Section II:

Evidence-Based Practice

Chapter 7. The Evidence for Evidence-Based Practice Implementation

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Background

Overview of Evidence-Based Practice

Evidence-based health care practices are available for a number of conditions such as asthma, heart failure, and diabetes. However, these practices are not always implemented in care delivery, and variation in practices abound.[1–4] Traditionally, patient safety research has focused on data analyses to identify patient safety issues and to demonstrate that a new practice will lead to improved quality and patient safety.[5] Much less research attention has been paid to how to implement practices. Yet, only by putting into practice what is learned from research will care be made safer.[5] Implementing evidence-based safety practices are difficult and need strategies that address the complexity of systems of care, individual practitioners, senior leadership, and—ultimately—changing health care cultures to be evidence-based safety practice environments.[5]

Nursing has a rich history of using research in practice, pioneered by Florence Nightingale.[6–9] Although during the early and mid-1900s, few nurses contributed to this foundation initiated by Nightingale,[10] the nursing profession has more recently provided major leadership for improving care through application of research findings in practice.[11]

Evidence-based practice (EBP) is the conscientious and judicious use of current best evidence in conjunction with clinical expertise and patient values to guide health care decisions.[12–15] Best evidence includes empirical evidence from randomized controlled trials; evidence from other scientific methods such as descriptive and qualitative research; as well as use of information from case reports, scientific principles, and expert opinion. When enough research evidence is available, the practice should be guided by research evidence in conjunction with clinical expertise and patient values. In some cases, however, a sufficient research base may not be available, and health care decisionmaking is derived principally from nonresearch evidence sources such as expert opinion and scientific principles.[16] As more research is done in a specific area, the research evidence must be incorporated into the EBP.[15]

Models of Evidence-Based Practice

Multiple models of EBP are available and have been used in a variety of clinical settings.[16–36] Although review of these models is beyond the scope of this chapter, common elements of these models are selecting a practice topic (e.g., discharge instructions for individuals with heart failure), critique and syntheses of evidence, implementation, evaluation of the impact on patient care and provider performance, and consideration of the context/setting in which the practice is implemented.[15, 17] The learning that occurs during the process of translating research into practice is valuable information to capture and feed back into the process, so that others can adapt the evidence-based guideline and/or the implementation strategies.

A recent conceptual framework for maximizing and accelerating the transfer of research results from the Agency for Healthcare Research and Quality (AHRQ) patient safety research portfolio to health care delivery was developed by the dissemination subcommittee of the AHRQ Patient Safety Research Coordinating Committee.[37] This model is a synthesis of concepts from scientific information on knowledge transfer, social marketing, social and organizational innovation, and behavior change (see Figure 1).[37] Although the framework is portrayed as a series of stages, the authors of this framework do not believe that the knowledge transfer process is linear; rather, activities occur simultaneously or in different sequences, with implementation of EBPs being a multifaceted process with many actors and systems.

Steps of Evidence-Based Practice

Steps of promoting adoption of EBPs can be viewed from the perspective of those who conduct research or generate knowledge,[23, 37] those who use the evidence-based information in practice,[16, 31] and those who serve as boundary spanners to link knowledge generators with knowledge users.[19]

Steps of knowledge transfer in the AHRQ model[37] represent three major stages: (1) knowledge creation and distillation, (2) diffusion and dissemination, and (3) organizational adoption and implementation. These stages of knowledge transfer are viewed through the lens of researchers/creators of new knowledge and begin with determining what findings from the patient safety portfolio or individual research projects ought to be disseminated.

Knowledge creation and distillation is conducting research (with expected variation in readiness for use in health care delivery systems) and then packaging relevant research findings into products that can be put into action—such as specific practice recommendations—thereby increasing the likelihood that research evidence will find its way into practice.[37] It is essential that the knowledge distillation process be informed and guided by end users for research findings to be implemented in care delivery. The criteria used in knowledge distillation should include perspectives of the end users (e.g., transportability to the real-world health care setting, feasibility, volume of evidence needed by health care organizations and clinicians), as well as traditional knowledge generation considerations (e.g., strength of the evidence, generalizability).

