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From spreading to embedding innovation in health care: Implications for theory and practice

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Issue: In broad terms, current thinking and literature on the spread of innovations in health care presents it as the study of two unconnected processes—diffusion *across* adopting organizations and implementation *within* adopting organizations. Evidence from the health care environment and beyond, however, shows the significance and systemic nature of *postadoption* challenges in sustainably implementing innovations at scale. There is often only partial diffusion of innovative practices, initial adoption that is followed by abandonment, incomplete or tokenistic implementation, and localized innovation modifications that do not provide feedback to inform global innovation designs.

Critical Theoretical Analysis: Such important barriers to realizing the benefits of innovation question the validity of treating diffusion and implementation as unconnected spheres of activity. We argue that theorizing the spread of innovations should be refocused toward what we call *embedding innovation*—the question of how innovations are successfully implemented at scale. This involves making the experience of implementation a central concern for the system-level spread of innovations rather than a localized concern of adopting organizations.

Insight/Advance: To contribute to this shift in theoretical focus, we outline three mechanisms that connect the experience of implementing innovations locally to their diffusion globally within a health care system: learning, adapting, and institutionalizing. These mechanisms support the distribution of the embedding work for innovation across time and space.

Practical Implications: Applying this focus enables us to identify the self-limiting tensions within existing top-down and bottom-up approaches to spreading innovation. Furthermore, we outline new approaches to spreading innovation, which better exploit these embedding mechanisms.

Key words: diffusion of innovation, digital health, dissemination, health care system, implementation science, institutional theory

Thanks to advances in life sciences and digital technology, as well as insights from business and social sciences, health care providers and health care systems are currently faced with a huge range of opportunities for innovation. Such innovations have the potential to revolutionize clinical care, improve health outcomes, and reduce health system costs. However, although the health care sector is fertile soil for those groups developing innovations, it can prove to be stony ground for anyone seeking to exploit them in practice. Many innovative technologies and treatments have been introduced into health care without ever being spread widely or used effectively, despite ample evidence of their benefits to patients (Berwick, 2003). This slow and uneven spread of innovations not only means that patients are deprived of clinical benefits but also potentially increases inequality in health outcomes by limiting state-of-the-art health care to the wealthier members of the society (Dearing & Cox, 2018).

This pattern of spread is a problem not only from a public health perspective or for countries with socialized systems of health care but also for private, independent health care organizations, which are incurring mounting costs and delivering suboptimal patient outcomes as a result. The consequences worldwide are significant. In the United States, for example, despite numerous initiatives by the federal government and private health systems to improve care, one study found that, on average, Americans received only about half of the recommended medical care interventions (McGlynn et al., 2003). Similarly, adult Australians received appropriate care in only 57% of health care interactions with care providers (Rose et al., 2015). This empirically documented failure to introduce innovations into practice is also a major, avoidable source of health care costs. In 2011, wasteful spending in the United States was estimated to exceed U.S.$100 billion, with much of this attributed to the widespread failure to adopt known best practices in routine medical care (Berwick & Hackbarth, 2012).

One of the major reasons for this constrained pattern of spread has to do with the challenges of implementing innovations in the health care environment. Since the seminal work of Schumpeter (1934), it has been recognized that innovation can take many different forms. Whereas Schumpeter's

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interest extended to the spread of innovations across different sectors, our focus in this article is on the spread of innovations within the field of health care. Although innovations here can take many different forms, many can usefully be labeled "service innovations" (Greenhalgh et al., 2004). These are multifaceted innovations, which involve improvements in health care services and the way they are organized and delivered, including, for example, the use of novel technologies (e.g., digital health or e-health applications), new medical procedures (e.g., minimally invasive surgery or robotic surgical platforms), the introduction of new services (e.g., dynamic case management), the adoption of new models of care or patient pathways (e.g., stepped care or integrated delivery systems), and the crafting of new occupational roles (e.g., physical therapists, health data analysts, or medical assistants). Crucially, such innovations usually cannot be applied "off the shelf" but need to be carefully integrated into existing care pathways, technical infrastructures, and ways of working to produce improvements in health outcomes (Greenhalgh et al., 2017).

