

The Adoption of Innovations by Provider Organizations in Health Care

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Innovations in health care account for some of the most dramatic improvements in population health outcomes in the developed world as well as for a nontrivial proportion of growth in expenditures. Provider organizations are the adopters of many of these innovations, and understanding the factors that inhibit or facilitate their diffusion to and possible disengagement from these organizations is important in addressing cost, quality, and access issues. Given the importance of these issues, the purpose of this article is to (1) create a comprehensive census of studies examining the adoption of and disengagement from innovations in health care provider organizations; (2) organize these studies into an inductively derived classification scheme; (3) assess the studies' strengths and weaknesses; and (4) reflect on the implications of our review for future research.

Keywords: *adoption of innovation; diffusion of innovations; disengagement from innovation; abandonment of innovation; literature review; health care organizations*

During the past 30 years, a wide array of innovations, both administrative and clinical, has flooded health care systems worldwide, offering potentially beneficial advances in the diagnosis and treatment of disease and the delivery of medical services in a growing number of clinical domains. Magnetic resonance imaging, routine immunizations provided by public health departments, monoclonal antibodies, and percutaneous coronary intervention are just a few examples. Innovations such as these account for some of the most dramatic improvements in population health outcomes in the

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developed world. Additionally, they often represent important investment opportunities for individual provider organizations in an increasingly turbulent and competitive environment. And we can look forward to more of the same in coming years as the clinical and financial promise of innovations such as nanotechnology, bionic devices, combination device/drug therapies, and advances in health information technology is realized.

However, innovations also account for a nontrivial proportion of growth in health care expenditures in the aggregate. In one survey, more than 81 percent of economists and 68 percent of practicing physicians identified technological change in medicine as the primary reason for the increase in the health sector's share of gross domestic product in the past 30 years (Fuchs 1996). Newhouse (1992) estimates that technological change accounts for more than half of the 50-year increase in medical care expenditures. At the level of individual provider organizations, the direct and indirect costs of acquiring and implementing innovation are often substantial, and the adoption and use of innovations typically present highly consequential financial and managerial challenges.

Do the benefits of innovation in health care outweigh the costs? Many believe that they do. Cutler and McClellan (2001), for example, argue that the benefits of technological change equal or outweigh the costs for five varied and high prevalence conditions, including heart attacks, low-birthweight infants, depression, cataracts, and breast cancer. Additionally, Cutler and Richardson (1998) evaluate the value of the health of the U.S. population and, incorporating both the benefits and the costs of health, estimate that health improved on average by \$100,000 to \$200,000 per person between 1970 and 1990. However, not all innovations yield unambiguous benefits. In fact, many have surely not been worth the expense and may have even been harmful. In the realm of medical technologies, Duffy and Farley (1992), for example, document the protracted demise of intermittent positive pressure breathing, an innovation that rapidly diffused despite a lack of evidence about efficacy and that later was shown to have limited therapeutic benefit despite costing Medicare and other payors substantial amounts of money. And in the realm of managerial innovations, studies have called into question the realized average benefit of total quality management in hospitals (Walston, Burns, and Kimberly 2000; Zbaracki 1998). Thus, while aggregate net benefits may already be positive, there is reason to believe that we could realize even more gains on average by decreasing investment in innovations that have low or negative value.

Furthermore, it is clear that the distribution of positive net benefits is unequal both between organizations and within the populations they serve. For example, Groeneveld, Laufer, and Garber (2005) tracked utilization of a set of five emerging procedures among a cohort of Medicare beneficiaries and documented lower rates of utilization for four of the procedures for both black and white patients who were admitted to hospitals that had larger black populations. They also documented greater disparities in procedure use for black inpatients in hospitals with larger black populations. Hospital-level variation in technology adoption may be a cause of these

disparities, pointing to the potential importance of heterogeneous organizational adoption rates in explaining access problems. We believe that the distribution of positive net benefits could be improved between organizations that serve primarily advantaged and disadvantaged populations as well as within the populations served by both types of organizations.¹ Finally, we know that many factors inhibit disengagement—the process through which an organization stops using an innovation in which it has previously invested (Kimberly 1981), although this is an area that has not received a good deal of research attention.²

The upshot is that, among organizations, some innovations may *over diffuse*, or spread beyond where their use is clinically and/or financially justified; *under diffuse* or not spread as widely as their net benefits suggest that they should;³ *inequitably diffuse*, or spread unevenly among organizations serving primarily advantaged or disadvantaged populations; or over-, under-, or inequitably exnovate. Because health care provider organizations are significant investors in medical innovations, understanding the factors that inhibit or facilitate adoption and disengagement in these organizations is important to enhance the *appropriate* system-level diffusion of innovations, which should be the goal of health policy.

New Contribution

Given the importance of these issues, the purpose of this article is to (1) create a comprehensive census of studies examining the adoption of and disengagement from innovations in health care provider organizations; (2) organize these studies into an inductively derived classification scheme; (3) assess the studies' strengths and weaknesses; and (4) reflect on the implications of our review for future research. The literature review was carried out in the context of a larger, interdisciplinary project at the University of Pennsylvania that was designed to examine the development, adoption, and diffusion of medical innovations.

This review extends previous reviews and meta-analyses in the health care and organizational literatures (e.g., Greenhalgh et al. 2004; Fleuren, Wiefferink, and Paulussen 2004; Scott 1990; Greer 1977; Kaluzny 1974; Damanpour 1991; Wolfe 1994). It thus both updates earlier reviews found in the health care literature and explores an important subsegment of articles in the organizational literature—those on innovation in health care organizations. Whereas recent reviews have covered both individual and organizational development and adoption (Greenhalgh et al. 2004) and implementation in provider organizations (Fleuren, Wiefferink, and Paulussen 2004), we focus specifically on provider organizations and the adoption stage of the diffusion process. Additionally, in an inductively derived classification scheme, we catalogue constructs that have been considered in previous research and index the studies that measure these constructs, thus enabling readers to see the foci in previous research. Finally, based on our review, we offer a number of recommendations for theory and research design in future research.

Definitions

We encountered many definitions of *innovation* in our review of the organizational adoption literature, and we found that researchers' definitions tend to differ in three important respects. First, some researchers conceptualize innovation as a discrete product or program, while others conceptualize innovation as a process. Rogers (2003, 12) exemplifies the former view, defining innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." Schon (1967, 1) provides an example of the latter view when he argues that "innovation will mean the process of bringing inventions into use." The conceptualization of innovation as a discrete product or program is often characteristic of the adoption literature, while the conceptualization of innovation as a process is typically characteristic of the implementation literature.

Another difference is in how the relationship between *innovation* and *newness* is conceptualized, and particularly, in who is to judge whether something is new. Zaltman, Duncan, and Holbek (1973, 158), for example, hold that innovation is "any idea, practice, or material artifact believed to be new by the relevant unit of adoption." In this definition, similar to Rogers's above, the criterion used for determining what qualifies as innovation is perceptions of newness on the part of the adopting system. This means that a given material artifact or practice could be an innovation in one organization but not in another because perceptions of its newness differ in the two contexts. This definition contrasts with other approaches in which the criterion of newness is some external standard, such as "the state of the art in the field." Thus, Meyer and Goes (1988, 903–4) follow Greer, Greer, and Meyer (1983) in defining medical innovation as "significant departures from previous techniques for diagnosis, treatment, or prevention, as determined by the collective judgments of experts in the field." Here, something is an innovation if it is judged to be such with reference to an external standard. If we were to dichotomize and cross-classify these two dimensions—adopter perceptions and an external standard—the result would be what is shown in Figure 1. The substantive implications of the two on-diagonal cells are clear. Where an artifact or practice is defined as an innovation with respect both to adopter perceptions and an external standard, there is clearly innovation. And where it is defined as an innovation by neither, innovation is not present. But where it is defined as innovation by one but not the other, there is ambiguity.

A third difference is in the definition of *newness* itself. Two meanings of newness are used in the adoption literature—*differentness* and *recency*. Differentness emphasizes the extent of departure from the status quo (or "radicalness"). There are many referents to which one might tie differentness, though embodied knowledge is the most common. For example, Dewar and Dutton (1986, 1423) emphasize embodied technological knowledge content, describing that radical innovation represents "revolutionary changes in technology . . . [it] represents clear departures from existing practice." This highlights that both technology and the technological practices

Figure 1
Definitions of Innovation

		External Standard	
		Innovation	Not an Innovation
Adopter Perceptions	Innovation	Innovation	<i>Ambiguity</i>
	Not an Innovation	<i>Ambiguity</i>	Not innovation

associated with technology are different. The meaning of differentness can either be tied to potential adopter perceptions or an objective standard. Recency, on the other hand, highlights the amount of time a material artifact or practice has been in the world. The meaning of recency is always tied to a time referent, but recency refers to either the objective time that something has been in the world or the perceived amount of time that something has been in the world. For example, in the Rogers (2003) definition above, "new" clearly refers to recency, though perceptions of recency are taken to have more impact on behavior than does objective recency. We found some casualness in the adoption and diffusion literature regarding these alternative definitions of newness. This is problematic, particularly as the definition of newness integrally plays into both the definition of an external standard and the perceptions of potential adopters, and thus, the content of Figure 1. Thus, for example, in the first on-diagonal cell in Figure 1, there is clearly innovation, but it is unclear whether this is because the innovation is different, recent, or both. A parallel case can be made for the second on-diagonal cell. Another layer of ambiguity is added to the off-diagonal cells. Finally, beyond definitions, each aspect of newness is also an independent variable that influences adoption in different ways.

The distinctions between definitions of innovation extend well beyond the level of semantics. These distinctions reveal often deep-seated differences in the fundamental assumptions and viewpoints of researchers, differences that influence the character of research questions and analyses. Above all, for our purposes here, these distinctions indicate the need for caution in comparing the results of innovation studies, because different groups of researchers may be talking about quite different things when they use the term innovation. These distinctions also point to a need for constructing clear boundaries between studies examining different conceptualizations of innovation, so

as to minimize the potential confusion associated with aggregating results from underlying models that may be built on quite different assumptions.

