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Interlocking interactions, the diffusion of innovations in health care

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ABSTRACT This article aims to provide a reassessment of the processes of diffusion of innovations into organizations, based on new empirical data. The focus of the article is the latter stages of the diffusion process. The article draws on the results of two studies, which examined the diffusion of innovations in health care in the UK. These projects were a matched pair of qualitative studies, using purposeful selections of comparative case studies. The results demonstrate the ambiguous, contested nature of new scientific knowledge. The highly interactive nature of diffusion, with active adopters is illustrated. There is no evidence of a single adoption decision. The science is socially mediated. The features of context and of actors interlock to influence diffusion.

KEYWORDS context ▪ diffusion ▪ health care ▪ innovation ▪ professionals

1. Introduction

This article builds on and extends prior research on the diffusion of innovation, through which non-linear and more complex models are being developed. In particular, we further explore the nature of 'organizational context' on diffusion processes. Wolfe (1994) has already argued that highly generic and linear models of diffusion lack empirical validity and that the current challenge to researchers lies in delineating the complex, context-sensitive nature of the phenomenon itself, in much greater depth.

Secondly, Fiol (1996) has already drawn on the meta-analysis of Damanpour (1991) to argue that much more attention within the diffusion of innovation literature needs to be paid to the underlying capacity of organizations to absorb new knowledge. The focus has to shift from the analysis of the innovation to that of the 'receiving organization', and its underlying capacity to absorb new knowledge and practices.

The core focus of this article is to debate our understanding of the processes of diffusion and present a reassessment. The article focuses on three aspects of diffusion and adoption processes. The first looks at knowledge bases, especially the role of certain forms of knowledge, such as evidence and science, in the process of adoption and diffusion. The second focus is the nature of adoption decisions and a further exploration of the purportedly 'passive' role played by adopters. The third focus is the influence of differing contexts on the diffusion processes. The article utilizes the empirical findings of two recently completed studies of the diffusion of innovations in the healthcare sector in the UK. The following section reviews and critiques the existing literature, with these foci particularly in mind.

The diffusion of new knowledge – The role of evidence; the credibility of evidence

The successful diffusion of new knowledge may be a prerequisite to changes in concrete practices. Such knowledge bases are particularly important in professionalized or knowledge-based organizations, including health care. Within such communities as medicine, scientific evidence is widely held up as a privileged form of knowledge. So, is the successful diffusion of knowledge critical in achieving practice change? Little prior research has taken place in the UK to explore why such professionals adopt new bodies of knowledge, which sources and modes of communication influence them; or indeed what makes the scientific evidence credible to them. What does the recent literature suggest?

In his critique of diffusion research to date, Rogers (1995) states 'We should increase our understanding of the motivations for adopting an innovation. Strangely, such "why" questions about adopting an innovation have only seldom been probed by diffusion researchers. . .' (p. 109).

Williamson (1992) usefully details the 'knowledge driven' and 'problem solving' models of knowledge production and use. The former is based on the assumption that the sheer fact that knowledge exists presses towards its use. The latter model suggests that research provides evidence and conclusions that help to solve problems.

Williams and Gibson (1990) elaborate the knowledge 'push' and problem 'pull' models into four models of dissemination. The appropriability

model, (a 'push' model) suggests that if one has sound scientific ideas, the technology will transfer. The dissemination model argues that the critical success factors include good science, but places greater stress on strong networks, communication and supportive human resource management (HRM) policies. The knowledge utilization model (a 'pull' model) sees success as cumulatively dependent on the prior factors mentioned, but also on complex relationships between users and researchers. The final, most complex model is the communication and feedback model, which argues that the requirements already quoted are necessary, but a feedback loop from users is an additional success factor. Rogers' (1995) work focuses attention on the question of whether need precedes knowledge or vice versa, but the interpretation and acceptance of the knowledge or evidence itself appears relatively unproblematic. Rich (1997) reviews the issues in developing measures of knowledge utilization and suggests that variance in knowledge utilization can be explained by differences in types of information, as well as by differences in the needs of users. However, these models only provide a limited explanation of the processes of interpretation of evidence in situations of ambiguity, where, drawing on Weick's ideas (1995), one would anticipate such 'sense making' to occur.