The challenges of implementing any but the simplest of these service innovations are daunting. This is evidenced by the many innovations that are adopted by health care providers but are only partially implemented, not sustained or abandoned outright (Greenhalgh et al., 2017; Horton et al., 2018). Although evidence on this gap between adoption and fully effective implementation likely experiences underreporting, we can cite as an example one report from Health Quality Ontario, which found that "fewer than 40% of health care improvement initiatives successfully transition from adoption to sustained implementation that spreads to more than one area of an organization" (Health Quality Ontario, 2013, p. 4). This implementation gap has important consequences for patients' ability to access the benefits of innovation. As Dearing and Cox (2018) note, "the extent and quality of implementation and the responses of clients and constituents are outcomes at least as important as initial adoption" (p. 187). One example that illustrates this point comes from a study of 16 U.S. hospitals that implemented a new technology for cardiac surgery (Edmondson et al., 2001). Those hospitals that failed to make the necessary complementary changes in their practices—new operating routines and patterns of communication in surgical teams—only secured low-level improvements from introducing the new technology. These implementation challenges are such a common occurrence for service innovations that they cannot be seen as a localized problem for individual adopting organizations. They also have global effects at the level of health care systems where innovations with proven efficacy and patient benefit struggle to become implemented more widely (Dixon-Woods et al., 2013; Horton et al., 2018).

Current thinking on how to overcome these challenges presents us with a broad division between, on one hand, studies of how to implement innovations successfully *within* a particular local setting such as a hospital or provider organization and, on the other, studies of how to spread innovations globally *across* a health care system. In this article, however, we argue that the *postadoption* challenges of implementing innovations are so great and so systemic that they should lead us to question the way implementation and diffusion are currently treated as unconnected spheres of activity. We argue that theorizing the spread of innovations should be refocused toward what we call embedding innovation—the question of how innovations are successfully implemented at scale. This involves making the experience of implementation a central concern for the system-level spread of innovations rather than a localized concern of adopting organizations. To contribute to this shift, we draw on a mechanism-based approach to theory (Davis & Marquis, 2005) to identify three embedding mechanisms that connect micro- and macrolevel phenomena in the spread of innovations: *learning*, *adapting*, and *institutionalizing*. These mechanisms connect the experience of implementing innovations locally to their diffusion globally within a health care system. Through case examples, we show how these mechanisms help us to better understand the embedding of innovation at a system level. We then address the implications for policy and practice, where our focus on embedding innovation highlights the tensions within existing top-down or bottom-up approaches to spreading innovation. Finally, we outline new approaches that more effectively exploit these mechanisms for embedding innovation and show how these are more aligned with the demands of the emerging wave of digital health innovations.

Theoretical Analysis

In positioning our concept of embedding innovation in relation to existing work, our analysis draws on and integrates relevant theorizing on innovation from a number of relevant fields, including health care management, population health, implementation science, and the wider literature of organization and management studies. To date, much of this research can be characterized as following one of two major perspectives: a diffusion perspective, which can be broadly defined as focusing on the spread of innovations *across* health care systems by a variety of means, and an implementation perspective, which highlights their implementation *within* particular contexts.

A keystone of the diffusion perspective is Rogers' (2010) diffusion of innovation model. This comprehensive model has evolved over a number of years, but in broad terms, it describes diffusion as centering on the communication of innovations in a relatively fixed and discrete form from innovators and change agents to individual adopters, while acknowledging that there may be some "reinvention" of the innovation at the point of implementation. The spread of innovations is seen as a cumulative process in which adoption by other individuals or organizations can act as a signal, via observation, imitation, and influence, to other prospective adopters, leading to a critical mass being reached when spread becomes self-sustaining (Rogers, 2010). Thus, studies of diffusion within a health care system typically focus on the way innovations are communicated over time, at a system level, and through the cumulative decisions of organizational or individual decision makers (e.g., physicians) to adopt them (Greenhalgh et al., 2004).

In contrast, the implementation perspective typically focuses on what happens after the initial adoption decision and asks

how innovations are effectively put into use or integrated within a local setting under real-world conditions. The dominant level of analysis is typically at program or project level; either addressing implementation efforts within specific localities or the top-down implementation of a defined innovation within multiple sites (Greenhalgh & Papoutsi, 2019). Work on "implementation science," for example, typically addresses the barriers and enablers involved in putting innovations to work *within* specific health care contexts. As an influential review defines it, "Implementation is the constellation of processes intended to get an intervention into use within an organization…it is the means by which an intervention is assimilated into an organization" (Damschroder et al., 2009 p. 3). Successful implementation is seen as involving a process of "mutual adjustment" between an innovation and its context, so that the innovation eventually becomes standard "business as usual" (Scheirer, 2005). Achieving this successful outcome, therefore, requires significant "embedding" work (May, 2013) to adapt the innovation to a specific local context, while making complementary changes in the way people work and the way care is delivered (Guzman et al., 2015). In this respect, "implementation is the critical gateway between an organizational decision to adopt an intervention and the routine use of that intervention" (Damschroder et al., 2009, p. 3).

