

Adopting Immunization Recommendations: A New Dissemination Model

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Objective: This paper presents a new approach for understanding factors related to physician adoption of clinical guidelines, using children's vaccine recommendations as a case study. **Methods:** The model traces sequential steps, from awareness to agreement to adoption and, finally, adherence to the guideline. Movement through these stages can be catalyzed or retarded by many influences, grouped into two major categories: environmental characteristics of the physician's practice, and information characteristics of the guideline. Environmental characteristics include sociocultural factors, professional characteristics, and practice organization factors. Information characteristics include the guideline's relative advantage, complexity, and compatibility with existing guidelines and protocols, as well as mechanisms of guideline dissemination. **Implications:** This model can be used to identify characteristics that will likely impede or facilitate guideline adoption, and to focus dissemination efforts on key issues.

KEY WORDS: immunization; guidelines; dissemination; recommendations.

INTRODUCTION

There are many reasons that U.S. children do not receive their immunizations at the appropriate ages, including difficulties with access to care. However, even when children successfully gain access, health care providers frequently fail to offer and provide immunizations (1, 2). To deal specifically with this problem, the *Healthy People 2000* report set as a goal to "increase to at least 90% the proportion of primary care providers who . . . offer immunizations as appropriate to their patients" (3).

The most publicized issues related to provider

immunization practice involve inappropriate contraindications and missed opportunities for immunization. Often overlooked is the question of whether physicians who care for children understand and follow immunization recommendations.

In all areas of medicine, the number of clinical practice guidelines put forth has increased substantially in recent years. Yet relatively little attention has been paid to the issue of how to disseminate clinical practice guidelines to influence patient care most effectively. Unfortunately, the work published to date has had little impact improving dissemination methods (4). As a result, many guidelines remain unfamiliar to physicians and have little effect on clinical practice (5, 6). In this paper, we apply the case of children's vaccine recommendations to a new paradigm for understanding the factors related to physician adoption of clinical guidelines. We believe examination of this case not only illustrates some of the recurrent concerns that are relevant to the formulation and implementation of clinical policies in a variety of settings and clinical domains, but also serves

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as an ideal vehicle to enrich our theoretical understanding of the processes underlying guideline diffusion.

UNDERSTANDING GUIDELINE DISSEMINATION

There are five reasons why immunization recommendations provide such an important test case for understanding guideline dissemination:

1. Until fairly recently, there had been a long period during which a uniform, universal immunization schedule was in place and thought to be generally accepted by most physicians. Since physician practice rarely changes in this arena in the absence of a new guideline, changes can be assessed from a period of relative stability and temporally associated with the introduction or modification of specific guidelines.
2. Considered in the context of other preventive services delivered by physicians, immunization is a "medicalized" procedure unlike, for example, dietary counseling and behavioral counseling, which have a more significant psychosocial orientation. Physicians are consistently and broadly trained to give vaccines—a maneuver that is relatively simple and clearly considered a typical part of medical practice.
3. The administration of children's vaccines is a relatively discrete, unambiguous activity that generally is documented in the ambulatory care medical record, unlike many preventive services. One of the sequelae of the concern with liability over vaccines is that the administration (or non administration) of a vaccine leaves a paper trail.
4. Generally, immunization recommendations are universal or, occasionally, limited to specific geographic areas where epidemics have occurred. Because contraindications for vaccine administration are few and usually are experienced temporarily, it is relatively easy to determine which immunizations should be given at a certain age compared to more complex contraindications for many other procedures.
5. Finally, immunization delivery is being incorporated into regimens designed to assess of the quality of care delivered by physicians,

and to rate the effectiveness of health care plans. Yet the administrative complexities and practical challenges involved in the measurement of this apparently straightforward indicator poses important challenges to efforts aimed at assessing more complex indicators.

Despite the importance of studying the dissemination of immunization recommendations to physicians, little is known about this process or the determinants of recommendation adoption and adherence. Traditionally, physician agreement and adoption of new immunization recommendations was taken for granted by medical societies and public health officials. However, recent studies demonstrating variation in awareness and adoption of new immunization recommendations for Hib and hepatitis B vaccines emphasize that adoption can no longer be assumed to occur uniformly (7–11).

