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Citation for published version:
Smith, K & Joyce, KE 2012, 'Capturing complex realities: understanding efforts to achieve evidence-based policy and practice in public health', *Evidence and Policy*, vol. 8, no. 1, pp. 57-78.
https://doi.org/10.1332/174426412X6201371

Digital Object Identifier (DOI):
10.1332/174426412X6201371

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Evidence and Policy

OPEN ACCESS

Capturing Complex Realities - Understanding Efforts to Achieve Evidence-Based Policy and Practice in Public Health

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Word counts:

Abstract: 100

Main text (excluding abstract and references): 8,635

Capturing Complex Realities - Understanding Efforts to Achieve Evidence-Informed Policy and Practice in Public Health

Abstract:

Studies exploring how and why evidence informs decisions (or not) often focus on perceived cultural, communicative and institutional gaps between research producers and users. More recently, there has been a growing interest in exploring how political differences between competing 'policy networks' might shape research utilisation. Drawing on two public health case studies, this paper highlights the multiplicity of divisions informing knowledge translation, arguing that this calls into question the appropriateness of prioritising professional or political divisions. It concludes by outlining how complexity theories might be employed to develop more sophisticated ways of conceptualising the relationships between research, policy and practice.

Key words: Complexity theories; knowledge translation; health inequalities; Geographical Information Systems (GIS).

Introduction:

The post-1997 UK Labour government's commitment to evidence-based policymaking (Cabinet Office 1999; Blunkett, 2000) promoted the idea that evidence should play a pivotal role in decision-making. Within public health, this emphasis was further reinforced by the related evidence-based medicine movement (Goldenberg, 2006) and calls by the World Health Organization (1998) for 'an evidence-based approach to health promotion policy and practice'. Reflecting these developments, there have been numerous recent attempts to explore the relationship between research, policy and practice within public health (e.g. Exworthy et al, 2002; Petticrew et al, 2004; Smith, 2007). Yet, despite all this activity, most analyses conclude that research plays a very limited role in health policy (e.g. Capability Reviews Team, 2007; Smith, 2007).

In seeking to account for this disjuncture, many commentators have challenged the idea that decisions about complex policy issues could, or even should, be based *solely* on research evidence (e.g. Davey Smith et al., 2001; Mulgan, 2005). Those levelling this kind of criticism often point out that such a linear relationship is dependent on an unrealistically simple account

of policymaking, given that policy decisions are also informed by a multitude of other factors, including ideology and values, public opinion and lobbying (Duncan, 2005; Mulgan, 2005; Young et al., 2002). Such contributions have led some to conclude that it may be more realistic to aim only for 'evidence-inspired' or 'evidence-informed' policy (e.g. Duncan, 2005; Young et al., 2002), whilst others claim such a semantic shift could undermine the *'drive to increase the influence of knowledge in the guidance of human affairs'* (Sanderson, 2009: p.705). Whichever term one prefers, efforts to improve the use of knowledge in public health decision-making continue and a recurrent claim is that significant benefits will be gained through overcoming the institutional, cultural and communicative gaps between research producers and users that were famously highlighted by Caplan in 1979 (e.g. Lomas, 2000; Petticrew et al., 2004). This position is supported by reviews of evidence which cite increased interactions between policymakers and researchers as the factor most likely to increase utilisation (e.g. Lavis et al, 2005; Walter *et al*, 2005). More recently, there have been a growing number of calls for 'sustained interaction' between researchers and policymakers (Saunders, 2005), including the 'co-production' of research, in which potential research users are directly involved in the research process (Lavis et al, 2005; Pope et al., 2006).

Whilst the above debates have largely focused on the use of research within *policy*, similar debates have occurred in relation to the use of evidence in local public health decision-making. Modern technologies, such as Geographical Information Systems (GIS) and computer aided software, offer a potential platform to improve the use of evidence in decision-making (Ho et al, 2003). However, echoing the 'cultural gap' identified between researchers and policymakers (Caplan, 1979), accounts of the adoption of evidence technologies by practice communities have been hallmarked by a concern with tensions between the research communities in which these technologies are traditionally used and the practice communities, in which the diffusion of new technologies is being promoted (e.g. Cockings et al., 2004; Kothari et al., 2008). Once again, there is a widespread belief that the diffusion of evidence or technologies will be aided by greater interaction and collaboration between these professional communities.

Concern with the professional boundaries between research producers and users often implies that research, policy and practice communities are clearly distinct from one another and relatively internally homogenous; a conceptualisation which seems in tension with both political science's preoccupation with policy networks (Marsh & Rhodes 1992; Marsh & Smith 2000), 'epistemic communities' (Haas, 1992) and 'advocacy coalitions' (Sabatier and Jenkins-Smith,

1993), and the broader social scientific turn towards complexity and networks (Thompson, 2004). Indeed, the policy networks literature pays little attention to professional divisions, contending instead that it is groups of actors (potentially including researchers, policymakers, practitioners and others) bound together through shared *value*-systems (or political interests) that provide key to understanding policy change. Viewed through this analytical lens, the most important boundaries lie not between research producers and 'users' but between different epistemological outlooks or political ideologies. From a research utilisation perspective, employing a policy networks approach would suggest that research-based ideas or technologies that are perceived to 'fit' with the perspectives/values of a dominant network will move into policy relatively smoothly, via the links between the different actors operating *within* networks. In this case, efforts to increase interaction between researchers and research users may well help achieve EIPP. However, policy networks also call attention to the prospect that, where researchers are promoting ideas or tools which are perceived to challenge the values or perspectives of a dominant policy network, it is far less likely that these ideas/tools will change policy and/or practice, no matter how many cross-sectoral 'bridges' are built. This (as well as policy inertia) may help explain situations in which vast bodies of evidence appear to have little impact on policy or practice.