Accordingly, we developed a definition to guide our inclusion criteria. For the purposes of this review, we define innovation as “any discrete material artifact or practice that represents a significant departure from currently embodied knowledge content, as determined by the collective judgment of knowledgeable persons in the field at the time it first appears.” By “material artifact or practice,” we mean to include both administrative and clinical innovations, which in our minds encompass innovations such as medical procedures, biopharmaceuticals, medical devices, research stemming from evidence-based medicine, managerial practices, and any other relevant tools used for the diagnosis, treatment, and prevention of disease as well as the provision of administrative services related to the delivery of medical care. This definition enables us to consider a wide array of innovations while excluding those that do not immediately relate to the provision or administration of care, such as educational innovations in teaching hospitals. By “as determined by the collective judgments of knowledgeable persons in the field,” we mean to frame innovation in terms of an external standard. For us, perception of newness is an independent variable and not a criterion for determining whether something is an innovation. Specifically, perceptions of newness by potential adopters may influence receptivity to innovation; it may be that organizational actors are more likely to adopt an innovation that is perceived not to be a significant departure from the status quo or that is perceived not to be very recent. But this explicates diffusion patterns rather than determining whether something is to be defined as an innovation (Kimberly 1981). It is necessary to define newness independently from the perceptions of potential adopters, because the goal is to understand diffusion patterns. Similarly, by “currently embodied knowledge content,” we mean to define innovation as some combination of being objectively recent, and to at least some degree, objectively different from existing embodied knowledge. We believe that both are necessary for innovation to be present. Finally, for the purposes of this review, innovation is conceptualized as a discrete, already developed material artifact or practice. This part of our definition is deliberately restrictive. We believe that the processes leading to the decision to adopt an innovation and the processes that follow subsequently (implementation) are fundamentally different, and we deemed that it was more important to maintain consistency in our findings and critique than to include all in our review.

We also encountered debate about the definition of *adoption*. One fundamental distinction lies in thinking about adoption as a distinct organizational event or as including both the adoption decision and implementation. Rogers (2003, 177) exemplifies the former view, in which adoption is perceived as “a decision to make full use of an innovation as the best course of action available,” and the process elements of adoption occur before or after the decision.⁴ In contrast, many others espouse the latter view; for example, Mansfield (1968) judges the processes of interorganizational and

intraorganizational adoption to be similar in character (Cool, Dierickx, and Szulanski 1997). Clearly, one can see the adoption of some innovations more clearly than the adoption of others, and the concreteness of the innovation is an important consideration in the measurement of adoption. In particular, we believe it is more difficult to operationalize the adoption of less concrete innovations such as total quality management (TQM) or guidelines as a discrete organizational event than it is for more concrete innovations such as a positron emission tomography scanner.

Finally, we would like to point out that, from a strategic perspective, an organization may “adopt” innovation in a variety of ways. In particular, the organization may have a wide range of possibilities for investing resources in innovation, including but not limited to outright purchase (e.g., automatic blood analyzer), hiring outside consultants or staff with specialized skills (e.g., TQM), or contracting with an outside party to gain access to the innovation (e.g., mobile magnetic resonance imaging [MRI]). The key dimension of adoption, for us, is that the focal organization secures or maintains *access* to innovations. The existence of options, however, may influence the form of innovation that is adopted, and the way in which the organization secures access may have implications for the correlates that influence adoption and disengagement. We will return to this point later in the article.

As before, we developed a definition of adoption to guide our inclusion criteria. Specifically, we defined organizational adoption as “the discrete organizational decision to accept or reject an innovation.” By using the phrase “discrete organizational decision,” we mean to focus our review on studies that examine adoption as a relatively distinct organizational event. While measuring a distinct organizational event may be easier for some innovations than for others, we believe that, as stated earlier, the processes of adoption and implementation are fundamentally different, and to maintain consistency, we included only the former in our review. However, we note that concreteness is also an independent variable that may influence diffusion and is not just a dimension of the dependent variable; in this former sense, measurement of concreteness would be included in our review.

There are two further nuances in the definition that should be pointed out. First, by using the phrase “accept or reject,” we mean to include organizational decisions both to adopt and to reject. In our view, there are two types of rejection—a decision not to adopt a given innovation and disengagement from a previously adopted innovation—and we include both. Second, it is likely in studying disengagement that by the criteria of recency and differentness that we set forth above, a previously adopted technology will no longer be an “innovation” by the time disengagement occurs. Thus, to be included in our sample, the technology must have been an innovation “at the time it first appears,” as is specified in our definition of innovation. Furthermore, by using the phrase “accept or reject,” we mean to include the various ways organizations can invest (or divest) resources in innovations. Again, the key dimension is *ensuring access to innovations*.

Methods

To initiate data collection, we conducted computerized searches through the National Library of Medicine's PubMed service. We relied on PubMed's medical subject headings ("MeSH") and searched all abstracts with the major topic headings "Diffusion of Innovation," "Organizational Innovation," and "Information Dissemination." We then collected all appropriate citations in five literature reviews that included organizational innovation adoption.⁵ Finally, we searched the reference sections of all articles identified through the first two steps.

For this review, we focused on research articles published in English-language, peer-reviewed journals from 1960 through June 2005. In addition, a study had to meet the following criteria for inclusion: (1) at least one level of analysis was at the organizational level; (2) the study had to be empirical—either qualitative or quantitative; (3) the innovation or innovations had to have been developed outside of the organization; (4) at least one dependent variable had to be adoption of or disengagement from an innovation or innovations; and (5) the organization studied had to be a health care provider organization. A total of 55 studies met all of these criteria.^{6,7}

Each study identified was reviewed independently by the authors and coded for theory and methods using an extensive data extraction form that was developed in five iterations in a preliminary review of articles. Quantitative articles were coded using a detailed, six-page form that captured information about data, methods, researched constructs, and variables measuring those constructs. Qualitative articles were coded according to an abbreviated form that captured analogous information, though constructs were classified only according to the main research areas identified for all articles through the preliminary review. Coding sheets are available from the authors on request. When the coder encountered doubt about classification of content, the authors met to discuss these instances. All differences of opinion were resolved through discussion.

Throughout this process, all independent variables for quantitative articles were classified according to the connection between measure and construct intended by the researcher. Coding variables according to the researcher's intended construct, as opposed to coding on the actual variable, was important to our overall design. We were particularly interested in theoretical models, but we quickly found that, across the literature, many of the same variables were used as measures of several different constructs, and thus, findings for a particular variable could be associated with a number of different adoption theories. For example, "percentage of staff with certain kinds of educational attainment" was sometimes used to measure the construct "professionalism" and sometimes used to measure the construct "absorptive capacity." The literature is teeming with similar examples. Thus, it would have been imprudent to classify on measure alone, as this would have left us in a position of being unable to group the findings of studies reliably based on intended meaning of constructs and

posited theoretical cause-effect relationship. We discuss the consequences of this operationalization issue below.

We developed an inductively derived classification scheme based on the article review and coding exercise. This framework organizes theoretical ideas in existing research, and thus, represents a road map of what previous researchers have explored. Implicit in our framework is a scheme of four levels of adoption correlates, which we call category, concept, construct, and variable. These organize the adoption correlates themselves at descending levels of abstraction. It is useful to explain each. A category clusters correlates together at the highest level of abstraction. In our scheme, there are four categories: Environmental Influences, Connectedness, Organizational Attributes, and Innovation Characteristics. These categories are intended to help readers map the literature. Contained within a category, a concept is a grouping of constructs that have a common meaning. For example, "Demand" is one of four main concepts within Environmental Influences, and "Organizational Structure" is one of the five concepts within Organizational Attributes. Contained within a concept, a construct is the idea or theoretical creation that an analyst intends to measure. For example, we identify four main groups of constructs within the Demand category, including affluence, population medical need, size of market, and physician supply. We say "groups of constructs," because we found that the definition of construct often varied at the discretion of the researcher and was often not clearly specified, a phenomenon that was compounded by disciplinary conventions in methodological reporting. This made precision difficult. We generalize here because of the diversity of operational definitions in the literature and the multidisciplinary nature of the review. Finally, a variable measures a construct. For example, "cumulative adoptions in an area" often measures *cohesion*.

Once the classification scheme was developed, we reclassified each coded construct in each article into this scheme. The reader should not believe that the assignment of variables to constructs and of constructs to concepts was a simple and straightforward task. In fact, a number of judgment calls had to be made, and it became clear to us as we did the work that in the movement from concept to construct and from construct to variable, there is actually a great deal of what might generously be called fluidity among theory, construct, and operationalization of construct into a variable.⁸ This occurred both within and between disciplines, reminding us of the need for caution and prudence in comparing the results of multiple studies, particularly given the added complexity of a multidisciplinary field. The consequences of this fluidity will be addressed in the Discussion and Recommendations section. Given the evident confusion, our classification scheme is intended to help readers make sense of the literature.

We assessed findings in a qualitative manner by cataloguing the quantitative variables used to measure focal constructs in this classification scheme and assessing the significance and directionality of constructs. Thus, findings are representative of theoretical mechanisms of action as opposed to variable-level findings. Specifically, we catalogued the variable-level findings for a construct into seven classes of significance

and directionality.⁹ We entered this information into a database and analyzed it across relevant studies to aggregate patterns of significance at the construct level, and if usually significant, directionality. This procedure was repeated for each variable and construct considered in each quantitative study in our sample examining adoption; constructs and variables for three articles assessing disengagement from innovations were excluded from this analysis because they examine different processes.

We assessed how correlates of innovation were associated with what we call *innovative behavior* or *adoption behavior*, which denote a variety of dependent variables relating to adoption, including but not limited to adoption of a single innovation and an additive scale representing adoption of multiple innovations. The reasons for this were practical. Articles in our review sample included many types of dependent variables; our sample was too small to parse out the correlates of different dependent variables; and we strove to consider all studies in the census.¹⁰ For qualitative studies, we catalogued where authors discovered findings related to categories, concepts, and constructs.

Correlates of Adoption

We identified four categories of adoption correlates that researchers have used, either singly or in various combinations, to explain the adoption of innovations by health provider organizations: Environmental Influences, Connectedness, Organizational Attributes, and Innovation Characteristics. These are illustrated in Table 1. Together, these four categories constitute—at a highly abstract level—a comprehensive set of influences on adoption. Tables 2 through 5 list commonly researched concepts within each category of adoption correlates as well as the different types of constructs that correspond to each concept. Furthermore, the tables delineate examples of quantitative studies in multiple disciplines that operationalize the constructs (the Appendix lists the articles associated with each number). These lists of studies are meant as a reference for empirical researchers wishing to study these concepts in more depth.¹¹ We describe typical findings for constructs and concepts in the following sections.