Each new or revised immunization recommendation increases the complexity of immunization delivery and requires a change in practice behavior. Moreover, the process of disseminating and cultivating compliance with new immunization recommendations has been compounded by the existence of several confusing, competing, and sometimes contradictory vaccine administration schedules issued by different professional and public health bodies. To correct these inconsistencies, uniform immunization schedules have been released as a joint effort of the Advisory Committee on Immunization Practices (ACIP), the Centers for Disease Control and Prevention, the American Academy of Pediatrics, and the American Academy of Family Physicians (12). However, the initial approval of new recommendations still is not coordinated, as evidenced by recent experience with varicella vaccine and injectable polio vaccine. There continue to be periods of uncertainty for providers in which ACIP recommendations do not match those of their own professional association.

A CONCEPTUAL MODEL OF GUIDELINE ADOPTION AND ADHERENCE

To provide a framework for research into the determinants of immunization guideline adherence for the individual practitioner, we constructed and tested (13) a conceptual model of this process (Fig. 1). Since that time, we have developed a greater understanding of the complexity, variety, and interre-

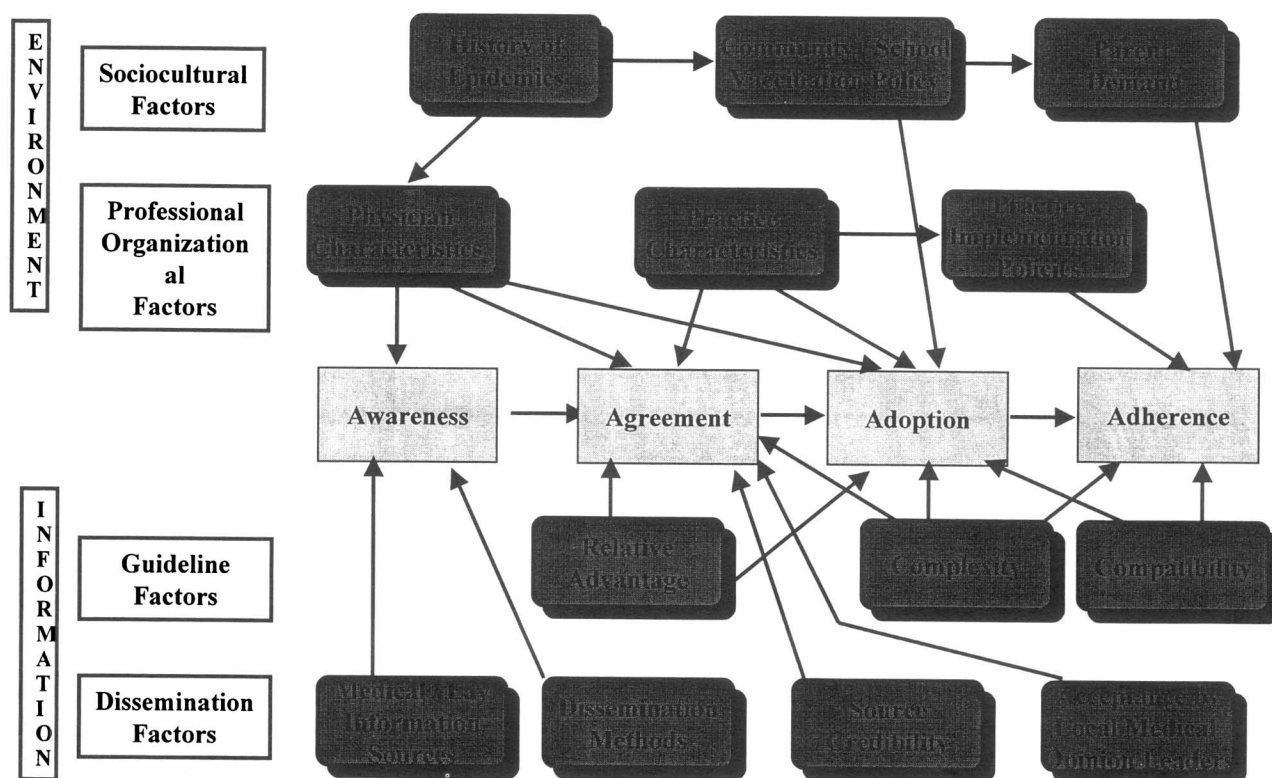


Fig. 1. Model of the immunization recommendation implementation process.

relationships of the variables affecting each stage of the process. We have performed additional studies exploring further the impact of parental factors (14), policy changes (15, 16), and legal issues (17, 18) on the adoption and adherence to immunization recommendations. The model presented here is now more complete in its demonstration of the process and its determinants with sequential stages from preawareness through implementation and adherence. According to the theoretical base of the model, movement through each stage in the process can be catalyzed or retarded by such factors as physician characteristics (19–21), practice organization (22, 23), practice environment (24), and characteristics of the vaccines and the guidelines themselves (25). This manuscript further details these factors and identifies the stage(s) at which they have an effect on the process.