Within the healthcare sector in the UK, current policy initiatives towards evidence-based medicine (EBM) place pressure on the individual clinical professional to adopt scientifically grounded innovations. EBM involves the diffusion of evidence, particularly new or updated evidence into clinical practice. A National Institute for Clinical Excellence (NICE) has been established whose remit is to 'provide a single focus for clear, consistent guidance for clinicians about which treatments work best for which patients' (Department of Health, 1998). Policy appears to be premised on the idea that for many conditions, there is one optimal solution, based on the science. The assumption appears to be that a top-down dissemination of evidence will lead to adoption by clinical staff locally. Berg (1997) argues that in reality, there is little evidence of agreement among a range of professionals on one optimal solution and without such agreement, a single solution is unlikely to be implemented. In a recent study, in one organization, Salaman and Storey (2002) raise interesting questions about the extent to which managers' perceptions of organizational priorities affect their willingness to initiate significant innovations. We suggest that the individual's interpretations are under-researched and need further investigation.

Nature of adoption decisions: Actors and complex interactions

Some models suggest a linear and simple 'stage-like' model of the diffusion process. Rogers (1995) utilizes a five-stage model of the innovation decision

process. These stages are Knowledge; Persuasion; Decision; Implementation and Confirmation (p. 163). They are represented pictorially in this model as a linear flow, with distinguishable prior conditions. Rogers characterizes the 'innovation–decision process' as essentially one of choice between an accept/reject decision. However, Emrick et al. (1977) and Rogers (1983, 1995) discuss the concept of 're-invention'. Re-invention is described as a process by which adopters of innovations adapt those innovations. In Roger's work, the context is not integrated into the analysis, although the contexts are described in examples. These indicate that re-invention may be more widespread in professionalized organizations (Rogers, 1995: 175–6).

Research by Jelinek and Schoonhoven (1990), in high technology firms in the private sector, provides a different language based on an awareness of interconnections, overlaps and multiple sets of relationships. One might argue that these ideas and concepts question the basic utility and validity of the linear model. Moreover, they show greater concern for the interactions between groups of adopters. Fincham et al. (1994) argue for a management of expertise approach in order to surmount the division between knowledge processes and political processes. In their definition, the concept of expertise has several components, the knowledge itself, the evaluation of that knowledge by communities of peers, and the validation and rewarding of a knowledge claim.

Actor–network theory (Callon et al., 1992; Latour, 1987) focuses on the social networks and diverse interrelationships between networks of heterogeneous actors, who are involved in a continuing process of negotiation to impose their own meanings. This work highlights support mechanisms and the way ideas are 'translated' by actors through mediation between one community of practice or network and another (Brown & Duguid, 1998).

Van de Ven et al.'s (1999) recent work draws on a large-scale, comparative project to characterize innovation processes as a non-linear, dynamic system, which is highly ambiguous and unique to the participants. Van de Ven et al. (1999) present an empirically grounded map of the key components of the innovation journey, (Figure 2.1, p. 25), which portrays innovation adoption and implementation as typically involving shifts in the criteria of success and the fluid participation of organizational personnel. These findings analyse coalitions for adoption, but present a manager-centred analysis. Robertson et al. (1996) demonstrate the critical role played by professional networks in influencing the diffusion process in the private sector.

Although recent work moves towards an understanding of the multiple interactions during innovation and an evaluation of effective processes, there is little to aid our knowledge of the interpretative processes involved.

There is a specific literature on innovation within health care, (Anglia

and Oxford Regional Health Authority, 1994; Coleman et al., 1966; Dopson et al., 1999; Fairhurst & Huby, 1998; Stocking, 1992), which draws on various diffusion models. It is apparent that, so far at least, the linear model of Rogers has proved the model of choice. Coleman's study is seen as a classic work which applied Rogers' model to an American healthcare context, but within a uniprofessional network, in which clinicians retained the freedom to prescribe and were not located within a wider organizational framework. Both these characteristics now appear highly limiting; we need to know more about how adoption decisions are made within multiprofessional groups and within large and complex organizations. However, collectively, these studies display the diffusion process as a complex process, whilst suggesting it may be critically influenced by the characteristics of the context.