Environmental influences. One set of adoption correlates is linked to what might be loosely termed “environmental influences.” These are stimuli for adoption that emanate from an organization’s general surroundings. We view this category as encompassing several different rationales for external influence that have been previously considered by students of innovation, including general environmental context and economic or market factors (Kimberly and Evanisko 1981; Baker and Phibbs 2002).

Among the factors examined by the studies in our review, four concepts are prominent. In Table 2, we see that a number of studies consider demand factors, which are usually believed to be associated with higher adoption because of cohort

Table 1
Classification Model

Environmental Influences	Connectedness	Organizational Attributes	Innovation Characteristics
• Demand • Competition • Regulation • Other characteristics of location	• Connections between organizations • Connections between organizational actors	• Organizational structure • Individuals and collectivities within organizations • Organizational learning, climate, and attitudes • Resources available for innovation • Strategic positioning	• Benefits of innovation • Costs of innovation • Usage characteristics

medical need or desire for medical services. The locus of demand is usually the potential patient (individual or aggregated); however, for physician supply, the locus of demand is the physician, thus acknowledging the potential for supplier-induced demand and/or referral relationships to drive adoption processes across organizations. Across the studies in our sample, we found that measures of affluence are usually insignificant; measures of medical need exhibit mixed significance; and among significant variables, there is no consistent pattern of effects. Although significance is mixed, when measures are significant, they usually indicate that larger markets are associated with more innovative activity at the organizational level. Physician supply, on the other hand, has differentiated effects. In particular, while Romeo, Wagner, and Lee (1984) find no support for the possibility of demand inducement by physicians, Sloan et al. (1986) find that more surgical specialists per population in the discipline that generally performs the procedure significantly increases the probability of adoption of five surgical procedure innovations, though significance is mixed across technologies for specialists in all medical fields and related medical fields.

Competition often appears as a concept that influences innovation adoption by organizations, in some cases facilitating and in other cases impeding diffusion. For example, competition may lead to a "medical arms race" because of distorted price signals and the general absence of price competition in medical markets (Kessler and McClellan 2000). On the other hand, competition may inhibit organizational adoption because of price competition, as price-sensitive consumers shop around for a better deal that could include a bundle of care that incorporates lower costs and potentially less innovation (Mas-Colell, Whinston, and Green 1995). Empirically, while there are no clear patterns in significance across studies, competition tends to be associated with more innovative behavior across studies in our sample when measures are significant.

Table 2
Quantitative Articles: Environmental Influences

Concept/Construct	Articles ^a
Demand	
Affluence	3, 4, 5, 20, 34, 46, 49, 52
Population medical need	3, 4, 49, 52
Size of market	30, 37, 44, 49, 50, 52
Physician supply	46, 49
Competition	
Competition	5, 8, 17, 19, 20, 26, 30, 32, 35, 36, 42, 46, 49, 50, 51, 52, 54
Regulation	
Existence and characteristics of CON program	5, 8, 26, 50
Pressures exerted by public payors and agencies	5, 8, 26, 32, 41, 46, 49, 50
Other characteristics of location	
Geographic differences in practice patterns	12, 13, 40, 42
Urbanization	3, 4, 13, 14, 20, 26, 31, 34, 40
Managed care penetration	3, 4, 33, 51, 52

a. The Appendix delineates the articles associated with each number.

Surprisingly, in the context of the literature as a whole, regulatory factors were very seldom formally incorporated into empirical models. Like competition, though, regulation is thought to both facilitate and inhibit adoption, depending on the context. Programs such as certificates of need (CONs) as well as stringent payment systems (e.g., prospective payment) are thought to decrease adoption of innovations and more so as the programs age and/or are more stringent. However, favorable reimbursement can create powerful incentives for adoption, and diffusion is often difficult to stop once these incentives are in place. While significance is mixed across and within studies, when measures are significant, the direction of effects is clear for quantitative studies within our sample. The existence of a CON, construction moratorium, or rate-setting program is typically associated with less innovative behavior across a wide array of innovations. Furthermore, Teplensky et al. (1995) find that greater stringency of CON and rate regulation programs is negatively associated with the likelihood of MRI adoption. In terms of qualitative studies, Dopson et al. (2002) theorize that government policy influences innovation diffusion and knowledge utilization by focusing attention and resources on certain priorities.

Finally, we note another concept we call—for lack of a better term—*other characteristics of location*. Several of the variables we included in this concept could have been included in another. However, the articles in which they were found did

not provide enough theory about the construct to enable unambiguous classification, and thus, the constructs were simply portrayed as generic, though important, characteristics of the market or health care system.¹² The general idea is that more urbanization and less managed care penetration are associated with increased adoption of high-cost technology, and different geographic locations differ in adoption for well-explored but poorly understood reasons. Across the studies we reviewed, higher managed care penetration is typically significantly associated with less innovative behavior, though across studies, we found mixed significance, and among significant variables, we found mixed directionality for urbanization.

Connectedness. Another set of adoption correlates focuses on the impact of what we call “connectedness” on adoption. Here, theorists suggest that organizational behavior, including adoption behavior, is strongly influenced by the character of its embeddedness in systems of social relations (Granovetter 1985). Researchers have explored how individual- and organization-level integration into external information environments contributes to competitive and institutional network pressures as well as information transfer through communication channels, which all may lead the organization to adopt innovations (Kimberly 1978; DiMaggio and Powell 1983; Burt 1987; Coleman, Katz, and Menzel 1966). This literature hypothesizes that various forms of social proximity and network structure facilitate the simple transfer of information, the flow of normative and institutional pressures, the ongoing interaction of competitive pressures, and the complex co-creation of socially acceptable interpretations of risk—and that these factors increase or decrease the propensity to adopt innovations.

We found two main concepts under the heading of Connectedness in the studies we reviewed, outlined in Table 3. First, 14 studies in our sample considered connections between organizations. In general, analysts believe that higher levels of each of these connections (or in the case of network position, a more central, dominant, or structurally equivalent position) facilitate adoption and that normative and institutional pressures may facilitate adoption to a greater extent for so-called late adopters than for early adopters. With a few exceptions, the empirical evidence usually bears out these predictions in our sample.¹³ Additionally, Westphal, Gulati, and Shortell (1997) provide evidence that institutional factors may moderate the role of network membership by influencing the form of an innovation that is adopted (and not just increase the propensity to adopt a predefined innovation). Two articles explored the influence of Connectedness on exnovation, or abandonment. Burns and Wholey (1993) find that normative and institutional pressures, as measured by cumulative regional proportion of hospitals discontinuing matrix management, are associated with an increased likelihood of abandonment of matrix management, while Duffy and Farley (1992) discover that system membership is associated with a decreased likelihood of abandoning intermittent positive pressure breathing. Furthermore, some recent qualitative evidence suggests that the process by which professional networks spread innovation is more

Table 3
Quantitative Articles: Connectedness

Concept/Construct	Articles ^a
Connections between organizations	
Structural links	1, 5, 8, 12, 18, 20, 51, 52, 54
Normative-institutional pressures	2, 7, 9, 20, 51, 55
Information transfer and learning	7, 20, 30
Network position and dominance	7, 55
Connections between organizational actors	
Centrality of organizational actors	6
Interaction with extra-organizational actors	2, 29, 36

a. The Appendix delineates the articles associated with each number.

complex than was previously thought. In particular, Ferlie et al. (2005) show that social and cognitive boundaries between medical professions contribute to the slow spread of innovations, particularly as professional communities of practice influence the socially constructed interpretation of evidence.

Second, much less frequent were quantitative articles that examined connections among interorganizational actors and how they relate to organization-level adoption outcomes. In particular, four articles in our sample measure network relationships that influence organizational adoption at the individual level. Here, greater interaction and centrality are hypothesized to be associated with an increased likelihood of adoption. Although significance is mixed across studies, these hypotheses are usually supported when measures are significant.

Organizational attributes. The influence of organizational attributes on adoption has been extensively investigated. This body of research examines how internal characteristics, resources, motivations, and coalitions act on organizational innovation adoption behavior. We view this category as encompassing several different classifications that have been considered in previous conceptual models, including organization structure, type of organization, organizational control processes, organizational innovativeness, system antecedents for innovation, and organizational context (e.g., Greenhalgh et al. 2004; Kaluzny 1974; Damanpour 1991; Rogers 2003). Additionally, we consider organizational strategy, and in contrast to previous models, we place the characteristics of individuals and groups within organizations underneath the Organizational Attributes umbrella. We consider the characteristics of individuals and groups to be attributes of organizations, because the measures are only meaningful given the position of the individuals and groups of individuals within the sociological structure of the organization.