Diffusion and dissemination involves partnering with professional opinion leaders and health care organizations to disseminate knowledge that can form the basis of action (e.g., essential elements for discharge teaching for hospitalized patient with heart failure) to potential users. Dissemination partnerships link researchers with intermediaries that can function as knowledge brokers and connectors to the practitioners and health care delivery organizations. Intermediaries can be professional organizations such as the National Patient Safety Foundation or multidisciplinary knowledge transfer teams such as those that are effective in disseminating research-based cancer prevention programs. In this model, dissemination partnerships provide an authoritative seal of approval for new knowledge and help identify influential groups and communities that can create a demand for application of the evidence in practice. Both mass communication and targeted dissemination are used to reach audiences with the anticipation that early users will influence the latter adopters of the new usable, evidence-based research findings. Targeted dissemination efforts must use multifaceted dissemination strategies, with an emphasis on channels and media that are most effective for particular user segments (e.g., nurses, physicians, pharmacists).

End user adoption, implementation, and institutionalization is the final stage of the knowledge transfer process.[37] This stage focuses on getting organizations, teams, and individuals

to adopt and consistently use evidence-based research findings and innovations in everyday practice. Implementing and sustaining EBPs in health care settings involves complex interrelationships among the EBP topic (e.g., reduction of medication errors), the organizational social system characteristics (such as operational structures and values, the external health care environment), and the individual clinicians.[35, 37–39] A variety of strategies for implementation include using a change champion in the organization who can address potential implementation challenges, piloting/trying the change in a particular patient care area of the organization, and using multidisciplinary implementation teams to assist in the practical aspects of embedding innovations into ongoing organizational processes.[35, 37] Changing practice takes considerable effort at both the individual and organizational level to apply evidence-based information and products in a particular context.[22] When improvements in care are demonstrated in the pilot studies and communicated to other relevant units in the organization, key personnel may then agree to fully adopt and sustain the change in practice. Once the EBP change is incorporated into the structure of the organization, the change is no longer considered an innovation but a standard of care.[22, 37]

In comparison, other models of EBP (e.g., Iowa Model of Evidence-based Practice to Promote Quality of Care[16]) view the steps of the EBP process from the perspective of clinicians and/or organizational/clinical contexts of care delivery. When viewing steps of the EBP process through the lens of an end user, the process begins with selecting an area for improving care based on evidence (rather than asking what findings ought to be disseminated); determining the priority of the potential topic for the organization; formulating an EBP team composed of key stakeholders; finding, critiquing, and synthesizing the evidence; setting forth EBP recommendations, with the type and strength of evidence used to support each clearly documented; determining if the evidence findings are appropriate for use in practice; writing an EBP standard specific to the organization; piloting the change in practice; implementing changes in practice in other relevant practice areas (depending on the outcome of the pilot); evaluating the EBP changes; and transitioning ongoing quality improvement (QI) monitoring, staff education, and competency review of the EBP topic to appropriate organizational groups as defined by the organizational structure.[15, 40] The work of EBP implementation from the perspective of the end user is greatly facilitated by efforts of AHRQ, professional nursing organizations (e.g., Oncology Nursing Society), and others that distill and package research findings into useful products and tools for use at the point of care delivery.

When the clinical questions of end users can be addressed through use of existing evidence that is packaged with end users in mind, steps of the EBP process take less time and more effort can be directed toward the implementation, evaluation, and sustainability components of the process. For example, finding, critiquing, and synthesizing the evidence; setting forth EBP recommendations with documentation of the type and strength of evidence for each recommendation; and determining appropriateness of the evidence for use in practice are accelerated when the knowledge-based information is readily available. Some distilled research findings also include quick reference guides that can be used at the point of care and/or integrated into health care information systems, which also helps with implementation.[41, 42]

Translation Science: An Overview

Translation science is the investigation of methods, interventions, and variables that influence adoption by individuals and organizations of EBPs to improve clinical and operational decisionmaking in health care.[35, 43–46] This includes testing the effect of interventions on

promoting and sustaining adoption of EBPs. Examples of translation studies include describing facilitators and barriers to knowledge uptake and use, organizational predictors of adherence to EBP guidelines, attitudes toward EBPs, and defining the structure of the scientific field.[11, 47–49]

Translation science must be guided by a conceptual model that organizes the strategies being tested, elucidates the extraneous variables (e.g., behaviors and facilitators) that may influence adoption of EBPs (e.g., organizational size, characteristics of users), and builds a scientific knowledge base for this field of inquiry.[15, 50] Conceptual models used in the translating-research-into-practice studies funded by AHRQ were adult learning, health education, social influence, marketing, and organizational and behavior theories.[51] Investigators have used Rogers's Diffusion of Innovation model,[35, 39, 52–55] the Promoting Action on Research Implementation in Health Services (PARIHS) model,[29] the push/pull framework,[23, 56, 57] the decisionmaking framework,[58] and the Institute for Healthcare Improvement (IHI) model[59] in translation science.