Context and the influence of variations in context

The influence of context on diffusion is noticeably absent in most of the early analysis of the diffusion of innovation. Kimberly (1981), Kimberly and Evanisko (1981), Kimberly and Pouvourville (1993) and Van de Ven (1986) are among the authors who have explored and highlighted the influence of context on the diffusion of innovations. Broadly, this research suggests that additional levels of analysis of the organizational context, at both sectoral and organizational level, are required if one is to understand the processes of diffusion. There are significant similarities here between research on innovation and on effective change processes in health care. The role of change champions, the establishment of a supportive climate for change, through management and HRM networks of support, and the importance of context have all been highlighted as major success factors in research on organizational change processes (Pettigrew et al., 1992). 'Context' was here operationalized in a primitive way, for example, merely distinguishing between local and national levels of context. There is a need for more specification. Abelson (2001) separates context into outer, societal 'predisposing' influences; inner, institutional 'enabling' influences and 'precipitating' political influences, which may prove useful categories. As Weick (1979) has argued, managerial problems persist because managers do not think in circles and continue to believe in unilateral causation. In most current analysis, context remains the background to events. Salaman and Storey (2002) move towards examining the interrelatedness of actors and context and this will be a focus of our analysis.

Reviewing the literature underlines the shift away from linear models and identifies that the impact of variable contexts is under-researched. The separation of the discussions on creating new knowledge, diffusion of knowledge

and innovations and knowledge management, means that the interconnections between key influences remain unclear. Context is not integrated into the analysis and there is minimal empirical evidence comparing contexts.

2. Methodology

Two recently completed studies on the diffusion of innovation in the acute and primary care sectors of health care in the UK provide the empirical data presented here. These studies occurred between 1995 and 1999 and explored the processes of diffusion of eight innovations, four in each subsector. In the UK, the process of innovation diffusion is a relatively under-researched topic and therefore an exploratory methodology was indicated. We employed comparative case studies, which allowed us to examine the trajectory of the innovations and to probe the 'why' questions, concerning the reasoning of participants. Case studies are holistic and can be used to explore formal and informal processes and to examine the views of a range of different stakeholders.

The case studies were selected on two key criteria, which were the strength of the scientific evidence on efficacy and the extent to which the innovations were judged uni- or multiprofessional. The purposeful selection of cases and the overall design of the methodology aimed to produce an analysis of the extent of the impact of strong scientific evidence on the diffusion process. Conceptually, the starting point for both studies was to examine and question the current models of diffusion and whether robust science would ensure diffusion. The selection matrix is set out in Figure 1.

The scientific evidence was judged to be strong on the basis of publications in reputable medical journals, reinforced by peer review by a group of medical specialists. Evidence was adjudged weaker, if there was some evidence of benefit, but contra-indications or there was little supporting evidence of clinical effectiveness.

The methodology employed was a two-stage one, with fieldwork in two health regions. In the first stage, the diffusion of the innovations across a geographical health region was assessed, through interviews with opinion leaders in a range of appropriate medical specialities, including public health and nursing. Opinion leaders were selected from individuals in the region who had published on the innovation or held a key position and then by a snowball process of recommendation. Each interview lasted 1–2 hours. The detailed breakdown of interviewees for both stages of the research is set out in Table 1. In the second stage of the study, a micro-analysis of each innovation was undertaken by examining the diffusion of the innovation, in

	Strong scientific evidence	Weaker scientific evidence
Largely uniprofessional	**Acute** Use of low molecular weight heparin following orthopaedic surgery **Primary** Use of aspirin for prevention of secondary cardiac incidents	**Acute** Use of laparoscopic surgery for inguinal hernia repair **Primary** Use of HRT for prevention of osteoporosis
Multiprofessional	**Acute** Use of computer support system for anti-coagulation **Primary** Treatment of diabetes following St Vincent Declaration	**Acute** Introduction of new service delivery systems for care of women in childbirth, as per targets in 'Changing Childbirth' **Primary** Direct employment of physiotherapists in GP practices

Figure 1 Criteria for case selection

detail, in one specific setting. Sites for the micro-analysis were selected randomly, from those sites in the region who had adopted and were using the innovation. This stage of the research included interviews with all staff who were involved in the implementation of the innovation, at all levels and in a range of medical, nursing and allied health professions. Secondary data collection included minutes of meetings, guidelines and grey literature and informal observation on site. Interviews at both stages were semi-structured, having a common core of questions to all interviewees. In total, the research covers 232 interviews with a wide range of clinical staff and some managers/administrators. All of the interviews were taped and then transcribed and subject to content analysis. The researchers analysed the themes emerging from the data at the end of each stage of the study. Once data collection was complete, the researchers compared the data across both individual interviews on each innovation and compared cases and produced an analysis of common themes and critical differences.

As the focus of the research is the process of diffusion of the innovations into clinical practice, the unit of analysis for the research was the clinical team or group. This places the focus above the individual, but below the organization.