These different perspectives on health care innovation remain largely unconnected (Cranfield et al., 2015), though some recent work in public health and health care management literature has sought to bridge their differences in order to address sustaining and scaling innovations (e.g., Balas & Chapman, 2018; Greenhalgh & Papoutsi, 2019; Lennox et al., 2018). The result of this disconnect, however, is that the postadoption embedding work, which is crucial to realizing the benefits of innovation, has been viewed primarily through the implementation lens, with its focus on specific local contexts. This neglects the possibility for such work to operate in a more distributed way across a system or to be enhanced by the relationships between multiple implementing sites.

To show how this gap in our knowledge relates to existing perspectives, we propose in Figure 1 a way of mapping the diffusion and implementation perspectives where these are conceptualized as addressing distinct dimensions of the innovation process. As outlined here, the diffusion perspective typically focuses on one dimension, namely, the extent of adoption across organizations at the system level (the vertical axis in our Figure 1). The implementation perspective, on the other hand, addresses how successfully, sustainably, or in-depth (Dearing & Cox, 2018) an innovation is implemented at program or organization level (the horizontal axis in our Figure 1). Through this analysis and recognizing that they are a continuum not a binary distinction, we are better able to situate the gap in our knowledge by relating it to different innovation outcomes. This emerges by contrasting innovations that are widely adopted but not fully implemented (top left) and innovations that are fully implemented in one organization or locality but not spread any further (bottom right) with what we term "embedding innovation" where innovations are successfully implemented at scale (top right). Unlike the other quadrants that are addressed by existing perspectives, this quadrant has received much less attention.

In this article, we aim to address this gap in knowledge around the concept of embedding innovation and the distributed work and outcomes associated with it. As per Figure 1 above, this work is not currently addressed within the diffusion perspective because this highlights the signaling effect of adoption decisions, not implementation outcomes, on the spread of innovations. As the implementation gap underlines, adopting may not equate to fully implementing an innovation and may only result in shallow spread. Likewise, the implementation perspective is primarily concerned with implementing innovations within a specific context, not across a health care system.

Theoretical Implications

One of the challenges for theoretical development in this area—and one highlighted by our analysis of the existing literatures—is the challenge of relating phenomena at different levels of analysis, specifically, in this article, seeing the connection between implementing an innovation in a local site, an individual hospital, or some other health care setting and the spread of that same innovation globally across many such sites. One approach to understanding these connections between the micro and the macro involves the identification of underlying "mechanisms" whose operations have the effect of connecting the local and the global. Diffusion itself is one such mechanism (Davis & Marquis, 2005).

When we turn to the embedding of innovation, our review of relevant literature suggests that three such mechanisms are relevant: *learning*, *adapting*, and *institutionalizing*. As we outline below, these mechanisms are co-constitutive, with mutually reinforcing links amongst them. The three mechanisms link implementation efforts at a local level to the creation of the global knowledge, design standards, and institutionalized arrangements that support the work of embedding innovations across multiple sites and over time.

Learning Mechanism

At the heart of innovation embedding lies a process of social learning and feedback that bridges the activities involved in spreading globally and implementing locally. Although there is widespread recognition, both in health care and, more generally, of the vital role of expertise, experience, and learning from the behavior of others in the adoption and implementation of innovations (Paré & Trudel, 2007), the diffusion and implementation literatures often neglect the learning processes involved. This is surprising, considering that key to the implementation process is the integration of generic knowledge of the innovation itself with localized, often tacit, knowledge of how best to apply it within a specific context (Edmondson et al., 2001). Because these different bodies of knowledge are distributed, both across time and across different groups, significant "knowledge barriers" can emerge to the embedding of innovation (Paré & Trudel, 2007). For example, one study of the introduction of infection control technologies in English hospitals found that neglecting localized