Study findings regarding evidence-based practices in a diversity of health care settings are building an empirical foundation of translation science.[19, 43, 51, 60–83] These investigations and others[18, 84–86] provide initial scientific knowledge to guide us in how to best promote use of evidence in practice. To advance knowledge about promoting and sustaining adoption of EBPs in health care, translation science needs more studies that test translating research into practice (TRIP) interventions: studies that investigate what TRIP interventions work, for whom, in what circumstances, in what types of settings; and studies that explain the underlying mechanisms of effective TRIP interventions.[35, 49, 79, 87] Partnership models, which encourage ongoing interaction between researchers and practitioners, may be the way forward to carry out such studies.[56] Challenges, issues, methods, and instruments used in translation research are described elsewhere.[11, 19, 49, 78, 88–97]

Research Evidence

What Is Known About Implementing Evidence-Based Practices?

Multifaceted implementation strategies are needed to promote use of research evidence in clinical and administrative health care decisionmaking.[15, 22, 37, 45, 64, 72, 77, 79, 98, 99] Although Grimshaw and colleagues[65] suggest that multifaceted interventions are no more effective than single interventions, context (site of care delivery) was not incorporated in the synthesis methodology. As noted by others, the same TRIP intervention may meet with varying degrees of effectiveness when applied in different contexts.[35, 49, 79, 80, 87, 100, 101] Implementation strategies also need to address *both* the individual practitioner and organizational perspective.[15, 22, 37, 64, 72, 77, 79, 98] When practitioners decide individually what evidence to use in practice, considerable variability in practice patterns result,[71] potentially resulting in adverse patient outcomes.

For example, an "individual" perspective of EBP would leave the decision about use of evidence-based endotracheal suctioning techniques to each nurse and respiratory therapist. Some individuals may be familiar with the research findings for endotracheal suctioning while others may not. This is likely to result in different and conflicting practices being used as people change shifts every 8 to 12 hours. From an organizational perspective, endotracheal suctioning policies and procedures based on research are written, the evidence-based information is integrated into the clinical information systems, and adoption of these practices by nurses and other practitioners is systematically promoted in the organization. This includes assuring that practitioners have the

necessary knowledge, skills, and equipment to carry out the evidence-based endotracheal suctioning practice. The organizational governance supports use of these practices through various councils and committees such as the Practice Committee, Staff Education Committee, and interdisciplinary EBP work groups.

The Translation Research Model,[35] built on Rogers's seminal work on diffusion of innovations,[39] provides a guiding framework for testing and selecting strategies to promote adoption of EBPs. According to the Translation Research Model, adoption of innovations such as EBPs are influenced by the nature of the innovation (e.g., the type and strength of evidence, the clinical topic) and the manner in which it is communicated (disseminated) to members (nurses) of a social system (organization, nursing profession).[35] Strategies for promoting adoption of EBPs must address these four areas (nature of the EBP topic; users of the evidence; communication; social system) within a context of participative change (see Figure 2)**.** This model provided the framework for a multisite study that tested the effectiveness of a multifaceted TRIP intervention designed to promote adoption of evidence-based acute pain management practices for hospitalized older adults. The intervention improved the quality of acute pain management practices and reduced costs.[81] The model is currently being used to test the effectiveness of a multifaceted TRIP intervention to promote evidence-based cancer pain management of older adults in home hospice settings.[*] This guiding framework is used herein to overview what is known about implementation interventions to promote use of EBPs in health care systems (see Evidence Table).

Nature of the Innovation or Evidence-Based Practice

Characteristics of an innovation or EBP topic that affect adoption include the relative advantage of the EBP (e.g., effectiveness, relevance to the task, social prestige); the compatibility with values, norms, work, and perceived needs of users; and complexity of the EBP topic.[39] For example, EBP topics that are perceived by users as relatively simple (e.g., influenza vaccines for older adults) are more easily adopted in less time than those that are more complex (acute pain management for hospitalized older adults). Strategies to promote adoption of EBPs related to characteristics of the topic include practitioner review and "reinvention" of the EBP guideline to fit the local context, use of quick reference guides and decision aids, and use of clinical reminders.[53, 59, 60, 65, 74, 82, 102–107] An important principle to remember when planning implementation of an EBP is that the attributes of the EBP topic as perceived by users and stakeholders (e.g., ease of use, valued part of practice) are neither stable features nor sure determinants of their adoption. Rather it is the interaction among the characteristics of the EBP topic, the intended users, and a particular context of practice that determines the rate and extent of adoption.[22, 35, 39]