Key contributors to the EIPP literature are increasingly drawing on policy networks theories (e.g. Exworthy, 2008; Jung and Nutley, 2008), although this is an area which remains under-developed. This article argues that while political differences should be explored in knowledge transfer studies, it is important to ensure that employing 'policy network' style theories does not merely replace a concern with professional divisions with a focus on political differences. Rather, the article illustrates the importance of acknowledging the multiple boundaries and relationships that shape knowledge transfer. This is achieved through a discussion of two public health case studies, one of which considers the use of evidence in national health policy and the other of which explores the use of evidence and technologies in local practice. The combination of case studies provides insights into two of the key 'contextual layers' of decision-making that Nixon and colleagues (2002) identify (national and local level decision-making in public health), helping to demonstrate the ongoing nature of knowledge translation. The findings suggest that it is crucial not to become overly preoccupied with debates about what kinds of divisions, or 'gaps', are most problematic for knowledge utilisation (or to presume that 'bridges' across these divides will significantly improve the way in which new knowledge is employed) but rather to approach the messy realities of knowledge transfer in a way which

allows multiple divisions and links to be explored. The Discussion goes on to argue that a theoretical framework which more comprehensively captures these multiple and intersecting relationships is required to advance understandings of EIPP, before outlining how complexity theories provide a plausible basis for such a framework. The aim is to help refocus explanations away from specific boundaries, towards whole systems. Complex adaptive systems are open systems with a large number of elements, in which dynamic interactions, feedback loops and non linearity are all important features (see Cilliers, 1998). We argue that our case studies indicate these features are all important aspects of knowledge transfer which complexity theories help highlight.

We are not the first to advocate the use of complexity theories in thinking about public health issues (Blackman (2006) has drawn on complexity theory to unpack the intricate and dynamic relations between communities, place and health inequalities) or knowledge transfer, where Sanderson (2006, 2009) has argued that complexity theories call for broader conceptions of rationality. However, the focus on complexity in the social sciences has been criticised for being vague and indirect (Cairney, 2010; McLennan, 2003), in contrast to the natural sciences, where complex systems are often given explanatory value (Cairney, 2010). Cognisant of this criticism, the Discussion attempts to advance debates by applying complexity theories to the two case studies and outlining how such theories might be employed to enhance future studies of knowledge transfer.

Methods and case study selection

The paper draws on two empirical, qualitative research projects, which were selected to highlight some of the nuances involved in knowledge transfer at both national and local levels. Case study A explored the relationship between health inequalities research and policy in Scotland and England between 1997 and 2007. Case study B examined how GIS technologies and their associated outputs were perceived and valued by public health decision-makers in the UK, in local practice settings over a similar period. Although the case studies are distinct, they help highlight the ongoing nature of knowledge transfer, in which knowledge is translated at multiple decision-making levels. Between them, the case studies demonstrate that both evidence and technologies can be translated in fundamentally different ways by decision-makers, who filter and frame their understandings of new information according to their previous experiences, epistemological and political positions and work-related priorities.

The research for case study A was undertaken between 2004 and 2007 and was based on semi-structured interviews with 61 actors involved in the construction of research, policy and media portrayals of health inequalities in the two localities. Case study B is based on semi-structured interviews, conducted between 2005 and 2006, with 23 individuals who were involved in public health practice (in environmental, medical/clinical and community settings). In both cases, the research projects were initially informed by the literature on EIPP, which privileges divisions between professional communities, and interviewees were therefore selected on the basis of their professional positions. Table 1 provides a summary of the types of professionals who were interviewed in each study.

Table 1: A breakdown of the professional location of interviewees in each case study

Case Study A	
Interviewees' profession	*Number of interviewees*
Academic researchers	29
Civil servants	10
Independent research organisations (including think tanks)	5
NHS based researchers / policy advisors	5
Media-communications related employees	5
Ministers / ex-ministers	4
Research funders	3
Total	**61**
Case Study B	
Interviewees' area of interest relating to public health	*Number of interviewees*
Medical/Clinical Domain: Includes clinical leads and senior managers in the NHS	7
Community/Social Domain: includes nurses, civil servants and senior managers	8
Environment/Information Domain: includes civil servants, researchers and senior managers	8
Total	**23**

The methodological approach to interviewing in both projects was informed by feminist theories (e.g. Maynard & Purvis, 1994), with the aim of creating, as far as possible, a collaborative, non-hierarchical relationship between the interviewee and researcher (Oakley, 1981). A semi-structured approach to interview questions was taken in each project, which involved the use of a thematic interview schedule. For case study A, questions focused on health inequalities research, policy and advocacy, and the relationship between each of these since 1997. For

case study B, questions explored how interviewees perceived GIS technologies, how they felt these technologies were valued in public health and the role that GIS maps played in decision-making. The interviews varied in length, lasting between 45–150 minutes (although most were around 60–70 minutes). All interviews were recorded and transcribed verbatim by the researchers. The transcripts were subsequently anonymised in conjunction with the interviewees, before being coded to aid analysis. The full transcripts for each case study were seen only by the lead researcher and the relevant interviewees, in order to protect the anonymity of interviewees. In both cases analytical codes were constructed iteratively, as part of the process of analysing the data. In case study A, coding was undertaken using *Atlas.ti*; in case study B the analysis employed Microsoft Excel (see Swallow et al, 2003).