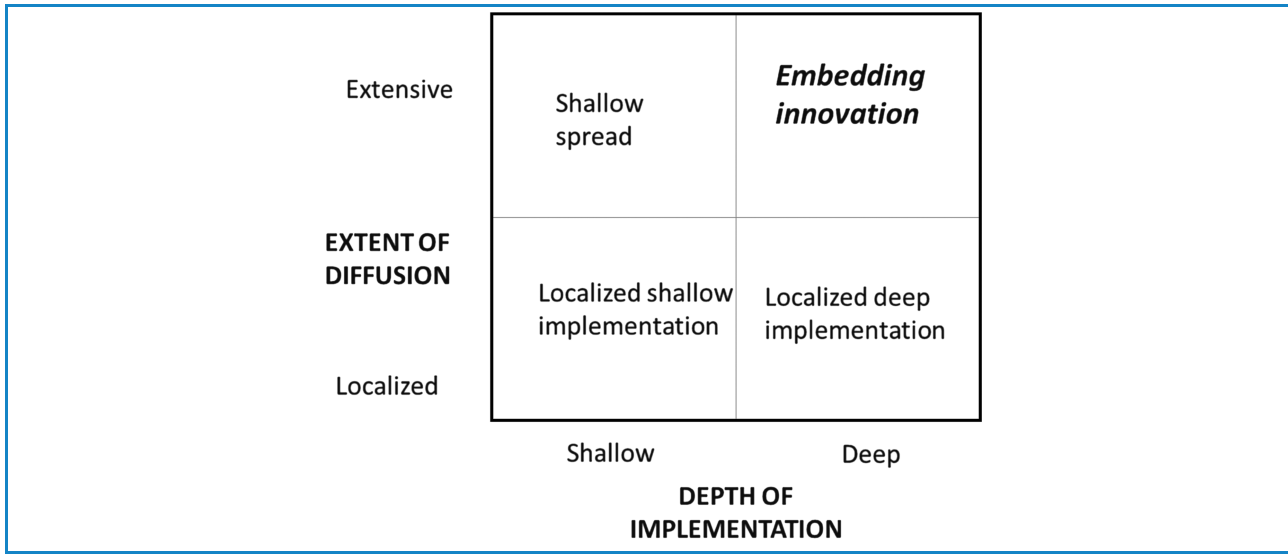

Figure 1. Embedding innovation—conceptual positioning.

experiences and "how-to" knowledge contributed to incomplete implementation or discontinuance after initial adoption (Kyratsis et al., 2012).

The learning that comes from the accumulating experience of implementation across contexts and in different stages of the diffusion process can help to overcome these knowledge barriers to embedding innovations (Balas & Chapman, 2018; Horton et al., 2018). This learning may be captured by intermediary groups, such as consultants or innovation intermediaries who then deploy it to support implementation across client sites (David & Strang, 2006). These groups act as knowledge brokers within practitioner and academic communities, and translators between global innovation designs and local innovation implementations. Also, such learning can be shared directly among different implementing sites, through social networks among individuals connected by ideology (Grossback et al., 2004), shared practice, or professional affiliations. A study of the diffusion of robotic surgery in Italy, for example, found that the tacit know-how around implementing this innovation was spread across many hospitals through the professional networks of surgeons (Compagni et al., 2014). This involved early adopter surgeons visiting other adopting sites and also "proctoring" colleagues in those sites by providing hands-on support in operations to pass on more tacit knowledge of working with robotic tools. Sharing implementation experience in this way promoted wider take-up of robotic surgery by helping to reduce uncertainty about the capacity of local surgeons to implement the new technology, helping to reduce the barriers to effective implementation.

Adapting Mechanism

Adapting—intentionally modifying the innovation to improve its effectiveness—has been widely highlighted within the implementation perspective as an important ingredient in achieving successful outcomes (Stirman et al., 2019). In this perspective, however, adapting is defined as achieving a better fit between the innovation and a given local context. Against this view of adapting as a localized response, there is increasing recognition of its role in embedding, with adopters translating and adapting innovations into new and different forms, negotiating their "fluid and negotiable boundaries," and instilling them with meaning during spread (Denis et al., 2002). Such studies show innovations not as relatively fixed entities but as being transformed in a nonlinear, iterative fashion, with adopters playing an interactive rather than a passive role (Dixon-Woods et al., 2011, 2013). One example of the operation of this mechanism can be found in the evolution of innovations over time—telemedicine being a case in point—where the involvement of end users not only helps to support effective implementation but also contributes to the reshaping of the innovation itself (Robinson et al., 2003).

Within existing perspectives, adaptation may be viewed as problematic, as work within the implementation perspective tends to emphasize the need to ensure the "fidelity" and "replicability" of the innovation (Stirman et al., 2019). On the other hand, there is evidence of how this tension between local adaptation and system-wide embedding can be effectively managed. Denis et al. (2002), for example, in a study of a diverse set of complex health care innovations, differentiated between a "hard-core" innovation element that is well defined and fixed and a "soft periphery" that is less well defined and, therefore, more amenable to adaptation. In this vein, adapting may also encompass "generification," which involves designing products around flexible standards to incorporate the localized experience and adaptations of multiple implementation sites (Pollock & Hyysalo, 2014).

In summary, adapting as an embedding mechanism involves customizing the innovation locally while retaining a degree of fit and standardization at the system level so as to retain the core elements of the innovation that replicate its impact more widely (Denis et al., 2002). This supports moving away from a concern with technical standardization, fidelity,

and replicability of form (Stirman et al., 2019) to an embedding approach that recognizes the need for flexibility and adaptation of the innovation, both to diverse local settings, and the wider institutional environment, so as to achieve replicability of impact at scale (Greenhalgh & Papoutsi, 2019).