Studies suggest that clinical systems, computerized decision support, and prompts that support practice (e.g., decisionmaking algorithms, paper reminders) have a positive effect on aligning practices with the evidence base.[15, 51, 65, 74, 80, 82, 102, 104, 107–110] Computerized knowledge management has consistently demonstrated significant improvements in provider performance and patient outcomes.[82] Feldman and colleagues, using a just-in-time e-mail reminder in home health care, have demonstrated (1) improvements in evidence-based care and outcomes for patients with heart failure,[64, 77] and (2) reduced pain intensity for cancer patients.[75] Clinical information systems should deploy the evidence base to the point of care and incorporate

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computer decision-support software that integrates evidence for use in clinical decisionmaking about individual patients.[40, 104, 111–114] There is still much to learn about the "best" manner of deploying evidence-based information through electronic clinical information systems to support evidence-based care.[115]

Methods of Communication

Interpersonal communication channels, methods of communication, and influence among social networks of users affect adoption of EBPs.[39] Use of mass media, opinion leaders, change champions, and consultation by experts along with education are among strategies tested to promote use of EBPs. Education is necessary but not sufficient to change practice, and didactic continuing education alone does little to change practice behavior.[61, 116] There is little evidence that interprofessional education as compared to discipline-specific education improves EBP.[117] Interactive education, used in combination with other practice-reinforcing strategies, has more positive effects on improving EBP than didactic education alone.[66, 68, 71, 74, 118, 119] There is evidence that mass media messages (e.g., television, radio, newspapers, leaflets, posters and pamphlets), targeted at the health care consumer population, have some effect on use of health services for the targeted behavior (e.g., colorectal cancer screening). However, little empirical evidence is available to guide framing of messages communicated through planned mass media campaigns to achieve the intended change.[120]

Several studies have demonstrated that opinion leaders are effective in changing behaviors of health care practitioners,[22, 68, 79, 100, 116, 121–123] especially in combination with educational outreach or performance feedback. Opinion leaders are from the local peer group, viewed as a respected source of influence, considered by associates as technically competent, and trusted to judge the fit between the innovation and the local situation.[39, 116, 121, 124–127] With their wide sphere of influence across several microsystems/units, opinion leaders' use of the innovation influences peers and alters group norms.[39,128] The key characteristic of an opinion leader is that he or she is trusted to evaluate new information in the context of group norms. Opinion leadership is multifaceted and complex, with role functions varying by the circumstances, but few successful projects to implement innovations in organizations have managed without the input of identifiable opinion leaders.[22, 35, 39, 81, 96] Social interactions such as "hallway chats," one-on-one discussions, and addressing questions are important, yet often overlooked components of translation.[39, 59] Thus, having local opinion leaders discuss the EBPs with members of their peer group is necessary to translate research into practice. If the EBP that is being implemented is interdisciplinary in nature, discipline-specific opinion leaders should be used to promote the change in practice.[39]

Change champions are also helpful for implementing innovations.[39, 49, 81, 129–131] They are practitioners within the local group setting (e.g., clinic, patient care unit) who are expert clinicians, passionate about the innovation, committed to improving quality of care, and have a positive working relationship with other health care professionals.[39, 125, 131, 132] They circulate information, encourage peers to adopt the innovation, arrange demonstrations, and orient staff to the innovation.[49, 130] The change champion believes in an idea; will not take "no" for an answer; is undaunted by insults and rebuffs; and, above all, persists.[133] Because nurses prefer interpersonal contact and communication with colleagues rather than Internet or traditional sources of practice knowledge,[134–137] it is imperative that one or two change champions be identified for each patient care unit or clinic where the change is being made for EBPs to be enacted by direct care providers.[81, 138] Conferencing with opinion leaders and change champions

periodically during implementation is helpful to address questions and provide guidance as needed.[35, 66, 81, 106]