The interviews in case study A were supplemented by the documentary analysis of 45 key policy documents concerning health inequalities which were published in Scotland and England between 1997 and 2007. The interviews in Case Study B were informed by pre-prepared stimulus material based on data pertaining to a topical public health issue that had been explored using GIS. More extensive accounts of the methodological approach employed in each study are available elsewhere (Smith, 2006, 2008; Joyce, 2009).

Case Study A: The relationship between health inequalities research and national policy

The election of New Labour in 1997 brought with it commitments to tackling health inequalities (Department of Health, 1997), a complex and cross-cutting issue which had been ignored by the previous Conservative government, as well as EIPP (Cabinet Office, 1999). A review of the evidence on health inequalities was commissioned (Acheson, 1999), updating an earlier review commissioned by the previous (1974-79) Labour government (Black, 1980), and the government promised that the evidence-based conclusions would directly inform its health strategy. The interviews took place at a time (2006-2007) which was marked by a clear enthusiasm for the fact that health inequalities were being taken seriously by policymakers, but a growing sense of disappointment that this did not appear to be resulting in actual reductions in health inequalities (see Shaw *et al.* 2005).

The findings support claims that the influence of research evidence on health inequalities policy in the UK has been limited (e.g. Exworthy et al, 2003; Shaw et al, 1999), with not a single

interviewee claiming that health inequalities policies had been *based* on research evidence in Scotland or England. As might be expected, and in line with 'two community' theories (Caplan, 1979), several interviewees felt that a gap between researchers and policymakers was part of the reason for the failure to achieve evidence-based policy. However, it was also clear that many of the academic interviewees were actively involved in promoting their research to policymakers (several held official advisory positions) and that many of the policy-based interviewees had experience of undertaking research (some in academia). Furthermore, nearly all of the policy-based interviewees demonstrated a high level of awareness of most of the major theories about health inequalities, and most of the academic interviewees demonstrated a similarly high awareness of policy desires in relation to health inequalities evidence (reflecting those expressed by policy-based interviewees). Hence, despite the perceptions of some interviewees, the overall data do not suggest that a gap between research and policy was preventing knowledge exchange about health inequalities.

Furthermore, the ideas and researchers most widely referred to by policy-based interviewees were not those which appeared to have enjoyed the greatest policy *influence*. For example, both Richard Wilkinson and Michael Marmot (the latter of whom undertook various, policy advisory roles within England both during and subsequent to the study period) were regularly named by policy-based interviewees as key health inequalities researchers, and both were linked to their work on 'psychosocial determinants' (e.g. Marmot, 2004; Marmot et al, 1997; Wilkinson, 1997, 2005). Some interviewees even had books and/or reports by these authors on their shelves. All this, would seem to suggest a strong link between researchers developing psychosocial theories of health inequalities and policymakers. Yet, whilst aspects of psychosocial theories, such as the importance of status, happiness and confidence, were evident in policy discourses (both within documents and conversations), an associated interest in the importance of egalitarianism (clearly present in the outputs of both Wilkinson and Marmot) had not (see Smith 2007, 2008). Meanwhile, the emphasis placed on both the potential for lifestyle-behavioural interventions and the NHS to reduce health inequalities was not only far greater in policy statements than research evidence would support but also far higher than many of the policy-based interviews seemed to believe it should be. In all of these cases, whilst divisions between researchers and policymakers may have played some role in the divergence between policy and research, professional divisions did not sufficiently explain what had happened. At least four other factors seemed crucial, each of which is now briefly outlined.

First, it was clear that particular ideas about health had been institutionalised within policymaking bodies and that this actively shaped knowledge transfer. During the study period, health inequalities remained the responsibility of the health departments in Scotland and England, despite clear policy awareness of the central role of wider, social determinants. These departments were responsible for the NHS and not for any of the major social determinants of health (and virtually all of the interviewees stressed that 'joined-up' policymaking remained a distant aspiration). Consequently, the policymakers charged with responsibility for constructing policies to tackle health inequalities faced difficulties in trying to exert levers beyond their department's control and this, rather inevitably, seemed to contribute to an over-emphasis on the role of the NHS in reducing health inequalities. Furthermore, the respective departments of health were divided into sub-units focusing on: aspects of the NHS; the prevention and better treatment of particular diseases; the perceived risk factors for non-communicable diseases; and the health of particular population groups. Only small numbers of staff in each department were specifically charged with thinking about health inequalities and their jobs largely seemed to involve trying to persuade colleagues to take inequalities into account. This organisation highlighted the institutionalisation of a way of thinking about health based on a biomedical, rather than a social, model and this clearly impacted on the potential routes for different kinds of ideas and evidence about health inequalities, providing a far more obvious policy audience for evidence relating to the NHS and lifestyle-behaviours than for research on social and psychosocial determinants. For example, in the following extract, the interviewee explains that specialists (with responsibilities for specific areas of health policy) and medics were some of the most likely policy actors to keep up to date with academic journals:

> Civil servant (Scotland): *'People don't go traipsing through professional journals but you do have specialists within the Department as well. So, for example, on diet and physical activity, there is a Diet Co-ordinator, and there is a Physical Activity Coordinator, who are specialists in their own right… and in addition to that, you have specialists in terms of doctors and things like, many of whom do actually spend a bit of time with the journals.'*

The above extract highlights how the division of responsibilities within departments (in this case embodied in individuals with a specialist focus on diet, physical activity and medical issues) shapes the potential routes via which research-based ideas might travel into policy. It suggests

that research will have a greater chance of being picked up by policymakers if it fits with the existing organisational divisions of a policy department. This illustrates the necessity of taking institutional contexts, as well as individual relationships, into account when studying knowledge transfer.

