce an outdated *status quo* and set of vested interests. Although power and politics will always be with us, it is the case that with better understanding and intent, their beneficial effects can be maximised and their damaging effects minimised.

Conclusion

The complexity of implementing change in health systems can seem overwhelming. But given that complex problems arise within systems as a consequence of human actions, deliberate or unintended, it follows that human action can be mobilised to solve them. We need deliberately coordinated and carefully crafted interventions involving the creative efforts of individuals and organisations at many levels and from different sectors (Lavis, 2006; Riley et al, 2015); we need to avoid attempts to control or manipulate the system but rather seek to work with the grain to foster and nurture emergent solutions.

This paper adds to the growing literature on knowledge-to-action in complexity by proposing immediate actions that can be taken by stakeholders working on or able to influence health system improvement. These actions are based on insights and themes derived from our case studies and existing literature, which in turn were interrogated in rigorous discussion with an invited group of policymakers, researchers and practitioners. All of these stakeholders reiterated the need for tangible and practical support for knowledge-to-action in complex health systems.

The workshop ended with a recommendation for a short-term action plan to further this effort. In turn, the authors of this paper issue a call to action related to one of the thematic areas: more co-production of knowledge related to complex system interventions by the growing community of people committed to this important area of study and practice.

References

Atkinson, J, Page, A, Wills, R, Milat, A, Wilson, A, 2015, A modeling tool for policy analysis to support the design of efficient and effective policy responses for complex public health problems, *Implementation Science* 10, 26

Barnes, R, Holmes, B, Lindstrom, R, Trytten, C, Wales, M, 2015, Evidence-informed healthcare through integration of health research, *Healthcare Management Forum* 28, 2, 75–8

Best, A, Clark, P, Leischow, S, Trochim, W (eds), 2007, *Greater than the sum: Systems thinking in tobacco control,* Smoking and Tobacco Control Monograph 18, Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute, NIH Publication

Best, A, Holmes, B, 2010, Systems thinking, knowledge and action: Towards better models and methods, *Evidence & Policy* 6, 2, 145–59

Best, A, Greenhalgh, T, Saul, J, Lewis, S, Carroll, S, Bitz, J, 2012, Large system transformation in health care: A realist review and evaluation of its usefulness in a policy context, *Milbank Quarterly* 90, 3, 421–56

Burton, C, Rycroft-Malone, J, 2015, An untapped resource: Patient and public involvement in implementation, comment on 'Knowledge mobilization in healthcare organizations: A view from the resource-based view of the firm', *International Journal of Health Policy and Management* 4, 12, 845–7

Chapman, J, 2003, *System failure: Why governments must learn to think differently* (2nd edn), London: Demos

Contandriopoulos, D, Lemire, M, Denis, J, Tremblay, E, 2010, Knowledge exchange processes in organisations and policy arenas: A narrative systematic review of the literature, *Milbank Quarterly* 88, 4, 444–83

Damschroder, L, Aron, D, Keith, R, Kirsh, S, Alexander, J, Lowery, J, 2009, Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science, *Implementation Science* 4, 50

Davies, H, Nutley, S, Walter, I, 2009, Why 'knowledge transfer' is misconceived for applied social research, *Health Services Research & Policy* 13, 3, 188–90

Davies, H, Powell, A, Nutley, S, 2016, Mobilizing knowledge in health care, in Ferlie, E, Montgomery, K, Pederson, AR (eds), *The Oxford handbook of healthcare management*, Oxford: Oxford University Press

Dobbins, M, Hanna, S, Ciliska, D, Manske, S, Cameron, R, Mercer, S, O'Mara, L, DeCorby, K, Robeson, P, 2009, A randomized controlled trial evaluating the impact of knowledge translation and exchange strategies, *Implementation Science* 4, 61

Edmonstone, J, 2013, What is wrong with NHS leadership development? *British Journal of Healthcare Management* 19, 11, 531–8

Ellen, M, Leon, G, Bouchard, G, Lavis, J, Ouimet, M, Grimshaw, J, 2013, What supports do health system organizations have in place to facilitate evidence-informed decision-making? A qualitative study, *Implementation Science* 8, 84

ExpandNet, 2013, *Nine steps for developing a scaling-up strategy*, Geneva: WHO

Frost, H, Geddes, R, Haw, S, Jackson, C, Jepson, R, Mooney, J, Frank, J, 2012, Experience of knowledge brokering for evidence informed public health policy and practice: Three years of the Scottish Collaboration for Public Health Research and Policy, *Evidence & Policy* 8, 3, 347–59

Graham, I, Tetroe, J, 2009, Getting evidence into policy and practice: Perspective of a health research funder, *Canadian Child and Adolescent Psychiatry* 18, 1, 46–50

Greenhalgh, T, Robert, G, Macfarlane, F, Bate, P, Kyriakidou, O, 2004, Diffusion of innovations in service organisations: Systematic review and recommendations, *Milbank Quarterly* 82, 581–629