The many influences on this process are organized in the model to better understand their complexity and interrelationships. Two broad categories encompass all others: *environmental characteristics* of a physician's practice setting and *information characteristics* of the recommendation.

Environmental Characteristics

Environmental characteristics include sociocultural, professional, and organizational factors. Each of these can be broken down further to specific factors that have an impact on each stage in the process.

Sociocultural factors, seen in the top portion of Fig. 1, include such things as previous history of epidemics, community or school vaccination policies, and parent demand. Professional and organizational factors include individual physician characteristics (e.g., age, specialty), practice characteristics (e.g., solo, group), and practice management policies.

Individual Physician Factors

Considerable attention has been given to the role played by features of individual physicians in medical innovation diffusion. Eisenberg concluded that the most important factors influencing clinical decision making were personal characteristics of individual physicians and their interactions within their profession (19). Individual physician factors, includ-

ing age and training, have been carefully studied in regard to the use of laboratory tests and prescription of drugs (20, 21, 26). Although individual physician characteristics have been found to be associated with practice patterns and prescribing styles, these associations vary with the class of drugs being studied. Linn found that prescribing patterns of psychotropic drugs were more likely to be related to characteristics reflecting physicians' "values, social position, or social background" than indicators of medical or scientific background (27, 28). Stolley noted that physicians more appropriate in their chloramphenicol prescribing habits were those who were younger, "more cosmopolitan," more modern, and those concerned with both the psychosocial and quality dimensions of medical care (21). The specific factors influencing medical decision making have been found to vary among specialties (29–31), perhaps related to known specialty differences in individuals' styles of information sharing and patterns of adoption of new treatments (32). This variation across specialties only complicates our understanding of the influence of individual factors on medical practices.

Burt categorized physicians into four groups based upon the timing of their adoption of tetracycline: eager innovators, early conformers, late conformers, and deviant laggards (33). Although associations were noted between some physician characteristics (e.g., age, number of journal subscriptions maintained, early contact with pharmaceutical representative) and the date of tetracycline adoption, Burt reported no attempt to specifically identify individual characteristics in each of these groups.

Practice Specific Characteristics

It is increasingly recognized that medicine is not practiced in a vacuum, but exists within a complex network of intra- and interorganizational arrangements influencing physician practice patterns (22). Thus, the ability to influence physician decision making must be based on our ability (a) to understand and affect the organizational context within which the physician functions, and (b) to recognize the network of organizations that influence activities within the practice (34).

Becker's data suggests that opinion leaders within health care organizations are selective in their support of innovations (35). Mohr speculated that individual motivation to innovate will be successful in direct relation to the availability of supportive or-

ganizational resources in a given situation, and in inverse relation to organizational obstacles to innovation (36). These factors may overpower individual efforts to adopt or reject new medical treatments. The effects of group style and peer pressure are thought to be stronger in more formally organized practices, such as health maintenance organizations (37). Williamson noted that the average time from awareness to adoption of new therapies was shorter for physicians in group practices than those in solo practice (23). Specifically, increasing time spent with colleagues was related to earlier adoption. The interaction between physicians, as fostered in medical groups, appears to enhance dissemination of information about new therapies, and helps legitimize an innovation (23, 38). Eisenberg noted the strong effect of "educationally influential" physicians within practices (37).

Other aspects of organizations that play significant roles in the diffusion of medical information and technology adoption include organizations' formal quality assurance efforts, methods used to enforce group standards of care, information management systems, patient flow efficiency, and delegation of patient care tasks to nurses and aides. These concrete factors, which reflect Mohr's supportive organizational resources or obstacles, (36) have received little formal assessment.