A second important factor involves the multitude of boundaries dividing (and uniting) different actors, including disciplinary experiences and epistemological and political preferences. For example, there was a clear distinction between interviewees who invested a great deal of faith in medical expertise and those who did not. The dominant status of medical expertise has been widely commented upon within the social sciences (e.g. Armstrong, 1995; Goldenberg, 2006) so it is perhaps unsurprising that a status struggle relating to the credibility of medical expertise was evident. Not all interviewees felt this division was problematic, but over half of the academic interviewees made some kind of reference to it and most suggested medical expertise was likely to aid the credibility of a researcher and his/her ideas (see Jacobson & Goering, 2006 for reflections on the importance of credibility in knowledge transfer):

> Academic: *'The thing that's held back inequalities is there's one school of people whose points of reference are within… the psychosocial work and then there's another group of people, like me, who are medical and biological, and there hasn't been a whole lot of dialogue. […] I mean I was a clinician […] so I'm kosher with the medical people. […] The kind of sort of freaky, left-wing people who do a load of health research antagonise doctors. They do it deliberately. […] But, at the end of the day, we're the guys who look after the patients and… so I have a very clear view about the poor of being sick 'cause I've had to care for them and look after them. […] I don't just write about it.'*

> Academic: *'[W]ithin the health inequalities group, those who are physicians have a much higher status and… they are somehow believed to be more credible sources of information. It's difficult to get the idea that… disease is caused by a social factor; they always try to find a gene or biochemical or a vitamin or… whatever.'*

Interestingly, neither of the above statements suggests that the evidence produced by researchers who are medically trained is necessarily any better in quality (more rigorous or valid). Rather, they both focus on the higher *status*, and credibility, accorded to researchers

who have medical training (and, consequently, to the research evidence and ideas with which they are associated). Although the data do not suggest that non-medical evidence was always deemed less credible, it is worth noting that none of the interviewees claimed medical expertise ever had a negative impact on a researcher's credibility. The consequence seemed to be that researchers able to draw on claims to medical expertise had an additional resource to employ when promoting evidence and ideas to policy audiences. Crucially, this boundary traversed the division between research and policy, with many of the policy-based interviewees also according medical expertise a higher status. Both this, and the institutionalisation of a medical model of health within the policy bodies responsible for health inequalities, could help explain why ideas about health inequalities relating to lifestyle-behaviours and health services (i.e. those associated with a medical paradigm) appeared to have exerted more influence within policy than theories concerning psychosocial and social determinants.

A related, though distinct, methodological tension was observable between interviewees who claimed the credibility of research methodologies depended on their appropriateness and those who argued that quantitative data were *always* more credible and convincing. The following interviewee (who had previously held a role within government) was particularly dismissive of qualitative research:

> Academic researcher (medically qualified): *'… what I <u>detest</u> are these qualitative reports where they've got quotes from people, you know – you must have seen them, they've got, 'so and so said this, and so and so said that' – I mean I just chuck them out – I'm not interested in what people say. I want to see some statistical analysis, correlation coefficients and all that. People say I'm extremely biased about that but it's only because it's the only way you can really prove something.'*

Others were more measured in their comments, often claiming that it was the preferences of policymakers, rather than academics, which aided the credibility and influence of quantitative ideas:

> Academic (and policy advisor): *'In health inequalities… if the hard science can get pushed out […] If you can get the medics, the academics, the… guys who are doing this stuff to be putting out hard - and I emphasis <u>hard</u> - scientific evidence […],*

Ministers love that. It stops the sense that they're sort of having their biases or prejudices… pandered to.'

Quotes like this suggest, despite claims that policy-orientated researchers tend to value qualitative research more highly (Oakley, 2006; Sempik *et al*, 2007), quantitative and 'scientific' approaches to research have retained a high kudos within health policy circles (a finding mirrored in studies focusing on other policy areas, e.g. Bowen *et al.*, 2009; Stevens, 2011). Several researchers reported they had employed quantitative data to help 'sell' particular ideas to others (policymakers *and* fellow academics) because they felt it was perceived to be more 'reassuring'.

The emphasis interviewees placed on these kinds of epistemological divisions (medical/non-medical and quantitative/qualitative) echo the disciplinary boundaries that Bartley (1988; 1992) highlighted in her exploration of the relationship between research and policy in the unemployment and health debates of the 1980s. However, unlike Bartley's work, the findings also suggest that there were important political boundaries which cut across epistemological boundaries, the most obvious of which divided those who believed health inequalities researchers ought to be working closely with policymakers and those who felt that they should remain independent of policy in order to critique it. As the reference by the interviewee quoted on p9 to 'freaky left-wing people' attests, those who sought a close relationship with policymakers were often extremely disparaging about their more critical colleagues. Equally, 'critical' academics were disparaging about researchers who worked closely with the Labour government. In both cases, interviewees suggested the work of the academics on the other side of this division was compromised by ideological convictions and lack of autonomy, claims which might be understood as the kind of 'boundary work' that Gieryn (1983, 1999) suggests scientists engage in with in order to increase the credibility of their research.

Although political and methodological divisions did not precisely reflect each other, these two boundaries seemed to have mutually functioned to limit the influence of some research ideas about health inequalities. In particular, theories concerning the influence of broader, difficult to empirically investigate determinants (e.g. the impact of economic inequalities on health inequalities) and nebulous, difficult to measure concepts (e.g. 'class' and 'consumerism') were sidelined, even though the majority of interviewees (in academic and policy settings) indicated they believed at least some of these factors were crucial to understanding health inequalities.