Because nurses' preferred information source is through peers and social interactions,[134–137, 139, 140] using a core group in conjunction with change champions is also helpful for implementing the practice change.[16, 110, 141] A core group is a select group of practitioners with the mutual goal of disseminating information regarding a practice change and facilitating the change by other staff in their unit/microsystem.[142] Core group members represent various shifts and days of the week and become knowledgeable about the scientific basis for the practice; the change champion educates and assists them in using practices that are aligned with the evidence. Each member of the core group, in turn, takes the responsibility for imparting evidence-based information and effecting practice change with two or three of their peers. Members assist the change champion and opinion leader with disseminating the EBP information to other staff, reinforce the practice change on a daily basis, and provide positive feedback to those who align their practice with the evidence base.[15] Using a core-group approach in conjunction with a change champion results in a critical mass of practitioners promoting adoption of the EBP.[39]

Educational outreach, also known as academic detailing, promotes positive changes in practice behaviors of nurses and physicians.[22, 64, 66, 71, 74, 75, 77, 81, 119, 143] Academic detailing is done by a topic expert, knowledgeable of the research base (e.g., cancer pain management), who may be external to the practice setting; he or she meets one-on-one with practitioners in their setting to provide information about the EBP topic. These individuals are able to explain the research base for the EBPs to others and are able to respond convincingly to challenges and debates.[22] This strategy may include providing feedback on provider or team performance with respect to selected EBP indicators (e.g., frequency of pain assessment).[66, 81, 119]

Users of the Innovation or Evidence-Based Practice

Members of a social system (e.g., nurses, physicians, clerical staff) influence how quickly and widely EBPs are adopted.[39] Audit and feedback, performance gap assessment (PGA), and trying the EBP are strategies that have been tested.[15, 22, 65, 66, 70–72, 81, 98, 124, 144] PGA and audit and feedback have consistently shown a positive effect on changing practice behavior of providers.[65, 66, 70, 72, 81, 98, 124, 144, 145] PGA (baseline practice performance) informs members, at the *beginning* of change, about a practice performance and opportunities for improvement. Specific practice indicators selected for PGA are related to the practices that are the focus of evidence-based practice change, such as every-4-hour pain assessment for acute pain management.[15, 66, 81]

Auditing and feedback are ongoing processes of using and assessing performance indicators (e.g., every-4-hour pain assessment), aggregating data into reports, and discussing the findings with practitioners *during* the practice change.[22, 49, 66, 70, 72, 81, 98, 145] This strategy helps staff know and see how their efforts to improve care and patient outcomes are progressing throughout the implementation process. Although there is no clear empirical evidence for how to provide audit and feedback,[70, 146] effects may be larger when clinicians are active participants in implementing change and discuss the data rather than being passive recipients of feedback reports.[67, 70] Qualitative studies provide some insight into use of audit and feedback.[60, 67] One study on use of data feedback for improving treatment of acute myocardial infarction found that (1) feedback data must be perceived by physicians as important and valid, (2) the data source and timeliness of data feedback are critical to perceived validity, (3) time is required to establish credibility of data within a hospital, (4) benchmarking improves the validity of the data feedback, and (5) physician leaders can enhance the effectiveness of data feedback. Data feedback that profiles an

individual physician's practices can be effective but may be perceived as punitive; data feedback must persist to sustain improved performance; and effectiveness of data feedback is intertwined with the organizational context, including physician leadership and organizational culture.[60] Hysong and colleagues[67] found that high-performing institutions provided timely, individualized, nonpunitive feedback to providers, whereas low performers were more variable in their timeliness and nonpunitiveness and relied more on standardized, facility-level reports. The concept of useful feedback emerged as the core concept around which timeliness, individualization, nonpunitiveness, and customizability are important.

Users of an innovation usually try it for a period of time before adopting it in their practice.[22, 39, 147] When "trying an EBP" (piloting the change) is incorporated as part of the implementation process, users have an opportunity to use it for a period of time, provide feedback to those in charge of implementation, and modify the practice if necessary.[148] Piloting the EBP as part of implementation has a positive influence on the extent of adoption of the new practice.[22, 39, 148]

Characteristics of users such as educational preparation, practice specialty, and views on innovativeness may influence adoption of an EBP, although findings are equivocal.[27, 39, 130, 149–153] Nurses' disposition to critical thinking is, however, positively correlated with research use,[154] and those in clinical educator roles are more likely to use research than staff nurses or nurse managers.[155]

Social System

Clearly, the social system or context of care delivery matters when implementing EBPs.[2, 30, 33, 39, 60, 84, 85, 91, 92, 101, 156–163] For example, investigators demonstrated the effectiveness of a prompted voiding intervention for urinary incontinence in nursing homes, but sustaining the intervention in day-to-day practice was limited when the responsibility of carrying out the intervention was shifted to nursing home staff (rather than the investigative team) and required staffing levels in excess of a majority of nursing home settings.[164] This illustrates the importance of embedding interventions into ongoing processes of care.