Organizational policies and procedures probably play a strong role in the ability of physicians within a practice to achieve high immunization rates among their pediatric patients. Appropriate times for well-child visits to physicians (tied to the ages when vaccines are to be given) are widely accepted, and likely assist in achieving high vaccine rates. It is a near uniform practice to record in a specially designed location in pediatric patient charts all vaccines administered, along with manufacturer batch information, and dates of administration. The availability of this data has helped make vaccine compliance a favorite target for practice's quality assurance efforts.

Practice Management Policies

Physicians, though operating within organizations, also interact with and are influenced by outside physicians. Coleman, in a study of tetracycline adoption soon after its release, determined that the behavior of a physician's peers was the strongest determinant of practice behavior (39). Those who were late adopters had peers who were late adopters. The in-

fluence of physicians outside one's practice is likely greatest for physicians in smaller groups or solo practice.

Physicians' medical practices are influenced increasingly by outside forces. Medical care decisions are guided by the requirements of health care payors for second opinions for surgical procedures, and limitations in drug prescribing options through restrictive formularies. Carey and Weis suggest that despite low vaccination rates in general for medicaid patients, that those enrolled in capitated arrangements might fare somewhat better (24).

State or local regulations specifying vaccine requirements for public school attendance are felt to exert strong influences on physicians' vaccine practices (17). Some state and local health departments are called upon to set local vaccine recommendations to meet recent vaccine-preventable disease outbreaks. They then also serve to educate physicians about these recommendations.

Information Characteristics

Information characteristics comprise specific features of the guideline itself and the mechanisms of the dissemination process. Information characteristics unique to each immunization recommendation, seen in the lower portion of Fig. 1, might involve the relative advantage of the revised or new recommendation, its complexity for providers and parents, and its compatibility with existing recommendations. The mechanisms of dissemination involve the choice of information sources (e.g., medical or lay, official or unofficial), the credibility of those sources, other methods of dissemination, and the initial acceptance by local medical opinion leaders.

Guideline Specific Factors

Innovation theory has taught that certain features of innovations themselves enhance their likelihood of being adopted (25, 30). Three specific characteristics—relative advantage, complexity, and compatibility—are found to be the most reliable predictors of adherence (40). Relative advantage refers to the degree to which the innovation is perceived as being better than that which it is intended to replace. Two specific dimensions of relative advantage are the innovation's scientific performance and cost. Complexity refers to the degree to which the innova-

tion is difficult to understand or use. Compatibility is the degree to which the innovation is seen as congruent with existing modes of operation, values, and needs.

Vaccine practices are influenced by characteristics of specific recommendations such as the timing recommended or the way in which contraindications are identified, or even the wording used in these recommendations. The notions of relative advantage, complexity, and compatibility seem highly relevant to explaining variation in vaccine protocol adherence. The past success of vaccine recommendation compliance may be explained by vaccines' perceived relative advantage (clear efficacy in disease prevention), limited complexity (recommendations traditionally easy to understand and injections themselves easy to administer), and high compatibility with medical office practice (injections are well accepted by parents patients and fall well within the traditional scope of work of physicians). An example of a successful instance of implementation of an innovation is the case of the change in *Haemophilus influenza*, type b, recommendations where adoption by physicians was relatively rapid (10). The relative advantage offered by the new recommendation was quite easy to convey to physicians, given the promise of disease protection through the earlier months of life carrying the greatest morbidity and mortality risk. Further, compatibility was high, given that the added vaccine doses were to be given at the same 2-, 4-, and 6-month well child visits as recommended for diphtheria, pertussis, and tetanus (DPT). Finally, complexity was low for this recommendation change since the major issue was merely a change in the timing of the first vaccine.

On the other hand, growing resistance of physicians and patients to recent and upcoming vaccine recommendations can be understood as emerging in a milieu that is itself changing. With the emergence of new vaccine recommendations for diseases perceived as less severe or life-threatening (e.g., rotavirus, varicella) (14), relative advantage will be less clear, complexity will increase, and compatibility cannot be taken for granted. The *perception* of relative advantage of new recommendations wanes as the living historical memory of dreaded childhood diseases diminishes, affecting the judgments of parents and physicians. Further, additional vaccines involve additional costs to parents and payors for children's health maintenance. On the other hand, physicians did not initially manifest consensus about the relative advantage of universal vaccination for hepatitis B (8, 9, 41), given that it is a disease with well-known

lifestyle risk factors. Each new vaccine recommendation or modification increases the complexity of the entire process. As more and more vaccines are added to the schedule, room for confusion and error grows.