Salient concepts, constructs, and studies are detailed in Table 4. The many now-familiar characteristics of organizational structure are well represented here, as they

Table 4
Quantitative Articles: Organizational Attributes

Concept/Construct	Articles ^a
Organizational structure	
Centralization	1, 24, 25, 28, 30, 35, 36, 47, 48
Formalization	1, 24, 25, 28
Functional differentiation	7, 30, 35, 36, 38, 50
Professionalism	1, 13, 28, 34, 37, 45
Specialization	29, 30, 35, 36
Complexity	1, 9, 18, 24, 25, 34
Internal communication	1, 38
Size	1, 2, 3, 4, 5, 7, 8, 9, 13, 14, 17, 18, 19, 20, 24, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 44, 45, 47, 48, 50, 51, 52, 54, 55
Age	19, 24, 26, 30, 31, 33, 39, 45
Type of organization ^b	3, 4, 5, 8, 12, 13, 14, 17, 18, 19, 20, 24, 26, 31, 32, 33, 36, 38, 40, 42, 44, 45, 46, 49, 50, 51, 52
Strategic positioning	
Market strategies	34, 50
Individuals and collectivities within organizations	
Values, attitudes, and involvement of leaders	6, 9, 17, 24, 25, 28, 30, 34, 37, 38, 43, 47, 48, 50, 55
Tenure and experience of executives	2, 6, 9, 30, 34, 45, 55
Executive educational background	6, 9, 30, 34, 45, 55
Executive age	6, 55
Resources available for innovation	
Cost position and management	41, 47, 48, 51, 54
Slack resources	1, 7, 8, 13, 18, 19, 20, 28, 37, 38, 39, 44, 47, 48, 50, 51, 52, 54
Insurance arrangements	5, 8, 12, 32, 33, 45, 46, 49, 50, 51, 52
Organizational learning, climate, and attitudes	
Learning	31, 51
Climate	24, 39, 44
Attitudes	19, 28, 43

a. The Appendix delineates the articles associated with each number.

b. Type of organization includes variables such as teaching status, control status, specialty/primary care practice, religious affiliation, and government ownership.

are in the broader organizational literature. Hypothesized effects of these variables cannot be briefly summarized, and we refer readers to reviews in the organizational literature, such as Damanpour (1991), that focus on this point and whose discussion of hypothesized effects is consistent with our particular read of the way these constructs are used in the health care literature. In general, while significance is mixed, empirical

evidence in our sample shows that, when significant, indicators of greater centralization and formalization are negatively associated with innovative behavior, and indicators of greater professionalism, internal communication, and organizational age are positively associated with innovative behavior. Indicators of greater specialization, complexity, and size are usually, with some exceptions, significantly and positively associated with innovative behavior, while measures of functional differentiation have mixed sign and significance across studies. Some studies show differentiated effects of organizational structure variables depending on the classification of the researched innovations, such as whether the focal innovations are technological or administrative (Kimberly and Evanisko 1981), are compatible or incompatible with interests of specialists or department heads (Moch and Morse 1977), or primarily entail advances in technological means or social risks (Nathanson and Morlock 1980).

Seventeen studies in our sample consider the characteristics of individuals and collectivities within organizations. In general, higher constituency involvement and support for an innovation, elite and organizational cosmopolitanism, and elite change values are believed to be associated with innovative behavior. Across studies in our review, however, these factors show no consistent effect on adoption. It seems that the association of particular correlates with innovative behavior typically depends on the combination of (1) which organizational actors (and in which combination of consensus and conflict) are differentially involved, are cosmopolitan, and hold change values; (2) the type of organization in which such combinations of involvement, attitudes, and values take place; and (3) the type of innovations that are being researched (see especially Kaluzny, Veney, and Gentry 1974; Kimberly and Evanisko 1981). While significance is mixed across studies, higher educational attainment by hospital CEOs is positively associated with innovative behavior when measures are significant. Researchers focus on both the facilitating and inhibiting influences of tenure, experience, and age on adoption. In particular, greater tenure, greater experience, and older age could mean legitimacy and knowledge of how to navigate political waters, and thus, could be positively associated with adoption. However, the same characteristics could mean that individuals are more committed to institutionalized ideas and practices, and thus, could be negatively associated with adoption. Empirically, while significance is mixed, greater tenure and experience are positively associated with innovative activity when significant. Additionally, Young, Charns, and Shortell (2001) show that having a younger CEO is significantly and positively associated with hospital adoption of TQM. Notably, many of these constructs are considered at the level of key individuals as well as at the levels of dyads and groups of individuals, and a few studies explore interactions between levels. For example, Hage and Dewar (1973) examine change values at multiple levels of the organization. Qualitative studies in our sample have particularly thorough treatments of the properties of individuals and collectivities. For example, Denis et al. (2002) emphasize the importance of the interests, values, and power distribution of the adopting system on the ultimate adoption of innovation. Greer (1985, 1986)

describes how different *decision systems*, or combinations of decision-making activity, within organizations influence adoption. Finally, among other findings, Weiner et al. (2004) show how enterprising chief information offices (CIOs) or small clinician groups, instead of senior managers, often lead adoption decision-making processes for clinical information systems in integrated delivery systems.

Many studies contemplate characteristics that affect or are indicative of the human and financial resources available for innovation. In general, organizations with more actual and expected patients with generous insurance and with more slack resources are thought to be more likely to adopt innovations, and organizations with higher costs are thought to be more likely to adopt cost-reducing technologies. The results of quantitative studies show that, while significance is mixed, greater slack is associated with more innovative behavior when measures are significant. The facility-level insurance status of patients and organizational cost structures are typically associated with adoption, though effects depend on type of innovation in predictable ways. For example, Li et al. (2004) find that a higher percentage of health maintenance organization (HMO) and point-of-service patients for whom hospital utilization management is delegated to a physician organization is associated with adoption of a greater number of organized care management processes, while Castle (2001) demonstrates that a higher percentage of private pay residents is associated with early adoption of nursing home innovations. Likewise, Walston, Kimberly, and Burns (2001) show that a higher relative cost structure is associated with an increased likelihood of adopting TQM, an innovation that holds the potential of lowering costs by streamlining operations.

Strategic positioning and its influence on adoption is an emerging theme in the literature. Research on this theme explores the explicit motivations behind innovation acquisition by probing for market strategies and organizational goals. Examples of strategies elicited and tested include local expert perceptions of the aggressiveness with which a focal hospital develops new services and penetrates new markets (Meyer and Goes 1988), the importance of being price competitive for a hospital's market development strategy (Teplensky et al. 1995), and a hospital's positioning as a technology leader (*ibid.*). This research usually suggests that market and technology strategies are significantly associated with adoption of technology.

Finally, a few articles consider diverse operationalizations of organizational climate, attitudes, and learning. Interestingly, Nystrom, Ramamurthy, and Wilson (2002) show that two climate measures—external orientation and risk orientation—significantly moderate the effect of organization size on innovativeness; external orientation also moderates the effects of age on innovativeness. In terms of attitudes, Kaluzny, Veney, and Gentry (1974) find that a hospital membership's satisfaction with the ability of the organization to meet community needs as well as the hospital's perceived community reputation are significantly and positively associated with organizational innovation adoption. Furthermore, Robertson and Wind (1983) explain the concept of *organizational cosmopolitanism* and show that the highest level of hospital innovativeness in their sample occurs when the administrative participant is "local"

Table 5
Quantitative Articles: Innovation Characteristics

Concept/Construct	Articles ^a
Benefits of innovation	
Safety and efficacy	34, 50
Technical performance	9
Value of innovation	9, 27, 41, 50
Costs of innovation	
Initial and continuing costs	27, 50
Adoption risk	27, 50
Usage characteristics	
Ease of use and communication	9, 27
Compatibility with routines	27, 34

a. The Appendix delineates the articles associated with each number.

and the professional participant (here, a radiologist) is cosmopolitan. Finally, Knudson and Roman (2004) explore the relationship between absorptive capacity and using innovative treatment techniques in substance-abuse treatment organizations. And Ferlie, FitzGerald, and Wood (2000) find that the learning and change capabilities of professional communities of practice are shaped by prior history and particular patterns of roles and relationships.

Innovation characteristics. Although undoubtedly important, research on the influence of innovation attributes on organizational adoption is surprisingly rare. In the studies that do exist, three principal concepts can be distinguished, as shown in Table 5. While their hypothesized effects are intuitive, measures of the benefits of adoption are surprisingly mixed in both sign and significance across studies. To take some examples, Cockerill, Charles, and Roberts (1999) find that in a survey of hospital CEOs and medical chiefs of staff (MCSs), rating the value and accuracy of physician impact analysis (PIA) more highly is associated with an increased likelihood of adopting PIA. Teplensky et al. (1995) show that a hospital's expectation that MRI will have a large influence on net revenues is associated with a greater likelihood of adoption. However, Teplensky et al. also find that perceptions of efficacy are not associated with adoption of MRI. Furthermore, Kaluzny and Veney (1973) demonstrate, paradoxically, that higher rates of cost recovery are negatively associated with innovativeness in hospitals and health departments.

Additionally, though it is intuitive that costs of innovations are important to organizations, they appear to be less important to health services researchers examining the organizational adoption of innovation. Two types of costs are examined in our sample—aggregate costs in the health care system and organizational investment costs.

While several studies talked about understanding how to inhibit aggregate cost inflation appropriately as an important rationale for pursuing adoption research, only two studies examined whether higher organizational investment costs were associated with decreased adoption of innovation (Teplensky et al. 1995; Kaluzny and Veney 1973). Teplensky et al. find that the cost of site preparation is significantly and negatively associated with the odds of MRI adoption, while the cost of the MRI unit itself was not significantly associated with adoption likelihood. Kaluzny and Veney find that higher continuing and initial costs are significantly negatively and positively associated with innovativeness in hospitals, respectively; neither of these types of costs is significantly associated with innovativeness in health departments.

Finally, we found that usage characteristics are a concept sometimes considered to be associated with adoption. In one study, an innovation's close association with the major activities of the organization was shown to be significantly and positively associated with hospital and health department innovativeness (Kaluzny and Veney 1973); these authors also find that requiring fewer changes in the overall characteristics of the hospital is significantly and positively associated with likelihood of adoption. Conversely, Cockerill, Charles, and Roberts (1999) report that ease of use, as perceived by hospital CEOs and MCSs, is not significantly associated with adoption of PIA.

Several qualitative studies provide noteworthy insights about innovation characteristics. In particular, Denis et al. (2002, 69) describe the "fluid and negotiable boundaries of innovations." Specifically, many innovations seem to exhibit a hard core that is relatively fixed and a soft periphery that is related to how an organization might implement an innovation (which feeds into the adoption decision). Diffusion entails negotiation of meaning in the soft periphery, and this enables a variety of pathways to innovation adoption. Additionally, Weiner et al. (2004) highlight the importance of compatibility, vendor support, and vendor stability in the adoption of clinical information systems by integrated delivery systems.

Discussion and Recommendations

Because health care provider organizations are significant investors in medical innovations, understanding the factors that inhibit or facilitate adoption, create equitable adoption, and promote appropriate disengagement in these organizations is important to ensuring that policy makers can enhance the appropriate system-level diffusion of innovations. Yet, while our framework shows that a wide variety of correlates has been explored, we found that some factors have been explored more fully and in more appropriate ways than others, and analyses investigate adoption often to the exclusion of issues of equity and disengagement. Furthermore, we found systemic problems in research design and theory, which may call into question findings for both individual studies and aggregated results in this literature.