All of the innovations can be characterized as clinical/service improvements. However, whereas most of the innovations (6 of 8) have clinical origins, some have organizational implications. The remaining two innovations, that is, the implementation of 'Changing Childbirth' targets and the employment of physiotherapists in primary care, have substantial organizational service delivery components. In all eight innovations, the research examined the innovation diffusion/adoption stage of the innovation process.

Table 1 Summary of interviewees

Innovation	*Number of interviews in Stage 1*	*Number of interviews in Stage 2*
Acute sector project		
Managing anti-coagulation service provision	19	9
Defining risk in pregnancy and childbirth	18	18
Laparoscopic inguinal hernia repair	17	11
Low molecular weight heparin in orthopaedic surgery	17	10
Final total	71	48
Primary care project		
Use of aspirin to prevent secondary cardiac incidents	16	12
Treatment of diabetes	20	4
HRT to prevent osteoporosis	17	13
Direct employment of physiotherapists	20	11
Final total	73	40
Overall total	232	

All of the innovations studied were within the public domain. The pairs of innovations with strong scientific evidence to support them had been subject to rigorous testing. The organizational contexts of the diffusion process differed between the two projects. The acute sector study focuses on changes as they occur within acute, general hospitals, some of which are teaching hospitals. These hospitals all employ a range of medical specialities, including both surgical and medical. Within each speciality, consultants would be the most senior medical professionals, supported by other medical, nursing, midwifery and allied health professionals. On the whole, these are large, complex organizations. The primary care sector study focuses on the general practice as the core organization. General practices are relatively small organizations consisting of general practitioners (GPs) who are the partners who own the practice. It is a partnership based form of organization (Brock et al., 1999), in which senior professionals have ownership rights (but within state regulation). The GPs employ other staff, such as practice nurses, and have attached staff, such as health visitors, who are employed by community trusts to work in the community. The primary care sector is characterized by fragmentation and a highly complex, but looser network of relationships.

The policy agenda discussed in the introduction is intended to produce

similar change in both these contexts. It is therefore pertinent to examine empirically how diffusion occurs in both these contexts.

In this article, it is only possible to provide an overview of the innovations studied. For further elaboration of the themes emerging from the individual studies, readers may consult other publications (Ferlie et al., 1999, 2000; Fitzgerald et al., 1999b; Wood et al., 1998a). Field reports of the case studies are also available (Fitzgerald et al., 1999a; Wood et al., 1998b).

3. Knowledge creation – The processes of interpreting ambiguous evidence

Reviewing patterns across the cases, it is apparent that robust, scientific evidence is not, of itself, sufficient to ensure diffusion. Figure 2 provides an overview of the spread (comprehensiveness of spread) and rate of diffusion of each of the innovations. Those innovations which were judged to be supported by strong, scientific evidence are shown in italics and have not all diffused most widely. The diagram indicates that there is no uniform pattern of diffusion either by sector, or within acute or primary care, or by the range of professional groups involved. Science 'push', by itself, appears fairly weak so that much depends on how evidence is interpreted and weighed by local individuals and groups. There are a number of reasons to account for this situation.

Our empirical data support the view that scientific evidence is not clear, accepted and bounded. There is no one fact, which can be seen as 'the evidence'. There are simply bodies of evidence, usually competing bodies of evidence.

The data suggest that debates about efficacy can persist for considerable periods, even though there is ample evidence available. The case of the use of the heparin drug following orthopaedic surgery is a good example. The experts selected this innovation as one which was strongly supported by the scientific evidence. Despite a long history of research and the involvement of major research centres, the debate in local contexts was still active and generating controversy and opposing schools of thought and practice. Even strong evidence is not automatically accepted. Another form of debate arises when the professionals believe the knowledge is not relevant to their population of patients. This source of argument is particularly prevalent in primary care. In the case of diabetes care, many GPs held the view that the St Vincent Declaration set out a standard of care which was only appropriate to acute cases and not to the majority of their patients.

Throughout our research, the data illustrate that there are few areas of

Widespread	Variable spread	Debated	Limited pockets	Pilot only	Nil
Primary; Uniprofessional: use of aspirin	Acute; Multiprofessional: implementation of 'Changing Childbirth'	*Acute; Uni-professional: low molecular weight heparin* *Primary; Multi-professional: treatment of diabetes* Acute; Uniprofessional: use of laparoscopic surgery for inguinal hernia repair	Primary; Multiprofessional: direct employment of physios Primary; Uniprofessional: HRT for osteoporosis	*Acute; Multi-professional: computer support system for anti-coagulation*	

Figure 2 Overall comparison of diffusion by innovation

agreed and accepted evidence and new knowledge is ambiguous. Furthermore, evidence was perceived as more or less 'credible' by different individuals and groups. What gives evidence 'credibility'?