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In contrast, the same boundaries appeared to have mutually aided the policy influence of ideas relating to interventions that were perceived to be both feasible and possible to evaluate (e.g. the impact of smoking cessation services on health inequalities), even though most interviewees did not believe these kinds of interventions would make any significant impact on health inequalities.

The third factor that seems to have played an important role in shaping the influence of research-based ideas about health inequalities was external events which promoted interest in particular issues. Two examples were mentioned repeatedly: (i) the celebrity chef Jamie Oliver's campaign to improve school meals, which was perceived to have facilitated policy interest in existing research-based ideas about nutrition in schools; and (ii) the decision to implement a ban on smoking in public places in Ireland and the subsequent policy interest in research on passive smoking in Scotland and England. The following interviewee mentioned both:

> Academic: *'We've been working in health promotion on healthy eating for over twenty years… […] and Jamie Oliver comes along [Laughs]. Now that, you know, that's a PhD in itself: Why is it that one TV programme can shift the agenda and we have been working on that for <u>years</u>? […] Research can have an effect, but often in ways you never expect, and a lot of research doesn't seem to be having any effect. But then something can happen, which then opens up… but you can't… judge it. Like, smoke free public places - it's <u>Ireland</u>! If Ireland hadn't done it, and it been successful, we wouldn't be doing it in Scotland… but <u>suddenly</u>…'*

The extent to which external events were perceived to have played a role in policy interest in particular ideas and evidence is congruent with the emphasis placed on external events in popular theories of policy change, such as Kingdon's (1995) concept of 'policy windows', in which entrepreneurs seeking to promote particular 'policy solutions' must wait for external events to present windows of opportunity through which they can promote their particular solution. This illustrates the unpredictability of knowledge transfer and suggests there will always be limitations to guidance on how to promote the increased uptake of research evidence.

The fourth and final factor that seemed to play an important role in shaping how policymakers responded to particular research-based ideas about health inequalities was the fact that some academics described presenting their work to policy audiences (who were perceived as both potential research users and, importantly, potential funders) in ways which emphasised the aspects of their work they felt was most likely to be received favourably and/or deliberately imbuing challenging ideas with chameleon-like qualities to ensure that they were not deemed 'too radical'. The fourth factor is discussed in more detail elsewhere (Smith, 2010). The main point for this article is to emphasise that academics' decisions to 'self-censor' or be deliberately vague about particular ideas did not appear to be the consequence of a failure to understand policymakers' needs but rather a response to their perception of the changing academic (increasingly funding-dependent) contexts in which they found themselves working. This aspect of the findings potentially helps explain why some ideas, such as psychosocial theories about health inequalities, did travel into policy but in fractured ways. Once again, it illustrates the necessity of employing a theoretical framework that pays sufficient attention to the contexts and systems within which actors are operating. It also suggests that one potentially unintended impact of increasing interactions between policymakers and researchers maybe the politicisation (in a broad sense) of research (see Hammersley, 2005).

Overall, this case study suggests that frameworks for understanding knowledge transfer need to take account of: (i) the institutionalisation of particular ideas and the subsequent impact of this on knowledge exchange; (ii) the multitude of intersecting and overlapping boundaries that can facilitate and impede the movement of ideas; (iii) the potentially significant but unpredictable role of external events; and (iv) the contexts within which research evidence and ideas are constructed and presented.

Case Study B: The value of GIS (and GIS outputs) in public health
Case study B sought to examine public health decision-makers' perceptions regarding the value of GIS technologies and the status of GIS evidence in decision-making pathways, at a time when GIS technologies and outputs were being promoted as part of the broader evidence-based movement in public health. This case study provides a useful contrast with case study A for two reasons: (i) it discusses knowledge translation at a local (rather than national) level; and (ii) as it focuses on technologies and outputs, which might be expected to be less malleable than the ideas/theories discussed in the previous case study.

Once again, in line with 'two communities' type theories, evidence was found to support the notion that there was a disjuncture between those traditionally involved in using GIS technologies to manipulate and analyse data (in research settings) and the local decision-makers and public health practitioners expected to use GIS outputs in decision-making. One of the clearest distinctions was the fact that GIS analysts tended to use GIS to try to *capture* complex and fluid realities, whilst practitioners and local decision-makers often described GIS as a tool which could *translate* complex, ever-changing realities into simpler and more stable messages. For example:

> Community based Practitioner: *'I think it's very useful in terms of presenting complex information to a diverse audience which is mixed together because people recognise the map. They know the map and they know usually where they sit on the map. They know where their village is or whatever. It just simplifies it and makes it real because of the visual impact of it'.*

The above extract signals an implicit sense that maps are somehow 'concrete' and 'fixed'. It is illustrative of aspects of the data highlighting that actors conceived (and valued) GIS representations for their static nature. In this way, most local decision-makers and practitioners constructed GIS technologies as tools capable of transforming uncertain and complex realities into concrete, immutable and simple information which could aid communication. This illustrates that technologies, as well as ideas, can be translated as they are taken up, for the value attached by interviewees to the static and fixed nature of GIS maps belies the fact that GIS technologies were designed to capture complex and fluid relationships, including the fact that the landscapes GIS outputs represent are themselves subject to continual change.