Guideline Dissemination Factors

Relatively little research has been devoted to the question of dissemination of guidelines in the area of vaccines. In a study of 12 organizations (HMO's, insurers, specialty societies) that develop and use practice guidelines, Audet, Greenfield, and Field surveyed a variety of professional, commercial and practice based organizations who were developing or disseminating medical practice guidelines (42). They found that less emphasis was placed on implementation than on guideline development. In general, organizations that both develop and use guidelines (i.e., payers and delivery organizations) appeared to devote more attention to implementation than did professional organizations (i.e., medical specialty societies). Less systematic dissemination of guidelines made updating of guidelines more difficult. Adding to the complexity is the discovery that different specialties have varying preferences for the source of new vaccine recommendations (43, 44).

In total, the process appears complex and convoluted, suggesting the difficulties encountered in disseminating new guidelines to achieve widespread adherence. The following sections examine each step in the process and the particular influences that may have an impact upon them.

Awareness. Before any publicity is released about a new recommendation, physicians are in a state of *preawareness*. The process of implementing a new immunization recommendation begins with *awareness*, where physicians learn about the guideline. The sources of this new information may include communications from the Centers for Disease Control, specialty societies, and local health departments, articles in medical journals, or television and other lay media efforts. Colleagues are also a source of information for many practitioners. The mechanism of dissemination unique to these sources may have a direct impact on their success in promoting awareness.

The individual characteristics of physicians also play a role in awareness. Physicians of different ages, specialties, and professional society affiliation may have differential access to information about a new recommendation. They vary in the number of meet-

ings attended, the amount of time spent reading medical literature, and the attention devoted to a particular medical issue (in this example, childhood immunization).

Agreement. The next step in the process, *agreement*, occurs when a physician conceptually understands and approves of the rationale for a recommendation. Movement toward agreement is influenced by a combination of factors, most importantly (1) credibility of the information source, (2) the relative advantage of the new recommendation over the status quo, (3) the complexity of the new recommendation, and (4) agreement by local medical leaders. Credibility of the information source is essential in fostering trust in the information presented. Concerns about liability and patient care will make physicians hesitant to accept new recommendations from sources not known for their accuracy or completeness. Increasingly, sources of information about immunization recommendations must "prove their case"—i.e., offer convincing evidence that the new or revised recommendation offers an advantage over the existing schedule. The importance of this factor was demonstrated by low rates of physician agreement with universal infant hepatitis B immunization (8, 9).

Previous research also has demonstrated the role that local medical opinion leaders play in fostering widespread agreement with innovation (37). Frequently, there are respected physicians in the community who guide colleagues in establishing community norms and determining standards of care. Their public agreement with a new recommendation may promote agreement by others (35).

Physician and practice characteristics also influence agreement. For example, members of specialty societies may be more likely to agree with a recommendation from their own organization. Also, rates of agreement with new recommendations have been shown to differ by practice type (e.g., solo, group, public, HMO) (8). This may reflect the nature of the individual physician who gravitates to a certain practice type.

Adoption. The next step is *adoption*, where physicians move from an abstract and intellectual concept (agreement) to a concrete endorsement of the recommendation to patients and preparations to alter clinical practice accordingly. Environmental factors involved in achieving this stage include the size and complexity of the practice organization, physician characteristics, and local or state vaccine requirements for school entry. Informational factors include

the complexity of the recommendation, its relative advantage over current recommendations, and its compatibility with existing recommendations (45).

Elements of a physician's practice setting often influence adoption (46). Physicians in small, independent, solo or two-physician practices may have little difficulty adopting new immunization recommendations; the process may be as simple as ordering a new product and training a small number of office staff. In a larger practice or HMO, the process of adoption often requires administrative approval from a clinical practice committee or from a third-party payer. In this setting, if approval is given, adoption of the new policy would be rapid and widespread, affecting many physicians. Conversely, if approval is denied, few if any physicians in the organization would adopt the change. Additionally, outside influences, such as requirements for school or day care attendance set by local or state ordinance, can foster and even hasten adoption of a new recommendation by influencing patient demand even when agreement with it is minimal.

The more complex a new recommendation, the longer it likely will take to adopt. Physicians must determine the best method to put a recommendation into action, often based on logistical concerns, (e.g., record-keeping, scheduling). The compatibility of the new recommendation with the immunization schedule already in place can also impact on the rapidity of adoption. For example, a new recommendation that necessitates additional office visits imposes many more difficulties than one that substitutes or adds injections at the regularly scheduled well-child visits.