The implication is that despite much effort, we still do not know as much as we would like, and what we do know, we may not know for sure. A stunning variety of correlates of innovation has been explored, as shown in Tables 2, 3, 4, and 5, and these tables reveal that some areas have been explored much more frequently than others. Furthermore, even for some well-researched concepts and constructs, theoretical development is weak or nonexistent. We have no widely accepted theory of innovation adoption in organizations, and this along with other empirical problems frustrates our efforts to make sense of the empirical results. Also, the complexity of the adoption of innovations is rarely appreciated in the theoretical models that do exist, and studies of interactions between constructs at similar and different levels of analysis are rare though essential to our understanding of the phenomenon. As for disengagement, we have only begun to explore theoretical models in any form.

And what we do know, we may not know for sure. Several authors claim that inconsistent findings are common in the organizational literature on the adoption and diffusion of innovations (e.g., Downs and Mohr 1976; Rogers 2003), and as one author concludes, one of the most consistent themes in this literature is that research results have been inconsistent (Wolfe 1994). Yet, while the claim is widespread, few empirical studies and conceptual articles empirically examine it (the meta-analytic study by Damanpour [1991] is a notable exception). To our knowledge, no studies have examined the consistency of research findings in the specific context of the literature on the adoption and diffusion of innovations in health care provider organizations empirically, and our review attempts to remedy this deficiency. Our detailed analysis of previous research reveals that unstable findings are widespread. Specifically, we found few constructs that exhibited both consistent significance and a uniform direction across studies; those that do are almost exclusively found in one category of correlates (Connectedness). These observed inconsistencies frustrate our ability to accumulate knowledge, and consequently, to specify with confidence the implications of research for policy regarding the diffusion of innovations in health care.

We believe that an agenda for future research on the adoption of and disengagement from innovations in health care provider organizations must address these issues. Across the studies in our review, we found issues relating to both theory and research design that systematically hinder our ability to draw inferences in single studies, accumulate knowledge across studies, and/or understand the full complexity of the adoption phenomenon, and we organize our agenda around the most important of these issues. Specifically, with respect to theory, we believe future researchers need to reconsider (1) typologies of innovation; (2) the scope of theoretical models; (3) disengagement from innovation; and (4) theoretical lacunae. Regarding research design, we believe future research needs to (1) enhance the conceptualization and measurement of constructs; (2) use longitudinal research designs; (3) sample a more comprehensive set of health care provider organizations; and (4) examine how organizations gain access to innovations. Many of the theory issues are related to research design and to each other and vice versa, and we discuss these relationships separately below.

Reconsidering Theory

Typologies of Innovation

Early research on the adoption and diffusion of innovation in organizations followed an established literature on the adoption of innovations by individuals (Rogers 2003). However, early research exhibited dramatically inconsistent findings, and several authors posited that one way of accounting for empirical instability was to abandon the search for a unitary theory of innovation, and instead, build a general theory of innovation organized around distinct types of innovation, the adoption of which could be explained by different, discrete theories (Downs and Mohr 1976). Essentially, the reasoning was that different types of innovation may involve different decision-making processes, and hence, have different underlying reasons for adoption (thus, grouping them together would cause empirical instability). These distinct reasons or theories along with the underlying innovation typology could be aggregated into a meta-theory of innovation adoption in organizations.

In the literature on the adoption of innovations by health care provider organizations, several innovation typologies can be found. The most prevalent is the administrative/technological innovation typology. Definitions of administrative and technological innovation are rooted in the idea that administrative and production processes involve different decision-making systems and serve different functions in an organization (Daft 1978; Evan 1966), and different functions and decision-making systems may imply different processes of adoption (Kimberly and Evanisko 1981). Most often, in single-innovation studies in the sample that uses this typology, authors classify focal innovations as either technological or administrative, and thus, as contributing to that stream of research (taking the decision-system rationale as implicit). Another typology used is Greer's hospital decision systems, in which innovations fall into one of three decision systems: medical-individualistic, fiscal-managerial, and strategic-institutional (Greer 1984, 1985, 1986). Certainly, there are others. Many studies in the sample, however, use no typology of innovation.

The underlying logic behind innovation typologies is still sound, and multiple-innovation studies using an innovation typology or single-innovation studies relating the studied innovation to a typology are to be lauded. There is an astounding number and variety of innovations in health care, and it is presumptuous to believe that a unitary theory could explain the adoption of them all. In fact, we were surprised by the variety of innovations considered in our review sample. In the 55 studies in our review, 225 unique innovations were considered (including duplicate innovations, 312 innovations). A few studies that are otherwise sound do not disclose or even circumscribe the set of innovations studied (e.g., Hage and Aiken 1967), so this is a conservative count. The innovations considered range from art therapy to matrix management, from a program to assist families with legal problems to neonatal intensive care units, from corporate restructuring to including fathers in the delivery

room.¹⁴ Aggregating correlates of adoption for innovations so vastly different will surely yield inconsistent findings. Clearly, a widely used, appropriate innovation typology would help us to aggregate results (Wolfe 1994).¹⁵

However, we believe that our traditional typologies are not adequate for this purpose and that it may be time to develop a new typology of health care innovations. Under fee-for-service medicine, decision systems may have been relatively clear-cut along functional lines such as technological or administrative or along the lines of Greer's decision systems. Yet, we believe that increasing environmental turbulence and resource constraints have forced health care provider organizations to make tough decisions, often across traditional decision-making boundaries. Dependence among the fiscal and medical (or administrative and technological) arms of a health care provider organization is likely (Greer 1985), and as a typology is meant to make differential predictions based on clearly delineated categories, this is problematic for classifying innovations based on these attributes. The upshot is that current decision systems activated by innovations are likely to be more complex than previously found in health care organizations, and hence, require revised innovation typologies to account for them.

Constructing an innovation typology is beyond the scope of this review; we believe the complexity of the task requires a separate theorizing effort. However, we briefly note a few considerations for researchers interested in constructing a typology. First, it would be useful to draw on the discussion of primary and secondary attributes of innovation by Downs and Mohr (1976); the use of primary and secondary attributes will influence the character and use of an innovation typology. Additionally, it would be useful to think about organizational decision-making research and the unique and complex authority structures and political dynamics found in health care in constructing such a typology. Currently, the preponderance of adoption and diffusion research, and particularly those studies on health care provider organizations, either do not contemplate this research or do so superficially. In particular, researchers contemplating an innovation typology should consider multiple decision-making perspectives including bounded rationality models, politics and power models, and garbage can models (e.g., Cyert and March 1963; Salancik and Pfeffer 1974; Cohen, March, and Olsen 1972; Eisenhardt and Zbaracki 1992) and their many subsequent enhancements and advances. Salient aspects of authority structures and political dynamics are discussed below.

Also, as noted above, our theoretical development in the adoption of innovations by health care provider organizations is weak. An innovation typology grounded in organizational decision-making theory in health care provider organizations (discovered through grounded theory and/or adapted from organization theory to this setting) could and should serve as the foundation for further theory-building efforts. We envision a middle range theory of innovation specific to health care organizations and organized around distinct types of innovation that could be eventually consolidated into a larger meta-theory of innovation adoption in organizations.

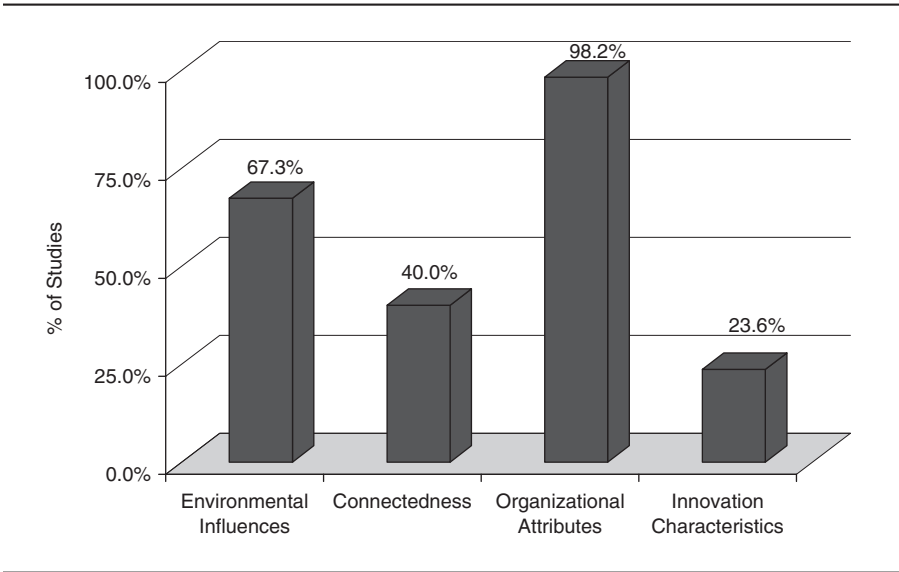
Finally, we note that despite the number and variety of innovations we describe above, there are still some types of innovations that are not represented or are under-represented in research. A full range of innovations should be considered in developing a new innovation typology so that the typology will be as complete and unbiased as possible. Furthermore, this full range of innovations should be considered in developing the middle range theory around the innovation typology. In particular, cumulative research thus far has clustered around innovations that are relatively costly, high profile, technological in character, and likely to be found in a hospital setting. Those interested in building an innovation typology should, in addition to the innovations explored thus far, examine new technologies that are relatively less costly and lower profile and that impinge on managerial work, as well as a complete array of technologies found in a variety of settings.

The Scope of Theoretical and Empirical Models

Because of our focus on coding theoretical constructs, we were able to assess some aggregate-level, quantitative characteristics of the scope of theoretical and empirical models. In brief, researchers have only begun to explore the full breadth, depth, and complexity of adoption models in health care provider organizations. We present some salient findings below and then assess the implications of those characteristics for a middle range theory of innovation adoption.