However, as with case study A, multiple other divisions also seemed important to understanding how GIS and GIS outputs were informing decision-making. In particular, interviewees' understandings, constructions and uses of GIS appeared to be shaped by their disciplinary backgrounds, epistemological outlooks and organisational settings, and these boundaries often cut across the divide between researchers and practitioners. Interviewees came from disparate organisational and disciplinary traditions and they often seemed to visualise GIS technologies and data through a lens informed by these experiences. Hence, actors from medical settings often constructed GIS as an alternative to epidemiological techniques:

> Medical Practitioner: *'I do think it's important and there are specific circumstances where GIS would be my first choice and I think an exposure or indeed a pattern of disease around a focal source would be one of those...'*

The above quotation is illustrative of the fact many participants with a medical background constructed GIS as a means of investigating the distribution and spread of diseases, such as examining disease incidence in relation to a putative environmental hazard or mapping the spread of food borne infections. In addition, many respondents with a medical background favoured the use of GIS as a form of deductive analysis which could contribute to better understandings of causal relationships:

> Medical Practitioner: *'[I]t gives you a different way of analysing data – that's the main benefit. The sorts of techniques you'd use originally is case control studies, well the problem of case control studies is the control. More often controls are identified on the basis of their physical, rather than spatial characteristics, and for a lot of environmental issues in particular, the spatial characteristics are more important.'*

The above extract focuses on the epidemiological power of GIS. The interviewee suggests that GIS provides a means of accessing evidence to demonstrate causality. Similar accounts of GIS were evident throughout discussions, with participants in the medical domain frequently constructing GIS as belonging to a positivist paradigm of analysis, imbued with a linear logic and a search for defined outcomes. By focusing on how GIS might help to provide deterministic evidence, these interviewees appeared to miss (or ignore) the rich and complex picture of inter-relationships that GIS can provide.

Non-medical decision-makers tended to conceptualise GIS primarily in terms of data visualisation, often equating GIS to a simple cartographic tool. This was particularly true of decision-makers working in environmental settings, who tended to use GIS as a data storage and visualisation facility. Maps were familiar constructs for most of these respondents and they talked far more about how GIS could be used in operational and strategic capacities within mapping exercises:

Environmental Practitioner: *'We've always been pretty map based, you need to know where the rivers are and you need to know where the landfill sites are and where the drainpipes are. All of our offices are pretty familiar with maps I think'*

As the extract above demonstrates, the mapping or cartographic properties of GIS were perceived to be well aligned with existing operational practices of decision-makers in environmental settings. In this way, the gap between research technologies and practice was less marked for environmental practitioners, due to a familiarity with the concepts associated with GIS, such as cartography or mapmaking.

Taking yet another approach, decision-makers from community settings also highlighted the value of GIS mapping but their conceptualisation of maps was rather different; as means of communication that could cross boundaries. For these interviewees, the advantages of GIS were often articulated in relation to the accessibility of GIS outputs:

Community based Practitioner: *'Maps are shapes and colours, which even primary school children can relate to. So they're much more accessible to a multi-disciplinary, multi-agency audience. […] Say… if you're comparing standardised mortality rates between areas in a table, you almost have to explain that's what you're doing. But with the map you've got a metaphor already, that message that says what you're doing'*

The above extract captures the essence of the map as metaphor by emphasising the familiarity of the map as a social construct, a notable contrast with the more technical account of maps provided by environmental practitioners.

All of this illustrates the importance of epistemological and disciplinary boundaries. Due to the multidisciplinary nature of public health, decision-makers inevitably come from a variety of different backgrounds, possess varied experiences, values and beliefs and work in a variety of settings. As with the previous case study, this case study highlights the importance of these different backgrounds and contexts to knowledge transfer.

One noticeable trend which cut across different professional and epistemological boundaries was the sense that GIS maps were appropriate vehicles to communicate complex situations to

a variety of audiences. Indeed, a crucial factor in understanding the diffusion of GIS and GIS technologies within public health seemed to be the fact interviewees associated GIS outputs with positivist paradigm. As with case study A, many interviewees seemed to perceive quantitative data as somehow more reassuring and reliable than other kinds of data and this informed their perception and use of GIS. For example, the following interviewee focused on how GIS could be used to increase confidence in causal relationships:

> *Environmental Practitioner: 'Analysis of* [quantitative] *data gives you a degree of confidence about what you present because you have certain rules around the statistical analysis tools that you use. So you can present information in a way that has a degree of confidence associated with it.'*

A preoccupation with using GIS to define authoritative causal relationships was a trend evident in interviewees based both in medical and environment settings. Quantitative evidence and its associated language of 'confidence intervals' and 'p values' seemed to bring with it a particular degree of legitimacy, and comfort, for interviewees, particularly for those with a medical background. The construction of GIS within a positivist and quantitative framework therefore helped promote its diffusion amongst public health practitioners with medical (and, to a lesser extent, environmental) backgrounds. At the same time, however, this construction appears to have constrained the way in which GIS technologies were used, limiting their implementation to tools to help analyse quantitative data and causal relationships, rather than as technologies capable of exploring complex inter-relationships and the role of changing social, and economic contexts.

In summary, the findings presented here echo two of the key findings in case study A. First, it was clear that disciplinary backgrounds and organisational settings informed interviewees' constructions, understandings and uses of GIS, highlighting the need for a theoretical framework that can capture the complex dynamics at work in the translation and diffusion of technologies and ideas. There was very little consensus regarding how participants framed GIS: as an analytical toolbox, a device for presentation; a means of communication; a research paradigm or even a discipline in its own right. Rather, the findings support Raphael's (2000, p.361) proposition that "*ideology, values and principles influence what is accepted as valid evidence*". Indeed, we would argue that these factors shape not just what is accepted as 'valid' but how new ideas and technologies are translated (Freeman, 2009). In other words, the ways

in which individuals 'saw' GIS and how they employed these technologies were shaped by a variety of cross-cutting factors such as experiences, epistemological positions and beliefs, and it would have been impossible to understand the diffusion of GIS without taking all of these complex interdependencies into account. Second, the findings reveal a widely held (often implicit) belief that GIS can effectively reduce complex realities into simple, user-friendly messages. This seems particularly strange given that GIS has capacities to capture intricate interrelationships within and between multiple disparate data and go some way towards explaining the inherent constructs of nonlinearity and emergence within complex adaptive systems. This aspect of case study B not only reinforces the notion (outlined in case study A) that evidence is often translated as it moves between actors and context, it also illustrates just how difficult it can be to achieve a shift to ways of thinking which acknowledge, rather than simplify, complex realities.