Adherence. The final stage is *adherence* to the new recommendation. This involves the net effect or outcome: whether or not patients consistently receive immunizations as recommended. Issues at work in this stage include the environmental factors of parent agreement or demand for the immunization and practice implementation policies, and informational factors related to complexity of the new recommenda-

tion and compatibility with existing immunization schedules and recommendations.

Parental agreement with new immunization recommendations may be influenced by many information sources. Physician recommendations, friends, school or day care requirements, and even the news media play a role in parents' impression of the safety, efficacy, and need for vaccines. Parental agreement is essential for a child to actually receive the vaccine. In some situations, parental demand for a vaccine required for school or day care will influence a physician to offer that vaccine, regardless of whether he agrees with the recommendation.

Also affecting adherence is the manner in which a new recommendation is implemented *vis-à-vis* existing practice. For example, the addition of hepatitis B vaccine to the primary immunization series required that infants receive three injections at one or more well-child visit. Many parents, nurses, and even physicians initially balked at giving multiple injections (41), the alternative, scheduling another appointment, affected adherence to that recommendation by delaying immunization receipt. Finally, the complexity of a new recommendation may prove confusing for physicians, office staff, and parents. For example, changes in the recommended age for administration of a vaccine may require the "relearning" of standard routines by office nurses, revisions to parent education materials, and an effective mechanism to identify children who may be missed because of the change.

LIMITATIONS TO THE MODEL

The model implies that all stages, from awareness to adherence, are equally significant and that progression through one stage is essential to reach the next. However, some influences on physician behavior may be so great as to cause stages to be skipped. For example, our empirical test of the model

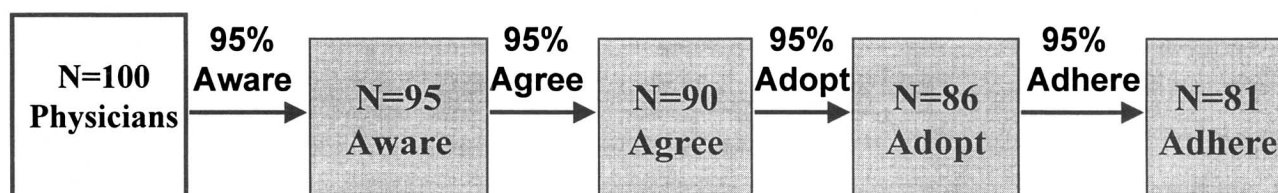


Fig. 2. Effect of 95% progression through each stage in the awareness-to-adherence model.

(13) identified several physicians who had adopted the universal hepatitis B vaccine recommendation even though they did not agree with it. Analysis of the factors responsible found that both parental pressures and community practice norms resulted in this phenomenon.

The model also does not demonstrate that for specific recommendations or guidelines, certain stages may be more difficult to achieve than others. However, the model does allow for the identification of the stage at which the progression to adherence is arrested. Then, the factor responsible may be "diagnosed" and "treated."

IMPLICATIONS FOR PRACTICE

The model presented here has an approach similar to others in the literature that have looked at changing patient behavior. Specifically, it is consistent with the recommendation from Prochaska that investigators shift from the perception that behavior change is a specific action to one that involves stages of progression (47). However, in contrast to individual health-related behaviors, the risk of "relapse" or returning to the previous prerecommendation is minimal (48).

The concept of movement through sequential stages involves certain mathematical consequences regarding population-based estimates of eventual adherence to a guideline. For example, even if 95% of physicians achieve each step in the process, the result is only an 80% adherence rate (Fig. 2)—a potential problem when striving to achieve herd immunity or other large-scale population coverage. Thus, if widespread adherence to any guideline follows a rational series of stages, it necessarily involves significant "buy-in" at each stage of the process. This places considerable importance on effective guideline dissemination.

This conceptual model of the process of implementing immunization recommendations has uses for both research and practice. Although designed for immunizations specifically, modification of individual factors will allow its use in predicting or following adoption of other guidelines. For organizations or governmental entities that craft and promulgate practice guidelines, early recognition of the potential pitfalls along the way to adoption and adherence will facilitate the planning process and suggest effective strategies for dissemination.

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