Institutionalizing Mechanism

The work of institutional theorists points us toward a third mechanism connecting local implementation of innovations to their system-level spread. The institutionalizing mechanism highlights the importance of social and cultural concerns over or alongside technical and economic explanations for the widespread use of innovations (Strang & Meyer, 1993). It leverages the institutional forces—regulatory, cognitive, and normative—which encourage adoption and diffusion. Such institutional forces are an important feature of health care systems because these typically represent highly regulated and professionalized environments.

The institutionalizing mechanism helps to embed innovation by creating social and regulatory pressures and shared interpretive schemes. These not only motivate professionals and organizations to adopt innovations more extensively but also implement them more deeply, as they perceive such actions as meaningful and legitimate. These motivations in the search for social gains via conformity with peers are further enhanced by the circulation of "success stories," which emerge from the implementation experience of leading organizations and exemplary users (Compagni et al., 2014; David & Strang, 2006). Those implementing the innovation develop new understandings of its use and experiment with new practices to achieve localized in-depth implementation. For diffusing innovations to become perceived as legitimate and become fully institutionalized over time (i.e., achieve taken for granted status), the localized experiences, learning, and understandings of implementers need to become part of new supportive social structures, codified narratives, and meaning systems within the field (Strang & Meyer, 1993).

At the same time, institutional factors may also operate as a barrier to the embedding of innovations. Organizations adopting innovations solely because of legitimacy concerns may adopt them in a tokenistic or ceremonial way—satisfying the need for legitimacy but avoiding any deeper implementation. This has been argued to be an important pattern in the spread of innovations in health care because of its highly institutionalized environments. For example, Mascia et al. (2014), in a study of the Italian health care system, found that many hospitals "decoupled" the adoption of an innovative, legally mandated model of clinical governance from its implementation. This decoupling was reflected in the "extent to which hospitals did not change the internal functioning of their clinical activities and avoided the adoption of clinical governance tools" (p. 119).

Practice Implications

For practical purposes, our analysis suggests that policymakers and managers of health care organizations need to consider the diffusion and implementation of innovation not as discrete arenas but as interlinked aspects of the innovation process. Figure 2 builds on this analysis by showing the choices facing policymakers, managers, and practitioners as they seek to embed innovation in practice.

Initiatives to spread innovation in health care can be broadly categorized into top-down or bottom-up approaches (Greenhalgh et al., 2004). The top-down approach involves efforts by policymakers and regulators to spread innovations through compliance or by using intermediaries to promote them. It prioritizes the role of "supply-side" actors, particularly policymakers or regulators over "demand-side" actors and the efforts of local adopters and implementers (Dixon-Woods et al., 2013). Where such approaches neglect the embedding work required for innovation, our analysis highlights the risks of a "shallow spread" outcome. This may be for institutional reasons as in the symbolic adoption of new forms of clinical governance in our Italian case (Mascia et al., 2014), or it may reflect a neglect of the need for learning and adapting discussed above, with the result that the embedding work needed to integrate the innovation into existing practices and routines is lacking. For example, a recent report on the spread of digital technology in the U.K. health care system observed: "Where technological interventions have failed, technology has simply been layered on top of existing structures and work patterns, creating additional workload for health care professionals" (Imison et al., 2016, p. 6).

An alternative set of problems is posed by the bottom-up or grassroots approach where innovation is driven from below through the efforts of many local innovators and champions. An important risk here, as indicated by the lower right quadrant of Figure 2, is that of so-called "pilotitis"; that innovators succeed in implementing their innovation within a particular site or area but fail to break out of that environment to replicate the innovation elsewhere and achieve a wider pattern of spread (Horton et al., 2018). They may also fail to sustain the change beyond a trial period or move proven projects into stable, scalable, funded programs (Bégin et al., 2009). Evidence of pilotitis as a failure to embed innovation has been identified in a range of health care fields, including telemedicine, digital technology, and mobile health innovation (Bhatia et al., 2020; Greenhalgh et al., 2017).

In our analysis, pilotitis can be explained in terms of the localized focus of implementation efforts, which may limit their ability to leverage the embedding mechanisms discussed above. Pilot projects are usually championed by highly committed individuals who are focused on implementing them within a particular, controlled environment. These exceptional features make such pilot sites outliers to the wider system and may limit their ability to share learning with other organizations that are less well-resourced and enthusiastic adopters (Bégin et al., 2009). Also, local adaptation of the innovation to fit the needs of the pilot setting may make it a poor fit with needs of other health care settings where norms, context, and culture may differ substantially (Denis et al., 2002).