Evidence is partially dependent on its methodological basis for credibility. There was a commonly expressed and accepted view across the professions that you had to use evidence as the basis of practice. The members of different professions and the specialities within medicine placed differential value on the methodological basis of evidence. Most doctors acknowledged the leading role of randomised controlled trials (RCTs), but some doctors felt there were aspects of experience and skilled delivery, which were difficult to research; the art of obstetrics or the craft skills of surgery.

Another important attribute of credibility is the place of publication of research evidence. Many doctors would acknowledge particular journals, such as the *British Medical Journal*, as credible sources. But other professions tended to look to different sources within the sphere of their own profession. There was some limited evidence to suggest that there were accepted, common sources of knowledge. Significantly, there remain only very limited data to suggest that cross-fertilization of ideas between professions is regularly occurring. For example, only a minority of the sites studied had a regular forum for the discussion of cases or problems by doctors and other professions, for example, nurses and physiotherapists, together.

So one reason which accounts for the widespread presence of contested evidence is the presence of multiple professions in the healthcare arena. The differences in history, training and approach to care mean that doctors and other professions do not start from the same foundations and predictably, can adopt differing approaches to research evidence.

These illustrations show that new knowledge is ambiguous and much knowledge is contested. Acceptance of evidence has to occur prior to practice change and will only follow after a process of debate in local contexts.

4. Adoption decisions: Knowledge embedded in networks and communities

If, as demonstrated earlier, evidence is ambiguous, then diffusing evidence into practice is a construct of debate and of agreement among communities of practice. The 'fuzziness' of evidence partially explains why the concept of individual adoption decisions is erroneous. In this section, we seek to demonstrate that the actors are not simply passive 'adopters' of a pre-packaged innovation.

Weighted decisions

Health professionals do not simply apply abstract, disembodied scientific research rigidly to the situations around them, but they collaborate in discussion and engage in work practices, which actively interpret and (re-)construct its local utility. The scientific data are weighed against a range of other factors in the decision-making process. Critically the most important factors are:

- adverse outcomes from the condition unless treated and/or the applicability of the innovation to many patients;
- financial incentives or neutral costs;
- concordance from other professionals;
- favourable patient responses indicating compliance with the intervention.

It is rare for *all* of these factors to be favourable. The individuals and groups involved are therefore making judgements by balancing and weighing different factors. These characteristics are similar to those described by Weick (1995) as the characteristics of ambiguity under which sense-making occurs. There is substantial evidence of two-way interactions, with adopters exercising a powerful influence on the form of innovation adoption. 'Adopters' are not passive receptors of an idea, but are actively involved. Opinion leaders are shown to be a particular example of these interactions. The data from our studies illustrate that individual innovations are not always understood to be 'positive' at the point of their creation.

If one returns to Figure 2, one can use the two extreme cases as exemplars. The use of aspirin for the prevention of secondary cardiac incidents provides an example of an innovation which was strongly supported by robust evidence. However, it was prioritized because it also had many other favourable characteristics, which produced a persuasive combination of forces. The condition affects many patients, is critical and is a national priority; the treatment is cheap and it is easy to take, so patient compliance is high. In many locations, combinations of primary care GPs, post-graduate educators and acute cardiac consultants campaigned for the wider use of aspirin. Local groups were frequently supported by the health authorities, who prioritized the innovation and reinforced diffusion through audits of the use of aspirin in primary care. Thus widespread diffusion is accounted for by multiple favourable factors.

At the other extreme, the case of the introduction of a computer support system for monitoring anti-coagulation shows a less effective diffusion process. Here, a network of acute consultants, GPs and practice nurses was recruited and developed, becoming enthusiastic and supporting a pilot project to test the system. The local alliance worked well, but despite producing strong evidence of efficacy, they could not diffuse the innovation more widely. It required financial resources to fund the innovation, and clinical tasks to move from the acute sector to primary care and from doctors towards a nurse-led process. So financial constraints and sectoral and professional boundaries inhibited the diffusion process.

Networks: Enrollers or controllers?