Greenhalgh, T, Wieringa, S, 2011, Is it time to drop the 'knowledge translation' metaphor? A critical literature review, *Royal Society of Medicine* 104, 501–09

Hannaway, C, Plsek, P, Hunter, DJ, 2007, Developing leadership and management for health, in Hunter, DJ (ed), *Managing for Health*, London: Routledge

Hanney, S, Boaz, A, Jones, T, Soper, B, 2013, Engagement in research: An innovative three-stage review of the benefits for healthcare performance, *Health Service Delivery Research* 1, 8

Havelock, R, 1969, *Planning for innovation through the dissemination and utilization of scientific knowledge*, Ann Arbor, MI: CRUSK Institute for Social Research

Holmes, BJ, Finegood, DT, Riley, BL, Best, A, 2012a, Systems thinking in dissemination and implementation research, in Brownson, R, Colditz, G, Proctor, E (eds), *Dissemination and implementation research in health: translating science to practice,* New York: Oxford University Press

Holmes, BJ, Scarrow, G, Schellenberg, M, 2012b, Translating evidence into practice: The role of health research funders, *Implementation Science* 7, 39

Holmes, BJ, Noel, K, 2015, Time to shift from systems thinking-talking to systems thinking-action, comment on constraints to applying systems thinking concepts in health systems: A regional perspective from surveying stakeholders on Eastern Mediterranian countries, *International Journal of Health Policy and Management* 4, 1–3

Hunter, DJ, 2015, Role of politics in understanding complex, messy health systems, *BMJ* 350, h1214

Hunter, DJ, Perkins, N, 2014, *Partnership working in health,* Bristol: Policy Press

Hunter, DJ, Nuno, R, Arratibel, P, Mora, J, Bengoa, R, 2016, *Implementation of health system transformation*, Copenhagen: WHO

Kelly, MP, Morgan, A, Ellis, S, Younger, T, Huntley, J, Swann, C, 2010, Evidence based public health: A review of the experience of the National Institute of Health and Clinical Excellence (NICE) of developing public health guidance in England, *Social Science and Medicine* 71, 1056–62

Kelly, MP, Moore, TA, 2012, The judgement process in evidence based medicine and health technology assessment, *Social Theory and Health* 10, 1–19

Kitson, A, Powell, K, Hoon, E, Newbury, J, Wilson, A, Beilby, J, 2013, Knowledge translation within a population health study: How do you do it? *Implementation Science* 8, 54

Knowledge to action: Addressing complex problems in health systems, 2015, Green paper stakeholder consultation workshop report, www.dur.ac.uk/public.health/newsitems/news_in_full/?itemno=24943

Lanham, HJ, Lehyuk, LK, Taylor, BC, McCannon, CJ, Lindberg, C, Lester, RT, 2013, How complexity science can inform scale-up and spread in health care: Understanding the role of self-organization in variation across local contexts, *Social Science & Medicine* 93, 194–202

Lavis, J, 2006, Research, public policymaking, and knowledge-translation processes: Canadian efforts to build bridges, *Continuing Education in the Health Professions* 26, 1, 37–45

Levin, B, 2013, To know is not enough: Research knowledge and its use, *Review of Education* 1, 1, 2–31

Lewis, SJ, Russell, AJ, 2011, Being embedded: A way forward for ethnographic research, *Ethnography* 12, 398–416

Lorenc, T, Tyner, EF, Petticrew, M, Duffy, S, Martineau, FP, Phillips, G, Lock, K, 2014, Cultures of evidence across policy sectors: Systematic review of qualitiative evidence, *European Journal of Public Health* 24, 6, 1041–7

Lukas, CV, Holmes, S, Cohen, AB, Restuccia, J, Cramer, IE, Schwartz, M, Charns, MP, 2007, Transformational change in health care systems: An organizational model, *Health Care Management Review* 32, 309–20

Marshall, M, Pagel, C, French, C, Utley, M, Allwood, D, Fulop, N, Pope, C, Banks, V, Goldman, A, 2014, Moving improvement research closer to practice: The researcher in residence model, *BMJ Quality and Safety* 23, 10, 801–05

Marshall, M, Eyre, L, Lalani, M, Khan, S, Mann, S, de Silva, D, Shapiro, J, 2016, Increasing the impact of health services research on service improvement: The researcher-in-residence model, *Royal Society of Medicine*, 109, 6

Mannion, R, Konteh, F, Davies, H, 2009, Assessing organisational culture for quality and safety improvement: A national survey of tools and tool use, *BMJ Quality and Safety* 18, 153–6

Mannion, R, Brown, S, Beck, M, Lunt, N, 2011, Managing cultural diversity in healthcare partnerships: The case of LIFT, *Health Organization Management* 25, 645–57

McCannon, CJ, Schall, MW, Perla, RJ, 2008, *Planning for scale: A guide for designing large-scale improvement initiatives*, IHI Innovation Series white paper, Cambridge, MA: Institute for Healthcare Improvement