First, we found substantial variation between and within categories in terms of the amount of empirical research attention to theoretical categories, concepts, and constructs. In particular, Figure 2 details the percentage of articles in our review that explore each major category in our framework. Organizational Attributes has been the most examined category of research; more than 98 percent of quantitative and qualitative pieces examine at least some attribute of the organization that is adopting the innovation or innovations being studied. Innovation Characteristics has been the least examined category; less than 24 percent of all empirical articles examine aspects of this category, and the number decreases to about 11 percent when examining quantitative pieces only. Importantly, there is also a high level of variation within the four major categories in terms of the amount of research that has been undertaken. Specifically, the lists of studies in Tables 2 through 5 illustrate the amount of quantitative research on each concept and group of constructs. We see that quantitative research has focused on some concepts to the exclusion of others. For example, very few studies examine the influence of the benefits of innovation on organizational adoption, whereas measures of organizational structure are almost ubiquitous. Further down, at the construct-group level, we found (for example) that many studies include size and competition as constructs, but few include internal communication or regulation as constructs. At the variable level (not shown), we found a plethora of diverse measures between studies for some constructs (such as slack resources) and very few for others (such as managed care penetration).

Figure 2
Amount of Research in Categories



Second, we found that many studies explored the major theoretical categories of research in total or near total isolation. Thus, the relative contribution of different categories to the likelihood of adoption and the importance of potential linkages between categories were impossible to ascertain. Specifically, Figure 3 details the cumulative number of qualitative and quantitative studies that examine at least one construct in more than one, two, or three research categories in their empirical model. By definition, all studies examine constructs in at least one category. However, only 21 studies (8 qualitative, 13 quantitative) analyze at least one construct in more than two categories, and only 5 studies look at all four categories. All of the five comprehensive studies were qualitative. The qualitative studies in our sample typically explored a wider array of independent variables compared with quantitative studies, though the set is still not comprehensive. Furthermore, qualitative studies typically explore theoretical and empirical interactions between types of influences at multiple levels, whereas only a handful of quantitative studies explore theoretically or empirically driven interactions between types of influences at any level. In a sense, this may be a result of methods; qualitative methods are well suited to exploring the messy terrain of multilevel theoretical and empirical interactions, particularly since little is known about how various correlates interact in adoption research.

Third, there is a time component to this issue. Figure 4 illustrates the time distribution of the average number of theoretical categories considered in research studies. We

Figure 3
Scope of Cross-category Research

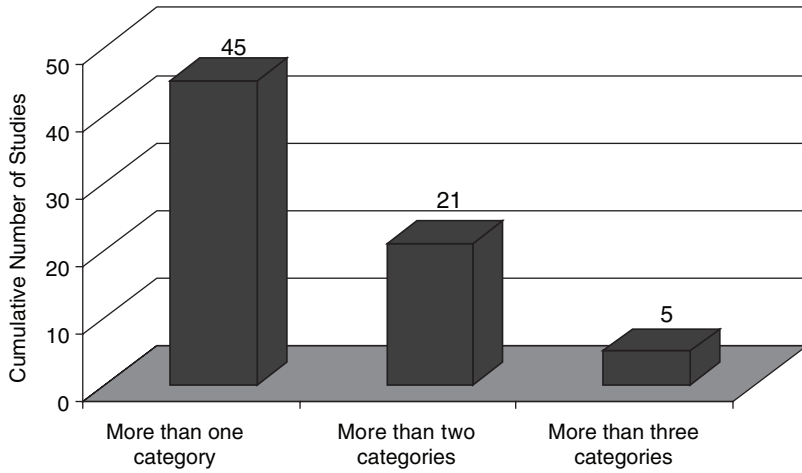
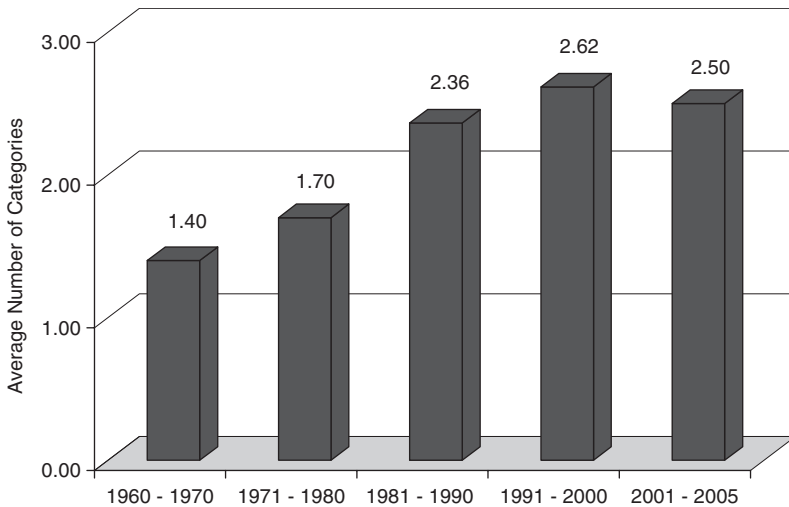


Figure 4
Distribution of Average Number of Categories Considered



found that earlier studies examine fewer conceptual categories. The average number of research categories considered for studies published between 1971 and 1980 is 1.70. However, there was a surge of studies considering more and more categories within the 1990s, with an average of 2.62 areas considered, though there has been somewhat of a pullback since 2001. The results are qualitatively similar for separate analyses of quantitative and qualitative empirical studies (though no pullback has occurred for qualitative research).

Examining the adoption and diffusion of organizational innovation in health care is a complex problem, and thus, it is unfortunate that so few studies have taken this complexity into account. We believe that some correlates in all categories are important and will continue to be so in a middle range theory of adoption based on organizational decision making. Considering only one or two major theoretical categories or a small number of concepts/constructs within each theoretical category—or both—leaves the analyst with incomplete theoretical and empirical models. The relative contribution of different categories to the likelihood of adoption is impossible to ascertain. Additionally, it can also result in missed opportunities in leveraging the theoretical and empirical interactions between and within categories, concepts, and constructs. Specifically, several qualitative and selected quantitative studies have hinted at complex theoretical linkages between major categories of research. For example, Denis et al. (2002, 66) suggest that “the more the pattern of benefits and risks surrounding the innovation maps onto the power distribution of interests, values, and power of the actors in the adopting system, the easier it is to create a coalition for adoption and the faster the adoption process.” This implies an interaction between an Organizational Attribute concept (specifically, characteristics of individuals and collectivities within organizations) and Innovation Characteristics. To the extent that we are not capturing these complex interactions, we are missing an important source of theoretical and empirical variation. Furthermore, to the extent that excluded constructs are both correlates of adoption and correlated with included constructs, omitted variables bias results. This is likely in many cases, particularly within category. Thus, including a wide array of constructs and capturing complex theoretical linkages in empirical interactions could help us identify deeper reasons for adoption and potentially untangle conflicting research findings (Greenhalgh et al. 2004; Damanpour 1991).

Although the inclusion of constructs and the linkages and relationships between categories, concepts, and constructs may change in future theory-building in the decision systems paradigm, as the underlying reasons for action are more completely understood, complexity will be present and will have to be taken into account. We believe that while articles exploring individual conceptual categories have improved our understanding of adoption correlates, we would be better served by focusing our efforts on examining multiple antecedents of adoption (both between and within major research categories and between levels of analysis) and exploring the theoretical linkages and empirical interactions between research categories, concepts, and constructs, all in the context of a middle range theory based on the decision systems

paradigm. This will require constructing both more complete single-level models and more complex multilevel models of organizational adoption (Klein and Kozlowski 2000). Some examples of studies in our sample that examine multiple types of adoption correlates include Kimberly and Evanisko (1981), Banaszak-Holl, Zinn, and Mor (1996), and Ferlie, FitzGerald, and Wood (2000). Studies that explore interactions between categories are few, but some examples include Denis et al. (2002) and Walston, Kimberly, and Burns (2001).

Based on our review, it appears that there is at least a trend toward examining different kinds of correlates in adoption models. We hope that this trend continues and deepens as a stronger theoretical base is developed and that the evolution toward appreciating complexity begins. We believe that the current trend toward more interdisciplinary research, being encouraged by both funding agencies and selected academic initiatives, will hasten this evolution.¹⁶

Disengagement from Innovation

In our sample, we continue to find the pro-innovation bias that has been observed in previous studies (Kimberly 1981). However, we believe the manifestation of the bias is different in current research. In particular, while many researchers now explicitly realize that not all innovation is good, we believe an implicit bias directs the subject of studies away from topics such as why, how, and under what conditions organizations disengage from innovations previously adopted and directs it toward what influences adoption. In fact, there is a striking imbalance between studies examining organizational adoption and studies examining disengagement. One form of disengagement is the discontinued use of innovation without the adoption of replacement innovation. We only found two studies in our review that considered this type of disengagement (Duffy and Farley 1992; Burns and Wholey 1993). Additional research is extremely important because the continued use of ineffective, less effective, or harmful innovations can be detrimental to quality of care, unnecessarily increase system costs, and/or ironically create access problems for disadvantaged patient populations. As an example of the latter, research shows that discontinued use of intermittent positive pressure breathing, which was shown in numerous journal articles to have limited therapeutic benefit, was less likely in public safety net hospitals and other resource-constrained facilities (Duffy and Farley 1992). We believe it is possible that inappropriately retaining innovations may create a "reverse access" problem in which disadvantaged patient populations have more access to ineffective, less effective, and harmful innovations than the population at large—and this clearly warrants research. A second form of disengagement—substitution—occurs when one innovation replaces another, and we found only one study in our review that considered this dimension (Eisenberg et al. 1989). Evidence suggests that substitution in health care takes a great deal of time to occur (if it occurs at all) and is often preceded by treatment expansion, co-diffusion of technologies, and complementarity (Cutler and Huckman 2003). Eisenberg et al.

(1989) find that new diagnostic services generally complement rather than replace older tests. Understanding the process and conditions under which organizations disengage from innovations they have previously adopted is just as important, in our view, to solving cost, quality, and access issues as understanding the factors influencing the adoption of innovations.

Some Theoretical Lacunae

Part of appreciating complexity in adoption models is appreciating the targeted areas from which future research should benefit. Thus, we present some theoretical areas that we believe are conspicuously absent or incompletely explored in current research and that should be considered in future theory-building efforts.