Although top-down and bottom-up approaches create different problems for spreading innovation, we argue that, to some degree, these problems flow from viewing the diffusion and implementation of innovations as distinct undertakings, which involve different actors, times, and places. This inevitably

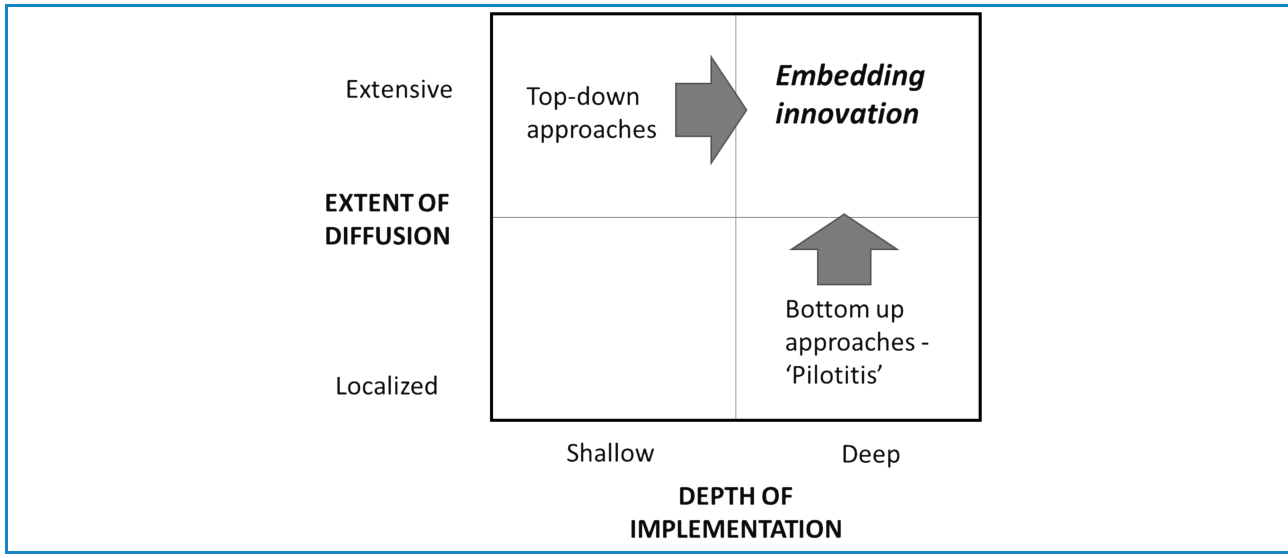

Figure 2. Embedding innovation—policy and practice implications.

stokes the tensions outlined above between, for example, imposing an innovation on health care organizations and individuals championing its in-depth implementation, and between adapting it to meet the needs of a particular setting and shaping an innovation for a wider system. One could argue that the challenge of embedding innovations across a health care system is more a concern for policymakers with a macrolevel view or for countries with more socialized forms of medicine. However, understanding how proven innovations can be spread more widely and rapidly is equally in the interests of clinicians and health care managers as they seek to deliver the best possible care to their patients in a way that is seen to be legitimate and well founded on experience. This involves not only accessing such innovations more quickly but also avoiding the wasteful proliferation of innovations, which are less suited to their needs.

Case Examples of Embedding Innovation

Our analysis shows how challenging it is to embed innovations in health care. However, there are cases that illustrate what can be achieved when these challenges are overcome by exploiting the mechanisms highlighted above. One well-known example is the Keystone Project in Michigan that aimed to decrease catheter-related bloodstream infections in the intensive care unit (ICU). This patient safety innovation was spread and successfully implemented across 108 ICUs in 77 hospitals in the state of Michigan, producing a large (up to 66%) and sustained reduction in bloodstream infections (Pronovost et al., 2006). To underline the challenges of embedding, however, when the National Health Service attempted to replicate the success of the Keystone Project in the United Kingdon, the resulting project was a well-documented failure. Comparative analysis of the U.S. and U.K. cases is revealing (Dixon-Woods et al., 2011, 2013). This suggested that the U.K. initiative failed, in part, because it was too heavily top-down and mandated rather than voluntary. In contrast, the Keystone Project team balanced top-down elements of leadership monitoring and control, such as the continuous benchmarking of data, with the bottom-up creation of a social network among physicians and normative isomorphic pressures, that is, a desire to conform to group norms, operating upon ICUs and their staff. This facilitated collaboration and influenced professional norms, thus legitimizing the intervention. Crucially, the leaders of the Keystone Project exploited the early learning from the implementation of the intervention and "used that knowledge dynamically to modify the program to respond to the participants' needs during its implementation" (Dixon-Woods et al., 2011, p. 173).