Discussion: making the case for complexity

Despite a growing acceptance of the complexities involved in knowledge transfer (Duncan, 2005; Young et al., 2002), many commentators continue to suggest that professional boundaries represent the key barrier to research utilisation, concluding that it will make a greater contribution to decision-making if researchers, policymakers and practitioners work more collaboratively (e.g. Lomas, 2000; Wimbush et al., 2005). In drawing on two case studies concerned with knowledge transfer in public health, this paper demonstrates the importance of acknowledging the variety of boundaries marking the landscape of knowledge transfer. In both case studies, it is clear that a variety of boundaries (epistemological, disciplinary and political) cut across professional differences and impacted on knowledge translation. This supports Jung and Nutley's (2008) assertion that 'two communities' models are over-simplistic. Given that political divisions were far from the only other important boundary identified, theories emphasising the importance of ideological divisions between competing policy networks also seem insufficient for capturing the complexities of the data.

Indeed, the case studies in this paper help illustrate the dynamic and unpredictable nature of the overall systems in which knowledge translation occurs. They suggest that attempting to build bridges between professional groups may be both more difficult and less effective than is often suggested. We therefore agree with Davies (2011) that it is necessary to move away

from 'bridging' metaphors and instead employ terms such as 'knowledge interaction' and 'knowledge mobilisation'; which better capture the dynamic nature of knowledge translation (see Davies et al, 2008). In this context, we believe studies of research utilisation that have employed actor-network theory (e.g. Bartley, 1992; Koivisto, 2007; Smith, 2007) have usefully helped unpack some of the processes through which knowledge is continually translated by different actors. Actor-network theory emphasises the extent to which technologies and ideas can be translated by users in ways that the originators never envisaged (Latour, 2005; see also Barthes, 1977[1967]), a phenomenon evident in both case studies in this paper. However, we also recognise that the detailed anthropological observations encouraged by actor-network theory (Latour, 2005) are not always feasible within research projects seeking to explore knowledge translation on a large-scale or across diverse networks. Indeed, it was not possible for either case study presented in this paper due both to resource constraints and issues of access.

This led us to turn instead to complexity theories to try to develop an alternative framework for better capturing the complexities of knowledge translation. Complexity theories emerged from a desire to understand multiple, non-linear relationships within fluid and dynamic systems in the natural sciences (Taylor, 2001). Such theories have already been employed in discussions about EIPP by Sanderson (2006, 2009), who argues they require us to broaden our concept of evidence *'beyond the 'technical' concerns of analysing 'what works''* (Sanderson, 2006, p.129) and acknowledge the importance of ethical and moral debates. They have also been drawn on by Greenhalgh and colleagues (2004) and Plesk (2003) in accounting for the diffusion and uptake of innovations in healthcare. However, to date, complexity theories do not appear to have made any significant contribution to informing the design of empirical studies of EIPP and, as discussed, more simplistic accounts of knowledge translation, especially those focusing on professional divisions, remain popular. This may partly be due to the fact complexity theory, as Cairney (2010) highlights, remains a vaguely defined term. Cairney (2010, p.3) nevertheless usefully identifies 'six common assumptions regarding how complex systems behave and how we should study them'. Table 1, below, presents a slightly amended version of these six features and summarises the implications of each from the perspective of studies of EIPP.

Table 1: Key features of complex systems and their relevance to the relationship between research and policy

Features of complex systems (adapted from Cairney, 2010)	Implications for studying EIPP
1. A complex system cannot be explained by studying constituent parts; rather, the analysis must be of the system as a whole, in order to capture interactions.	This underlines the need to carefully assess the research boundaries around studies of knowledge translation. It suggests, as case study A illustrates, that it may be necessary to explore the construction of research, as well as its translation, and that, as case study B illustrates, translation takes place at multiple levels. It also highlights (as do policy network theories) that relevant actors beyond research, policy and practice settings (e.g. journalists and lobbyists) ought to be included.
2. The non-linearity of, and feedback loops in, complex systems mean it is extremely difficult to predict behaviour. Consequently, small actions can have big effects and vice versa.	These two aspects of complex systems highlight the importance of considering multiple, interacting relationships and also suggest that we should not be surprised either when vast bodies of research have very little impact on policy/practice (as has been the case of much health inequalities research) or when minor events, or events apparently unrelated to the nature of the research evidence/technology, suddenly lead to significantly higher use (or different kinds of uses). These features further indicate that it may be difficult to come up with many generalisable recommendations for improving the use of research.
3. The above features of complex systems are likely to result in periods of stability/inertia and periods of significant, and potentially sudden, change ('punctuated equilibriums').	
4. Complex systems are particularly sensitive to initial conditions, which have long-term consequences.	This aspect of complex systems, much like path-dependency and historic institutionalism, highlights the extent to which historical decisions inform subsequent developments. This suggests that long-term approaches to studying knowledge translation are desirable.
5. As behaviour emerges from interactions within the system, key changes can occur at a local (rather than central) level and the system is difficult to control.	This aspect further highlights the importance of studying how evidence is employed and understood at a variety of governance levels (e.g. it cautions against the idea that the use of research within a national policy document can tell us much about what subsequently happens locally). It also draws attention to the interactions between different aspects of the system, including different levels.
6. The various problems that complexity theory seeks to address can only be solved by interdisciplinary contributions.	This aspect has two obvious implications for those studying the relationship between research and policy. First, it is important to ensure that such studies are open enough to consider the full variety of research that is of potential relevance to decisions about complex issues. In such cases, multiple barriers transecting disciplinary divisions may emerge as important features, as they did for the case studies in this paper. Second, it suggests interdisciplinary teams may be useful in unpacking process of knowledge translation.