Environmental influences. Although we found that many studies consider environmental influences (see Table 2), we see a number of gaps that need to be filled. First, most studies concentrate on market structure and demand-side forces. Supply-side forces, such as marketing by manufacturers, and the influence of professional associations, such as the introduction of guidelines by specialty associations, are rarely considered in the organizational setting. Yet, they are either important in the aggregate (e.g., marketing—see Berndt et al. 1995) or are salient tools of organizational decision makers (e.g., guidelines).¹⁶ Second, very few studies explore more than one or two concepts, or multiple aspects of a concept, at a time. Thus, we understand comparatively little about the relative effects and interactions of different environmental influences. This is surprising, particularly given the salience of regulation, competition, demand, and location differences in policy debates. The problem appears to be particularly acute with respect to regulation, as only a handful of studies in our sample include regulatory factors in their analyses.

Connectedness. We believe that existing research demonstrates the importance of connections among adopting organizations as a facilitator of adoption. However, since only a small number of articles explore these connections, additional validation studies are needed. In addition, researchers should begin to model (1) how individuals within networks contribute to organization-level decision making; and (2) how an increasingly diverse array of network forms in health care contribute to the adoption of innovations. Most organization theory acknowledges that social construction by a network of organizational actors is the link between the actions of particular organizations and the collective structure that results (Davis and Greve 1997). In other words, it is connections between people within organizations and not organizations themselves that constitute the link between organizational action and diffusion patterns. Yet, few studies explicitly measure connections at the level of the organizational actor; they instead take the organization as the unit of network analysis (ibid.). Future research should focus on exploring patterns in individual-level network connections and how

they relate to organizational adoption. As organizational connections, particularly of a nonstructural variety, are essentially higher level constructs that emerge from the perceptions and cognitions of lower level actors, this research should be careful to provide theoretical explanations of how organizational connectedness emerges from these perceptions and cognitions (Klein and Kozlowski 2000).

Second, the boundaries of provider organizations have blurred in recent years as extensive vertical, virtual, and horizontal integration has taken place to create a diverse array of new organizational entities (e.g., physician-hospital organizations, multihospital systems, and physician specialty groups; Alexander et al. 1996; Bazzoli et al. 2001). Yet, with very few exceptions (e.g., Goes and Park 1997), research on the adoption of innovations by provider organizations has not kept up with these developments, and besides occasional mention of hospital system membership as a control variable, the influence of various types of organizational linkages on the adoption of innovations is rarely considered. Future research should examine how recent experimentation in organizational form may have shaped the pattern of innovation diffusion.

Organizational attributes. There is an abundance of research in this area, and we recommend that the direction of research be shifted into new, more subtle dimensions. Specifically, future research might profitably focus on (1) examining the impact of complex authority structures, political dynamics, and conflict/consensus within an organization on organizational adoption of innovation; and (2) exploring the strategic significance of innovation adoption and/or disengagement.

With respect to the first point, March and Simon (1958, 2) argued that the “conversion of conflict into cooperation, the mobilization of resources, and the coordination of effort” are key to understanding organizational behavior in general, and we believe this to apply particularly well in provider organizations where innovation is concerned. Because of the often divergent interests between management and the medical staff and because the medical staff itself is composed of a variety of professional groups—each a community of practice with its own extraorganizational cultures, agendas, and questions (Ferlie et al. 2005)—we can expect the usual conflicts around mobilization of resources and coordination of effort, and hence, around innovation, to be intensified.

In addition, the already complex organizational structures in health care have changed quite dramatically in recent years, further complicating authority relationships, political dynamics, and conflict/consensus. For example, in the 1980s and 1990s, physicians became increasingly linked financially to provider organizations; while some of these relationships have begun to dissolve, particularly salaried relationships, others have remained—and new ones have emerged, such as physician interests in specialty hospitals and outpatient surgery centers (Burns and Thorpe 1993; Government Accountability Office 2003). These changes have undoubtedly altered physician involvement in organizational decision making, particularly around innovation.

More generally, considerable variation in authority relationships and governance structures now exists, and these structures define organizational objectives at multiple levels and exhibit varying degrees of integration (Fennell and Alexander 1993; Burns et al. 2001). As more health care organizations combine into horizontal, vertical, and virtual relationships, the likelihood of interprofessional and intraprofessional conflict is increased (Fennel and Alexander 1993), and this has surely complicated organizational decision making and the adoption of innovations in provider organizations.

Despite the importance of these issues, the quantitative studies we reviewed were largely inattentive to them. However, a number of qualitative studies have been able to gain theoretical purchase on some of them (see especially Ferlie et al. 2005; Denis et al. 2002; Greer 1984, 1985, 1986; Weiner et al. 2004). We believe that there is room for both types of research to continue to make contributions. Future studies should focus on multilevel research that looks at the diverse values, norms, and interests of physicians, physician specialties and associations, and management as well as the incentives and authority relationships embedded into various governance structures and should aggregate them into organizational adoption behavior. In particular, we see Robertson and Wind (1980, 1983) as exemplars of how to begin to examine interactions and agreement among organizational actors quantitatively; their 1980 study, for example, uses survey research to measure the impact of different types of organizational consensus and conflict on innovativeness. Using this type of research, we can begin to examine the behavior of organizational members and constituencies within various governance structures and how they aggregate into organizational adoption and disengagement.

With regard to the second point, innovations often represent important investment opportunities for individual provider organizations in competitive and uncertain environments. Innovations, along with their consequent implementation and management, are key resources for the health care provider organization. Furthermore, organizational investment in a particular portfolio of innovations and their associated routines can lead to competitive advantage. We believe that future research should explore the strategic significance of innovation to provider organizations.

Innovation characteristics. Rogers (2003) notes that there is very little research on the characteristics of innovations. We found that innovation characteristics were rarely considered in the literature on organizational adoption of innovation by provider organizations. More research on how innovation characteristics may either enhance or impede diffusion would be most helpful. Finally, very little research focuses on how demonstrated efficacy may influence the adoption of innovations in organizations. Some research suggests that organizations may adopt innovations *before* there is evidence that they actually produce their intended effects, particularly in health care, where the impact of medical innovation on patients is sometimes ambiguous (Ramsey et al. 1993). Thus, research should focus on the role of evidence in adoption decisions as well as on how emerging evidence influences disengagement.

Reconsidering Research Design

Enhance the Conceptualization and Measurement of Constructs

We believe that the conceptualization and measurement of constructs is a serious concern in the organizational adoption literature, and this concern extends to the research on health care organizations. We would like to highlight two classes of construct validity problems: (1) the fluidity of construct and variable definitions; and (2) the operationalization of different constructs with the same variable across studies.

First, we found that the definition of a construct was often not clearly specified, resulting in confusion about exactly what theoretical conceptualization was being measured. This also results in unclear aggregate conceptualizations of the mechanisms that drive adoption. We will be less able to influence policy if we do not understand the mechanisms by which measures operate on behavior. The problem is particularly serious in a multidisciplinary field that already has cognitive, disciplinary, and professional boundaries that researchers must overcome. We advocate increased attention to construct definition in future studies.

Second, we found that across some studies by different authors, the same variables were used as measures of several different constructs, and thus, findings for a particular variable could be associated with a number of different theories about the mechanism of adoption and diffusion. For example, in our sample, *medical school affiliation* was used as a measure of four different constructs within Organizational Attributes—functional diversity, complexity, high degree of information flow (e.g., internal communication), and type of organization. The problem reaches across categories as well, as some variables are used as measures of constructs in multiple categories. The problem becomes serious in aggregation and reduces the comparability between studies. Given that this is a multidisciplinary review, we were conscious of and interested in differences among disciplines in the conceptualization of problems. We found that some, though certainly not all, of this issue stems from differences in disciplinary conceptualizations of phenomena. This could be an unacknowledged risk of multidisciplinary research and warrants further consideration.

The implication is that construct validity is threatened, and operationalizations of constructs may be subject to measurement error. The problem of measurement error, in particular, becomes serious when considering the implications of measurement error on statistical power (Boyd, Gove, and Hitt 2005; Greene 2000). Specifically, statistical power declines with the magnitude of measurement error, and small deviations in measurement accuracy can result in considerable decreases in power. Thus, the measurement error found in poor operationalizations will decrease the chance that an existing relationship will be successfully detected. The potential of widespread measurement error in the literature has nontrivial consequences. In particular, the inconsistency in research findings has been a defining theme in adoption and diffusion research. We suggest that some of the observed inconsistencies may be an

artifact of measurement error. This has been found in controversies in other organizational disciplines (Boyd, Gove, and Hitt 2005). The exploration of how measurement error may contribute to the inconsistency in adoption and diffusion research findings should be a fruitful area for future research.

Use Longitudinal Research Designs

Longitudinal designs should be used in innovation adoption research because of the theoretical and empirical limitations of cross-sectional approaches, particularly prevalent in the study of diffusion (Kimberly 1976; Kaluzny 1974). In particular, longitudinal research (1) facilitates attempts to establish causality; (2) can minimize the problems encountered when a process is inferred from cross-sectional data; (3) facilitates the development of models of growth and change; (4) permits the analyst to take contextual constraints into account; and (5) enhances the effectiveness of various strategies for organizational intervention (Kimberly 1976).

We believe that the conduct of longitudinal research is absolutely essential for understanding a process—diffusion—that is inherently time dependent. Qualitative studies vary in the lengths of time during which they collect data, though retrospective histories of adoption and diffusion are important to most research designs. However, across the quantitative research included in our review, we found that only 15 of 47 studies use data sets with some form of time series data; furthermore, only nine studies use repeated cross-sectional, or panel, data. This distinction is important. In the former count, we consider all studies exploiting panel data (using a variety of statistical techniques) as well as all studies carrying out survival analyses. However, one can carry out survival analyses with time-invariant as well as time-variant covariates. Clearly, we classify survival analysis with time-variant covariates as longitudinal analysis; indeed, the data have a panel structure. Survival analysis with time-invariant covariates measures the dependent variable with time series data and the independent variables with cross-sectional data. Timing/ordering of events and censoring are taken into account, and this facilitates analysis of temporal phenomena. Here, causal inferences may be made—but only with respect to the *fixed* covariates. Hence, inferences may or may not be valid; some covariates are fixed (e.g., profit status), but many important covariates in the phenomena that health care diffusion research investigates often change dramatically through time (e.g., competition). For this reason, we found that using time-invariant covariates in survival analyses was often problematic.