Although the Keystone Project is an example of a clinical innovation, an example of a more systemic change is provided by the embedding of an organizational innovation, namely, the establishment of the professional role of a "hospitalist" in the United States. A hospitalist is a generalist type of physician in hospital wards who cares for acutely ill, hospitalized patients. The successful embedding of this innovation is reflected in the rise in numbers fulfilling this role. These increased from 4,000 in the year 2000 to 50,000 in 2016, such that they constitute the largest subspecialty in internal medicine and the fastest growing medical specialty in the United States (Wachter & Goldman, 2016). By 2016, nearly all teaching hospitals and 75% of all U.S. hospitals had hospitalists (Wachter & Goldman, 2016). As with the Keystone Project, this model has been *dynamically adapted* to meet the needs of physicians and hospitals locally. The academic promoters and designers of the model from the University of California, San Francisco worked closely with users to continually redesign it so that it would work for family care physicians as well as for hospital internists (the main physician group retrained as hospitalists). The new specialty required little additional training for internists, which allowed for a very rapid expansion. The adapted model provided physicians with choice over when and how they worked, and job plans could be tailored to individual intellectual interests and lifestyle preferences. Although this adaptation helped professionals to embrace the new role, its introduction into a large number of autonomously managed hospitals created in effect a large-scale experiment.

This had great learning benefits for further development and standardization of the model at the system level: "In hospitals where the local configuration of the model benefited patients, doctors, lawyers and the chief financial officer, the model thrived, while in other cases hospitalist programs simply collapsed, often in the space of months. [This]…environment allowed for very rapid learning" (Vaughan, 2016).

Over time, the embedding of this new role was marked by evidence of institutionalizing, with hospitalists developing their own professional society, training program, and independent research and education. This development was reinforced by the new role's strategic alignment with the wider policy agenda of quality and safety in U.S. health care, as it emerged in the wake of two influential reports: "To Err Is Human" (1999) and "Crossing the Quality Chasm" (2001). Professor Wachter, the leading academic champion of the U.S. hospitalist movement, commented, "There was a very clear assessment of problems at system level and rapid movement to align hospitalist services with other national agendas, making the introduction of hospitalist services to the advantage of all players in the system" (Vaughan, 2016). This alignment conferred legitimacy on the new role, rendered it meaningful to powerful stakeholders, and allowed hospitalist medicine to be framed around the prevailing health policy improvement agenda. The improvements in patient safety, the associated decrease in malpractice lawsuits, and the reductions in hospital length of stay created clear efficiency benefits for hospital leaders and management teams.

What Could Be Done to Promote Embedding?

In summary, embedding involves connecting the local adapting of innovations to malleable global designs; codifying and sharing knowledge from situated implementation experience; and evolving local norms, roles, and practices in line with the emergence of supportive institutions and policies. These three mechanisms create the potential for a virtuous circle to operate between the in-depth implementation of an innovation and its diffusion across settings. For example, embedding is enhanced and shallow implementations are avoided when the spread of an innovation builds on and does not outpace the accumulating sum of knowledge on how to implement it (Compagni et al., 2014; Kyratsis et al., 2012). Likewise, capturing, codifying, and sharing the wealth of local implementation experience by adapting innovation designs can reduce uncertainty and smooth the path for future adopters.

Evidence for these mutually reinforcing mechanisms has been highlighted in the case examples discussed above, with clear signs of learning, adapting, and institutionalizing in the embedding of robotic surgery in Italy and the institutionalization and professionalization of hospitalist roles in the United States. In these cases, a trajectory of innovation adaptations, learning, and institutional alignments unfolds where system-level diffusion and local innovation use mutually shape and benefit each other. In the process, "learning by using" and adapting the innovation helps to speed diffusion by improving its functionality and ease of implementation for future adopters.

One limitation of our analytical focus on the underlying mechanisms of embedding is that it does not directly address the question of the actors and interpretive processes involved in enacting these mechanisms. Our case examples do provide some illustrative instances of the way a variety of actors engage with such mechanisms, but these rather help to signpost the need for further research in this area. In particular, our analysis suggests that embedding is a product of the *relationships between* different groups of innovators, adopters, and implementers on both the supply side and demand side of innovation. This highlights the need to understand the ability of such groups to act collaboratively through appropriate forms of governance and the role played by boundary-spanning actors and relationships, for example, intermediary groups and social networks, in making these connections (Gray & Purdy, 2018).