From our research evidence, the local situation in which a clinician operates appears to be a potent mediator of everyday experience. In health care, as in other contexts (Robertson et al., 1996), networks are one of the key determinants of whether an innovation is successfully diffused into use. Many of the micro-processes of diffusion into a local, specific context are negotiated and such processes are constrained by the macro-power balances and mediated by the local ones.

Health care is an interesting and complex domain, populated by a diverse set of groups, both professional and aspiring professional. Historically and currently, it is clear that the medical profession retains preeminence. All of the innovations studied, whether in drugs, clinical procedures or organizational systems impacted on clinical work. One common theme across the sectors and the different specialisms was the prime influence exercised by the medical profession in the decisions to adopt an innovation at local level. One illustrative example of this is the way in which

guidelines and protocols are produced which define 'best practice' and set standards of care. In all of our examples, doctors defined these guidelines, either exclusively or predominantly, with limited involvement from members of other professions.

Across the cases, analysis demonstrates that processes of diffusion are radically affected by the nature of the prior, interprofessional relationships in each context. For example, there were wide variations in progress towards implementing innovations in service delivery in maternity care, within our research. Some sites had made substantial progress towards the achievement of a number of targets set out by the Government, whereas other locations had not. One crucial element in explaining these variations was the quality of interprofessional relationships between consultant obstetricians and midwives within a specific unit. In one instance, despite many adverse factors, – including low resources, high demand, poor capital – the maternity unit had made good progress towards achieving the targets. In this organization, relationships of trust and respect were able to counterbalance negative contextual factors.

The research data do not support the idea of a single adoption decision, but rather a more prolonged and negotiated process between individuals and groups. Alliances may be formed and reformed. Diffusion occurs when a coalition for change builds up which includes a sufficient range of the many stakeholders – including at least some of the most powerful ones – to generate a sufficient power base. This means it is unlikely that adoption will occur, without a basis of trust between groups. Networks can engage people in the diffusion process *or* they can halt the process. For example, where different networks exist, and the innovation has to cross these interprofessional and interorganizational boundaries, as in the case of the adoption of the computer support system for anti-coagulation, then boundaries may inhibit the diffusion process. In health care, many networks are delineated by profession or by speciality and there is limited evidence of interchange between networks. The differential power and status of professional groups is one of a number of factors which account for the fact that knowledge is 'sticky' and diffusion is slow across heterogeneous groups.

Opinion leaders as accelerators/facilitators of change

Locock et al. (2001) identify both positive and negative roles played by opinion leaders at the micro-level. Locock et al. argue that different types of opinion leaders may be more or less influential at different stages of the innovation process. Comparison across the cases in our research supports the view that opinion leaders play an active and influential role in the diffusion

of innovations. They reinterpret, shape and alter the form in which the innovation is adopted locally. Similar patterns emerged across the varied contexts.

Our findings illustrate and identify opinion leaders playing a variety of roles. We distinguish three types of opinion leader – a node or focal point for information and a model of behaviour, who may act as a link between the worlds of academic research and practice; an 'expert' opinion leader, with local credibility; and a strategic, 'political' opinion leader, with combined management and political skills.

Opinion leaders may facilitate or inhibit diffusion. But demonstrably, many of the facilitators are active in promoting and, indeed, seeking innovation.

5. Contexts shape and mould diffusion

Sections 3 and 4 referred to the impact of local contexts on diffusion and this section elaborates this theme. Although previous literature has identified context as an influence, it has nevertheless conceptualized context as the background to the innovation, exerting an influence from the outside in. Our research seeks to embrace context as an integral component in the diffusion process.

The influence of context can be distinguished at two levels of analysis. At the macro-level, considerable differences can be identified in the factors impacting on diffusion in the acute and primary care contexts. The pattern of intra- and interorganizational relationships among doctors and their professional bodies and the structures of the organizations are radically different in the acute sector, when compared with primary care. Moreover, acute sector consultants/doctors and GPs in primary care do not have identical views of credible evidence. GPs have longer term relationships with their patients and more frequently take account of patients' views. GPs pay attention to different cues when compared with their colleagues in the acute sector.

Structurally, the intermediate tier of the health authority (HA) influences diffusion more in the primary care sector than in the acute sector. In the latter sector, the HA played virtually no active role in the diffusion of innovations and was rarely mentioned by interviewees. In the primary care sector, the picture was variable. In some locations, the HA had low influence and credibility and/or played a limited role in the diffusion of innovations, whereas in others, the HA clearly perceived its role as facilitative and took active steps to support the diffusion of prioritized innovations.