Few studies pass the longitudinal research litmus test. Were longitudinal research more common, inconsistencies in findings across studies might be less common.

Sample a Broader Set of Health Care Provider Organizations

We also found that studies examining hospitals were much more numerous than those examining other types of provider organizations. However, research on hospitals

may not generalize to other types of provider organizations with diverse structures and incentives. But because we know so little about adoption in other types of organizations, it is tempting to assume that results from hospitals generalize to them. Furthermore, by only exploring hospital adoption of innovations, we may systematically underrepresent research on certain types of health care innovations such as care management practices in physicians organizations and pharmaceutical therapies in drug abuse treatment centers (two innovations that have been examined in recent research; see Li et al. 2004; Roman and Johnson 2002). Future research should examine innovation in a wider array of functional provider settings, including but not limited to physician group practices, mental health clinics, health departments, drug treatment organizations, outpatient renal dialysis centers, and outpatient surgery centers.

Examine How Provider Organizations Gain Access to Innovations

Many studies equate adoption with purchase, either implicitly or explicitly. However, a given organization has a wide range of possibilities for investing resources in innovation: the innovation may be purchased outright, but it may also be rented, leased, or accessed through an outsourcing or joint-venture arrangement. For example, Renshaw, Kimberly, and Schwartz (1990) find that in a quest to secure access to MRI technology, some hospitals contracted with mobile MRI units rather than purchasing or leasing scanners. What is key for us is how the organization secures access to the innovation capabilities it is seeking.

In a theoretical vein, these different approaches to accessing innovation represent different strategies for cultivating and sustaining competitive advantage. Alternatively, through the lens of institutional theory, an organization is trying to secure access to innovation for purposes of legitimation. Regardless of one's theoretical angle on the issue, we believe that the correlates that influence adoption and diffusion may vary as a function of the way in which the organization secures access (e.g., purchase versus lease versus outsource). This possibility has at least two implications. First, particularly given the increasing importance of alternate mechanisms for gaining access to innovations, we should conduct more research to understand better how the significance and magnitude of correlates vary based on adoption modality. And second, we should research how organizations choose how they want to access innovation and the implications of those choices for adoption and disengagement.

Conclusions

The direct and indirect costs of acquiring and implementing innovation are often substantial, though the potential financial benefits can be large as well. Deciding what innovations to adopt and not to adopt and whether and how to disengage from innovations previously adopted presents highly consequential financial and managerial

challenges for health care provider organizations. And in the aggregate, the consequences of these decisions have enormous implications for how well the health care system in this country performs, both in financial and clinical terms. If done well, research on the factors that influence provider organizations to adopt innovations can lead to more effective decision processes at the level of individual organizations and to more effective policy initiatives at the system level, be it state or national.

Our review of existing research on the adoption of innovation by these organizations has revealed a number of problems that need to be addressed in future research to enhance its policy relevance. As a guide for readers, we developed a scheme for classifying the studies reviewed. In addition, we have shown how gaps between measures and constructs limit our ability to draw clear implications from the research included in our data set. Furthermore, we have argued that much of the research included in our review fails to capture the complexity of the innovation decision process, a fact that further limits the conclusions that can be drawn. And finally, we have pointed out two areas, specifically, in which fresh thinking and new approaches would be particularly useful—disengagement and access. We are confident that if researchers pay more attention to the conceptual and measurement issues we identified in our review, if they take seriously the challenge of longitudinal research, if they focus on disengagement as well as adoption, and if they begin to consider the full range of options provider organizations have for gaining access to innovations, we will both know more and be surer of what we do know about the fate of innovations in health care. This knowledge will then provide the building blocks for more informed policy choices, and hence, more appropriate levels of diffusion—outcomes that would have substantial cost, quality, and access benefits.

Appendix

Reviewed Articles

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Notes

1. Given the purpose of the review, we are primarily concerned with the first problem here.
2. For an exception, see the discussion of exnovation in Kimberly (1981).
3. We thank the Penn Medical Innovation Working Group; this point emerged during our discussions.
4. Specifically, Rogers (2003) identifies five stages in the innovation process in organizations, including agenda-setting, matching, redefining/restructuring, clarifying, and routinizing. Furthermore, he describes

two higher level stages—initiation (composed of agenda-setting and matching) and implementation (composed of redefining/restructuring, clarifying, and routinizing)—that are divided by the adoption decision.

5. These literature reviews included Greenhalgh et al. (2004), Damanpour (1991), Scott (1990), Greer (1977), and Kaluzny (1974).

6. For the purposes of this review, we used the authors' judgment, as expressed in the candidate study, as a proxy of an external standard in determining whether the focal material artifact or practice was an innovation. Simply put, if the author described the focal material artifact or practice as "new" or as an "innovation," then we took his or her word for it and included the study for further consideration. By using this decision rule, we excluded some outstanding articles in which adoption of the focal practice was not described as an innovation, but rather, as an example of more general organizational change. Examples include Casalino et al. (2003), Alexander et al. (2001), Shortell et al. (2001), and Alexander and Bloom (1987).

7. Our inclusion criteria were such that a number of sometimes cited but, in our opinion, descriptive studies were excluded (e.g., Salkever and Bice 1976; Russell 1977; Banta 1980; Baker and Wheeler 1998). We also excluded some excellent articles dealing with implementation, intraorganizational adoption, and/or utilization, including Huckman (2003), Pisano, Bohmer, and Edmondson (2001), and Wilson et al. (2005).

8. Specifically, we ran into a number of situations in which it was difficult to classify variables and constructs, primarily because of (1) ambiguity about what the construct was; (2) different potential classifications of different measurements of constructs; and (3) different constructs being operationalized by the same or similar variables. The first issue is self-explanatory, and in these cases, we used our best judgment to identify and classify constructs. The second issue refers to the situation in which a construct was operationalized with multiple measures, and one or more of these measures could have been coded in categories or concepts different from the overall construct. In these cases, we coded the construct and all its measures based on the authors' description of the overall construct. Third, many of the same variables were used as measures of several different constructs, as noted in the Methods section. Sometimes, the constructs were similar (i.e., would have been placed at least within the same category), but sometimes they were quite different (i.e., would have been placed in different categories). As an example of the latter, one study measures bandwagon pressures with a survey question about competitive pressure from other hospitals adopting the same technology. Similar variables are used to measure an economic competition construct in another study. However, the former variable measures Connectedness in our conceptual model, while the latter measures Environmental Influences. The problem is not simply a coding issue; because the posited mechanisms of bandwagon pressures are different from those of economic competition, we are left with inconclusive aggregate evidence on the nature of the mechanism of action driving adoption. These issues will be further explored in the Discussion and Recommendations section.

9. These classes were as follows: significant and positive, significant and negative, significant and mixed directionality, insignificant, mixed significance within study and positive when significant, mixed significance within study and negative when significant, and mixed significance within study and mixed directionality when significant. Clearly, some categories were only useful when multiple measures of a construct were employed.

10. This process of aggregating dependent variables is logically similar to the result of other methods used in review articles (such as Delphi methods and simple description of selected study findings) in which evidence about correlates of innovation are gathered in studies using different dependent variables and/or different econometric specifications, though the issue is usually implicit. Clearly, our method lacks the precision of meta-analysis. However, meta-analysis would not have been feasible with multiple types of dependent variables and construct-level analysis. While there are trade-offs, we think that our method allows us to (1) develop a census of studies, and hence, make available and assess a greater number and broader array of research; (2) consider conflicting evidence systematically; and (3) examine construct-level findings while still enabling us to deduce patterns (or lack thereof) in the data in a structured format. Still, the reported findings should be construed as only suggestive of observed significance and directionality. We discuss this issue further in the Discussion and Recommendations section.

11. Every construct from every study does not appear in the tables; some constructs had few peers or were deemed idiosyncratic to the particular study, and thus, were excluded.

12. The notable exception is managed care penetration, which exhibited the opposite extreme—there was such a diversity of potential reasons why it might affect organizational adoption that it is best characterized as an attribute of the local market.

13. Exceptions include Goes and Park (1997), who find a significant negative relationship between contract management links and innovation adoption in California hospitals, and Arndt and Bigelow (1995), who find that the cumulative rate of adoption of corporate restructuring among Massachusetts hospitals was significantly and negatively related to adoption of corporate restructuring by hospitals who had not yet adopted.

14. A full list of innovations is available on request from the authors; it is not presented here for considerations of space.

15. We tried to break out results based on product/process and technological/administrative categories, but some studies in our sample used innovativeness scores that included different types of innovations in the single score, and furthermore, some studies did not disclose or circumscribe the set of innovations studied. Thus, it was not feasible to break out results. Furthermore, only 12 studies examined administrative innovations, and combined with the uneven consideration of constructs between studies, the number of studies examining many constructs for administrative innovations was too small. Finally, we believe that traditional typologies might be outdated, and hence, it may be inappropriate to group innovations using these typologies. Please see the following discussion.

16. More specifically, we could imagine a number of directions for this future research. Considering multiple content areas is relatively straightforward. However, exploring linkages and interactions is more complex. It would be impractical to delineate the hundreds of potentially useful combinations, but it is possible to give examples. A prominent example is the fit of an innovation with the power distribution of an adopting system, as noted above (e.g., Denis et al. 2002). This theory could be empirically examined in a quantitative model as well. Also, for example, one might theoretically and empirically examine whether organizations with certain structural attributes in more or less connected networks adopt fewer or greater numbers of innovations. Highly connected organizations with a functionally differentiated structure, for example, should theoretically be a hotbed for information flow. Does this situation create positive conditions for adoption, or might there be a point at which too much information flow creates intraorganizational confusion, and hence, diminishes adoption potential? How do structural attributes and network concentration further interact with coalitions of actors and innovation characteristics? Does agreement between coalitions of important actors mediate the impetus for adoption in an information-rich environment? Do innovation characteristics matter in this context? These are but a few of the myriad important issues regarding enhanced theoretical and empirical linkages among correlates that can and should be investigated.

17. Clearly, there is a large literature taking the physician as the unit of analysis that examines the impact of guidelines on the adoption decision. However, guidelines are rarely considered in studies taking the organization as the unit of analysis.

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