The importance attached to such intergroup collaboration and boundary-spanning actors is underlined when we focus on the practical ways in which professionals, managers, and policymakers might help to create the right conditions for embedding work. A cornerstone of these practical responses is the need to understand how the actions of individual adopters may resonate with a wider audience of prospective adopters. In relation to the problem of pilotitis as seen with bottom-up approaches, for example, our analysis highlights the need to ensure that the site where an innovation is initially piloted becomes a gateway to the wider health care system rather than a one-off event (Bégin et al., 2009). This requires a reconceptualization of the role of pilot implementation studies, so that they generate evidence not only on the outcomes of implementing an innovation locally but also for scaling it globally. This can be advanced by forms of "real-world evaluation" that help to capture and spread the experience of implementing innovations (Stirman et al., 2019). In the same vein, adapting an innovation to fit one implementation site needs to be balanced by adapting it to travel more effectively across many sites—by, for example, standardizing the core elements of the innovation (Dearing & Cox, 2018).

More generally, this analysis reinforces calls to put in place new approaches that can increase the connectivity between innovators and implementers of innovations (Balas & Chapman, 2018; Horton et al., 2018). Practical examples include new formats for developing innovation, such as "hackathons," which bring together developers and clinicians to focus on solutions to real-world health care challenges (Poncette et al., 2020). Crucially, these models avoid the limitations of top-down and bottom-up approaches by lowering the barriers to knowledge sharing between different actors so as to enable more rapid learning and adaptation of the innovation.

The effectiveness of new boundary-spanning approaches to innovation will also depend on their ability to align with policy environments that truly support and reward the sustainable embedding of innovation over more short-term outcomes. This challenge is heightened by the rapid emergence of a new wave of digital health innovations. Such innovations underline the importance of embedding mechanisms because they allow—and even demand—the kind of learning and adapting feedback loops highlighted here for widespread adoption. However, it is also true that their "agile, rapid

iteration technology development" is difficult to accommodate within "the risk-averse, highly regulated, and randomized trial-dominated context of much biomedical innovation" (Greenhalgh et al., 2017, p. 9).

In response then, policymakers and regulators need to be more creative and flexible in their approach. This includes adapting their standards to be more inclusive of new and shifting forms of evidence on patient benefits that do not conform to the established format of the randomized clinical trial. It may also involve the development of new practices, such as the creation of so-called "regulatory sandboxes," which connect policymakers with innovators and help to avoid the pilotitis, which plagues the bottom-up development of innovations. Such testbeds, it is argued, could help to "optimize interventions by tweaking them in a real-world context, and to generate the evidence required to scale up" (Bhatia et al., 2020).

Conclusion

In this article, we ask how innovations in health care can be implemented both effectively and at scale. This is an important question for policymakers and practitioners alike because the greatest benefits for patients flow when these conditions are met. Existing perspectives, however, tend to break this into two different questions: How can innovations be spread globally, and how they can be successfully implemented locally? In so doing, they fail to address the potential for what we term "embedding innovation"—how local implementation experiences can recursively benefit from and contribute to the wider global spread of the innovation? To contribute to a new research agenda in this area, we outline in this article how innovation can be embedded by exploiting the interrelated mechanisms of learning, adapting, and institutionalizing, which support the distribution of embedding work more widely within a health care system. Although previous studies have shown how the postadoption challenges facing innovations represent a major barrier to their spread (e.g., Balas & Chapman, 2018; Greenhalgh et al., 2017; Horton et al., 2018), this does not address the tensions that arise when diffusion and implementation are treated as unconnected activities. In contrast, our focus in this article has been on exploring how they may become better connected through embedding mechanisms that enable the experience of implementation in one context to be generalized into the spread of innovation across contexts.

From a policy standpoint, this focus can help avoid the limitations of current approaches to spreading innovation, mitigating both the risks of pilotitis, on the one hand, and the shallow spread of innovation, on the other. Looking ahead, a focus on embedding rather than spreading innovation also aligns with the emerging demands of digital health technologies. The greater adaptability of these technologies and the importance placed on rapidly learning from the experience of implementing them take us even further away from the dichotomous thinking that separates diffusion from implementation (Cranfield et al., 2015; Greenhalgh et al., 2017).

Overall, as the scope for such potentially disruptive innovation increases within health care systems, policymakers and health system leaders need to develop new approaches to the spread of innovations that secure its positive benefits for health systems and patients, without the attendant costs and risks of disruption. This involves a shift away from top-down policies toward more collaborative forms of governance, which incorporate the valuable forms of evidence and experience to be gained by frontline adopters in the work of embedding innovation. By providing greater time, space, and resources for learning, networking, and redefining of roles, that work can be distributed more effectively in support of the kind of sustainable and transformational innovations that health systems worldwide will increasingly depend on.

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