The features outlined in Table 1 are clearly helpful to understanding the empirical case studies presented in this paper. Whilst neither case study can claim to have studied the complete 'whole system', broadening out case study A to explore processes of knowledge construction within academia helped reveal how policy informs research, as well as the other way round. In case study B, interviewing a variety of local public health decision-makers, working in different settings and with contrasting disciplinary backgrounds, helped illustrate that there is no singular interpretation or use of GIS or GIS outputs. Both studies also illustrated the intersection of different boundaries/relationships and the ongoing and multi-directional nature of knowledge

transfer (although resource limitations meant we were unable to explore translations of evidence beyond particular points). The non-linearity and unpredictable nature of knowledge transfer was highlighted by interviewees in case study A, who referred to the sudden and significant interest in particular ideas and evidence following two key external events. In case study A, the crucial role that 'initial conditions' play on knowledge translation became evident when exploring how the organisation of the policy bodies with responsibility for health inequalities opened or blocked routes via which evidence-based ideas might travel into policy. In case study B, it was clear that the shadow of individuals' disciplinary backgrounds informed their contemporary interpretations of the new technologies and evidence that they were engaging with.

The framework outlined in Table 1 also highlights some of the flaws in both case studies. Although we believe resource constraints mean many studies of knowledge translation will also fail to adequately explore 'whole systems', it is important to acknowledge that the case studies in this paper were each restricted to particular 'levels' of decision-making (national policy decisions in A and local decision-making in B). They therefore reveal little about the interactions between these different 'contextual layers' that Nixon and colleagues (2002) identify. Further, both case studies were conducted by individual researchers, rather than interdisciplinary teams, and whilst both individuals had interdisciplinary research backgrounds, the dynamics and complexities observed may well have been even greater (or at least different) if interpreted from multiple perspectives. A more general limitation of this paper relates to the fact it draws solely on data concerning public health in the UK; other national and disciplinary contexts may, of course, differ in significant ways and further research is required to explore this.

Although it will be difficult to achieve, the framework outlined in Table 1 suggests that studies of knowledge translation will benefit significantly from large-scale, long-term studies involving multidisciplinary teams but even these 'ideal' studies are likely to experience problems in deciding where to draw the boundaries around the study, given the likely interconnections between multiple networks and systems. These kinds of difficulties, combined with the difficulty in accepting that it may not be possible to make generalisable recommendations about how to improve outcomes (Sanderson, 2006), frequently lead mono-causal approaches to remain attractive *'long after knowledge about irreducible uncertainties, emergent properties and non-linear dynamics have became available'* (Gee, 2008, p.258). Indeed, people's deeply-held

desire for data and concepts that help simplify (rather than capture) messy realities was evident in both case studies, with a preference for 'concrete', 'hard' data frequently emerging. It is therefore likely to be difficult to achieve a shift in approaches to studying and discussing knowledge translation. Nevertheless, we believe the rationale for trying to embrace complexity is compelling, not least because, for complex systems, concentrating on particular parts of the puzzle may actually inhibit understandings, as '*the interacting systems involved will always overwhelm predictions of independent effects of any single factor, reducing them to very limited and uncertain information*' (Gee, 2008, 258-9).

We propose that the information detailed in Table 1 represents a useful preliminary framework for beginning to think through how complexity theories might be applied to knowledge translation studies, improving their design to better 'capture' some of the inherent complexities. Like other emergent theories, complexity theories have been criticised for failing to move beyond description and provide explanatory models (Gatrell, 2005; Joyce, 2007) and we believe this is where the challenge now lies. Although our paper has gone some way to begin to address this deficit, further empirical studies (preferably informed by complexity theories from an early stage) are required to advance these debates.

Conclusion

This paper began by outlining what we perceive to be some weaknesses in commonly employed conceptualisations of the relationships between research, evidence and policy. It then presented data from two empirical case studies exploring knowledge transfer at two different levels of public health decision-making in the UK. The first focused on the exchange of evidence and ideas about health inequalities between research and national policy, whilst the second explored perceptions and uses of GIS technologies in public health decision-making at a local level. Whilst there are some important differences in the ways in which technologies and research evidence can be translated, this paper draws out some of the unexpected similarities between these two distinct case studies, highlighting how each demonstrates the fluid nature of evidence and the overlapping and intricate nature of the relationships that shape knowledge translation. The Discussion first outlined why we believe a new theoretical framework is required for studying knowledge translation and then set out what a framework for studying EIPP informed by complexity theories might look like, which was used to reflect on the two case studies. This helped demonstrate the importance of aspects of the

data but also drew attention to the limitations of these case studies (limitations shared by many other contemporary studies of EIPP), suggesting that the design of future studies of EIPP could be significantly improved. We believe complexity theories offer the potential to substantially improve our ability to explore and 'capture' the multiple factors that inform knowledge transfer. This is important not only from a scholarly perspective but also because, if we can better describe and understand the processes involved in knowledge transfer, we may be able to better support EIPP, even if complexity theories caution against the seductive possibility of generalisable rules for improving the uptake of evidence.

Acknowledgements

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