Structural complexity has an impact. In organizations with many layers and with strong departmental boundaries, these boundaries act as hurdles in the diffusion process. In two of the eight cases (use of computer support systems in anti-coagulation and the treatment of diabetes according to the St Vincent Declaration), in which an innovation needed to diffuse across inter-professional and interorganizational boundaries, these acted as inhibitors, which could only be overcome with substantial effort.

Resourcing is a factor, which influences at the macro- and micro-levels. The evidence illustrates that financial considerations will be a key factor in the diffusion or lack of diffusion of an innovation. In the UK, with restricted resources and almost unlimited demand for services in health care, resources are directed towards priorities. If the innovation occurs in a non-priority area, it may not be supported. Where an innovation creates additional work, uses people resources or incurs costs, this will be a factor for consideration. The existence or absence of financial incentives affects the diffusion of an innovation. This is especially apparent where the innovation requires the alteration of modes of service delivery and shifts work across professional or organizational boundaries. Where the innovation shifts work across both professional and organizational boundaries, as in the cases of the use of the computer support system for anti-coagulation and of following the St Vincent Declaration standards in the treatment of diabetes in primary care, then the problems multiply.

In addition to structure and finance, within the local context, there is a range of factors which impact on the organization and its employees' ability, willingness and capacity to adopt and diffuse an innovation. The capacity of an organization to innovate will depend on the history, culture and the quality of relationships and these will vary by context. For example, surgeons, both orthopaedic and general, operate in a tightly bounded professional world, subject to fewer external influences on their clinical work, compared with GPs or nurses.

Another contextual factor relates to the characteristics of the patient group, their willingness to conform to treatment and the pressures they exert on professionals. Innovations are more likely to be adopted if the targeted conditions are serious and the treatment easy to follow. Patient pressure may increase the probability of adoption and was a significant influence in two of the eight cases.

A final factor is the nature, type and strength of external networks. The vital significance of this factor may be specific to professionalized settings. However, it is apparent that the nature and strength of professional organizations will have a key impact on the diffusion of innovations.

6. The processes of diffusion and adoption: A re-conceptualization

In this section, we draw together key themes emerging from these data about the realities of the processes of innovation diffusion and adoption in health care and in professionalized settings. We seek to extend, on the basis of evidence, a number of prior concepts about the diffusion of innovations.

Key themes emerging from these data are:

1. The process of establishing the credibility of evidence is interpretative and negotiated. New knowledge has to be accepted before it will be utilized and much knowledge is ambiguous and contested. Professionalized organizations are an extreme case, in terms of the complexity of diffusion processes.
2. Adoption decisions involve active, not passive adopters, with interaction between actors and innovations and between groups of actors. With multiple professional groups, these interactions assume far greater importance than would be predicted from the extant literature.
3. The progress of diffusion is influenced by the interlocking characteristics of communities of practice and contexts. The interactions include not only the actors, but also extend to interactions between the actors and the context.

The evidence is not self evident: Complex processes of utilization

The findings from this research focus attention on the ambiguous nature of knowledge itself (Fitzgerald et al., 1999b). The 'strength' of the evidence or high-quality evidence does not cause it to flow into practice. Indeed, across the eight cases in our research, there was no direct association between the robustness of the scientific evidence and the speed of diffusion. Evidence is debated and weighed alongside other factors and differential judgements are made by individuals and shared in professional groups. Some of the factors which are seen to influence adoption or rejection decisions are not rational, but political. Thus, a practice community may be reluctant to accept the efficacy of a novel treatment because it threatens their established skill base and thus threatens their status and professional position. Similarly, financial incentives may act as both facilitators and inhibitors of adoption.

Though there is further research required, these findings identify the critical factors competing with evidence in influencing diffusion.

Although the healthcare context has many characteristics in common with other organizations, where adoption judgements can be seen as complex, hesitant and debated (Van de Ven et al., 1999), here, we argue that it represents an extreme case in terms of complexity and ambiguity. Becker (2001) proposes that a distinction can be made between uncertainty and ambiguity, with the latter seen as a strong form of uncertainty, which cannot be remedied by the standard strategy of increasing the information available. In health care, the adopters use more nebulous criteria for judging the efficacy of an innovation than the profit-orientated criteria used in a commercial setting. So high levels of ambiguity are created, partly, by the 'fuzzy' nature of the evidence and also by the complexity of the range of other factors which are taken into account and by the existence of multiple stakeholders.