McNeill, A, Briggs, P, 2014, Understanding Twitter influence in the health domain: A social-psychological contribution, http://nrl.northumbria.ac.uk/16566/1/socmedhealthmcneillbriggs2.pdf

Midgely, G, 2003, Science as systemic intervention: Some implications of systems thinking and complexity for the philosophy of science, *Systemic Practice and Action Research* 16, 20, 77–97

Nilson, P, 2015, Making sense of implementation theories, models and frameworks, *Implementation Science* 10, 53

Norton, WE, McCannon, CJ, Schall, MW, Mittman, BS, 2012, A stakeholder-driven agenda for advancing the science and practice of scale-up and spread in health, *Implementation Science* 7, 118

Ogilvie, D, Hamilton, V, Egan, M, Petticrew, M, 2005, Systematic reviews of health effects of social interventions: 1, Finding the evidence: How far should you go? *Epidemiology and Community Health* 59, 804–08

Paina, L, Peters, DH, 2012, Understanding pathways for scaling up health services through the lens of complex adaptive systems, *Health Policy and Planning* 27, 5, 365–73

Parry, G, Carson-Stevens, A, Luff, DF, McPherson, ME, Goldmann, DA, 2013, Recommendations for evaluation of health care improvement initiatives, *Academic Pediatrics* 13, 6, S23–S30

Pawson, R, 2013, *The science of evaluation: a realist manifesto,* London: Sage

PHAC (Public Health Agency of Canada), 2013, *Considerations for the scale up of PHP interventions*, Ottawa: Public Health Agency of Canada

Plsek, P, Greenhalgh, T, 2001, The challenge of complexity in health care, *BMJ* 323, 625–8

Rich, R, 1979, The pursuit of knowledge, *Science Communication* 1, 1, 6–30

Riley, BL, Robinson, KL, Gamble, J, Finegood, DT, Sheppard, D, Penney, TL, Best, A, 2015, Knowledge to action for solving complex problems: Insights from a review

of nine international case studies, *Health Promotion and Chronic Disease Prevention in Canada* 35, 3, 47–53

Rittel, HWJ, Webber, MM, 1973, Dilemmas in a general theory of planning, *Policy Sciences* 4, 155–69

Rogers, EM, 2003, *Diffusion of innovations* (5th edn), New York: Simon & Schuster

Roth, V, 2013, One hundred fifty years of infection prevention and control: Still searching for the cure, *Healthcare Papers* 13, 1, 24–9

Rouse, WB, 2000, Managing complexity: Disease control as complex adaptive system, *Information Knowledge Systems Management* 2, 2, 143–65

Rycroft-Malone, J, Wilkinson, J, Burton, C, Harvey, G, McCormack, B, Graham, I, Staniszewska, S, 2013, Collaborative action around implementation in Collaborations for Leadership in Applied Health Research and Care: Towards a programme theory, *Health Services Research & Policy* 18, 3, 13–26

Rycroft-Malone, J, 2014, From knowing to doing: From the academy to practice, comment on The many meanings of evidence: Implications for the translational science agenda in healthcare, *International Journal of Health Policy and Management* 2, 1–2

Scott, S, Profetto-McGrath, J, Estabrooks, C, Winther, C, Wallin, L, Lavis, JN, 2010, Mapping the knowledge utilization field in nursing from 1945 to 2004: A bibliometric analysis, *Worldviews on Evidence Based Nursing* 7, 4, 226–37

Stetler, C, Ritchie, J, Rycroft-Malone, J, Schultz, AA, Charns, MP, 2009, Institutionalising evidence-based practice: An organisational case study using a model of strategic change, *Implementation Science* 4, 78

Stetler, C, Richie, J, Rycroft-Malone, J, Charns, M, 2014, Leadership for evidence-based practice: Strategic and functional behaviors for institutionalising EBP, *Worldviews on Evidence Based Nursing* 1, 4, 219–26

Van de Ven, AH, 2007, *Engaged scholarship: a guide for organizational and social research,* New York: Oxford University Press

Walshe, K, Davies, HTO, 2013, Health research, development and innovation in England from 1988 to 2013: From research production to knowledge mobilization, *Health Services Research & Policy*, 18, 3, Suppl 1–12

Ward, V, Smith, S, House, A, Hamer, S, 2012, Exploring knowledge exchange: A useful framework for policy and practice, *Social Science and Medicine* 74, 297–304

Weiss, C, 1979, The many meanings of research utilization, *Public Administration Review* 39, 5, 426-31

Willis, CD, Saul, JE, Bevan, H, Scheirer, MA, Best, A, Greenhalgh, T, Mannion, R, Cornelissen, E, Howland, D, Jenkins, E, Bitz, J, 2016, Sustaining organizational culture change in health systems, *Health Organization and Management* 30, 1, 2–30

Zimmerman, B, Reason, P, Rykert, L, Gitterman, L, Christian, J, Gardam, M, 2013, Front-line ownership: Generating a cure midset for patient safety, *Healthcare Papers* 13, 1, 6–23