Diffusion as an interactive and iterative process

Diffusion processes are not only complex and ambiguous, but interactive and iterative. Crucially, one needs to see adopters not as passive receptors of influence or ideas, but as active participants. For the majority of the innovations in our study, diffusion and adoption of the innovation included alteration and customization of the innovation to the specific context. Users influence and are themselves influenced, but the processes are interactive. These interactions frequently go beyond 're-invention' as described by Rogers (1995) or 'translation' as in actor–network theory (Latour, 1987). They include users framing their own agenda, selection and prioritization by users, innovation-seeking behaviour and a constant process of re-negotiation.

The activities of opinion leaders exemplify this innovation-seeking behaviour, which can create innovation. Through our data, a number of specific roles have been delineated. 'Technical' opinion leaders were seen to create innovation by constantly promoting improvements and by resource-seeking behaviour. They frequently modify and translate innovations to suit local needs and thus aid diffusion.

With multiple stakeholders, a far greater importance needs to be placed on the interactions between groups than previous literature predicts (Van de Ven et al., 1999) to extend our understanding of these processes. The quality of intergroup relations is crucial and intergroup debate is essential. In particular, the boundaries between professional groups, aspiring professional and expert groups, which exist in many contexts, can have a profound influence on the diffusion process. Knowledge can be described as 'sticky' when passing across the boundaries of professional/expert groups.

The progress of diffusion is dependent on the interlocking interactions of actors and context

Our data demonstrate the critical and variable influence of context on the diffusion process. We would argue that this contextual influence is multilayered. As Rich (1997) proposed, the nature of the innovation itself will influence the interactions between the outer and inner context. There is evidence of more positive, outer, contextual forces at work to promote the diffusion of technological and drug innovations than there are of other forms of innovation. The data suggest that 'high tech' equipment is promoted by its manufacturers, but also arouses interest among clinicians, who like to acquire the latest advances, as exemplified by the use of laparoscopic surgery for inguinal hernia repair. Thus, there is a more receptive climate for technological advances (even though they are often expensive).

Critically, we draw attention to the interplay of features of the outer and inner context (Pettigrew et al., 1992) and of the characteristics of the communities of practice. Elsewhere, we have argued that there may be a more complex interaction between the outer context and the inner context, in that certain outer contexts tend to produce a given organizational form or archetype (Ferlie at al., 2001). By organizational form, we refer to the 'deep structure' of organizing work processes, which are translated into taken-for-granted assumptions. In the diffusion of innovations in the public sector, the interactions between outer and inner context take specific forms. The policy priorities in the outer context, as defined in government documents (Cmnd, 1997; Department of Health, 1998) cause the professionals and managers within the healthcare system to focus attention on specific aspects of the system. Thus, innovation that relates to priority targets is more likely to be supported by strategic decisions to invest resources (Salaman & Storey, 2002). Additionally, stakeholders and stakeholder groups display innovation-seeking behaviour, which relates to their own motivations, interests and expertise. Thus, Abelson's categories of 'predisposing' and 'enabling' influences offer only a partial explanation of the characteristics of a receptive context, whilst not emphasizing the interlocking process.

Our evidence indicates multiple differences of values, structures, education and relationships between the acute and primary care sectors of health care. Within the inner context of the organization's boundary, the history, culture and quality of interprofessional relationships will be factors which account for variation in rates of diffusion. Such local patterns of roles and relationships are critical to what Fiol (1996) has described as the absorptive capacity of organizations. These relationships are not simply determined structurally, but evolve over time and are the product of joint action. We

argue that learning and change capacity may vary sharply by local setting; that these competencies build up over a long time. One implication is that innovations, which require such underlying capacity for their enactment, cannot 'roll out' readily.

Ultimately, the behaviour of the stakeholders and the features of context are interlocked. The combination of multilayered, two-way influences, multiple stakeholders with interpretative schema, innovation-seeking behaviour by individuals and groups, and differing absorptive capacity in organizations, produces a situation in which context is an actor. Conceptually, one needs to adopt Weick's (1979) idea of thinking in circles and loops to understand the diffusion processes.

We may need to modify our thinking to accept that there can be no uniform pattern in the diffusion of innovations. Diffusion will be influenced by an interplay of factors: the credibility of the evidence, the characteristics of the multiple groups of actors, of the organization itself, and of the characteristics of the outer and inner contexts.

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