Several organizational factors affect adoption of EBPs.[22, 39, 79, 134, 165–167] Vaughn and colleagues[101] demonstrated that organizational resources, physician full-time employees (FTEs) per 1,000 patient visits, organizational size, and whether the facility was located in or near a city affected use of evidence in the health care system of the Department of Veterans Affairs (VA). Large, mature, functionally differentiated organizations (e.g., divided into semiautonomous departments and units) that are specialized, with a focus of professional knowledge, slack resources to channel into new projects, decentralized decisionmaking, and low levels of formalization will more readily adopt innovations such as new practices based on evidence. Larger organizations are generally more innovative because size increases the likelihood that other predictors of innovation adoption—such as slack financial and human resources and differentiation—will be present. However, these organizational determinants account for only about 15 percent of the variation in innovation adoption between comparable organizations.[22] Adler and colleagues[168] hypothesize that while more structurally complex organizations may be more innovative and hence adopt EBPs relatively early, less structurally complex organizations may be able to diffuse EBPs more effectively. Establishing semiautonomous teams is associated with successful implementation of EBPs, and thus should be considered in managing organizational units.[168–170]

As part of the work of implementing EBPs, it is important that the social system—unit, service line, or clinic—ensures that policies, procedures, standards, clinical pathways, and documentation systems support the use of the EBPs.[49, 68, 72, 73, 103, 140, 171] Documentation forms or clinical information systems may need revision to support changes in practice; documentation systems that fail to readily support the new practice thwart change.[82]

Absorptive capacity for new knowledge is another social system factor that affects adoption of EBPs. Absorptive capacity is the knowledge and skills to enact the EBPs; the strength of evidence alone will not promote adoption. An organization that is able to systematically identify, capture, interpret, share, reframe, and recodify new knowledge, and put it to appropriate use, will be better able to assimilate EBPs.[82, 103, 172, 173] A learning organizational culture and proactive leadership that promotes knowledge sharing are important components of building absorptive capacity for new knowledge.[66, 139, 142, 174] Components of a receptive context for EBP include strong leadership, clear strategic vision, good managerial relations, visionary staff in key positions, a climate conducive to experimentation and risk taking, and effective data capture systems. Leadership is critical in encouraging organizational members to break out of the convergent thinking and routines that are the norm in large, well-established organizations.[4, 22, 39, 122, 148, 163, 175]

An organization may be generally amenable to innovations but not ready or willing to assimilate a particular EBP. Elements of system readiness include tension for change, EBP-system fit, assessment of implications, support and advocacy for the EBP, dedicated time and resources, and capacity to evaluate the impact of the EBP during and following implementation. If there is tension around specific work or clinical issues and staff perceive that the situation is intolerable, a potential EBP is likely to be assimilated if it can successfully address the issues, and thereby reduce the tension.[22, 175]

Assessing and structuring workflow to fit with a potential EBP is an important component of fostering adoption. If implications of the EBP are fully assessed, anticipated, and planned for, the practice is more likely to be adopted.[148, 162, 176] If supporters for a specific EBP outnumber and are more strategically placed within the organizational power base than opponents, the EBP is more likely to be adopted by the organization.[60, 175] Organizations that have the capacity to evaluate the impact of the EBP change are more likely to assimilate it. Effective implementation needs both a receptive climate and a good fit between the EBP and intended adopters' needs and values.[22, 60, 140, 175, 177]

Leadership support is critical for promoting use of EBPs.[33, 59, 72, 85, 98, 122, 178–181] This support, which is expressed verbally, provides necessary resources, materials, and time to fulfill assigned responsibilities.[148, 171, 182, 183] Senior leaders need to create an organizational mission, vision, and strategic plan that incorporate EBP; implement performance expectations for staff that include EBP work; integrate the work of EBP into the governance structure of the health care system; demonstrate the value of EBPs through administrative behaviors; and establish explicit expectations that nurse leaders will create microsystems that value and support clinical inquiry.[122, 183, 184]

A recent review of organizational interventions to implement EBPs for improving patient care examined five major aspects of patient care. The review suggests that revision of professional roles (changing responsibilities and work of health professionals such as expanding roles of nurses and pharmacists) improved processes of care, but it was less clear about the effect on improvement of patient outcomes. Multidisciplinary teams (collaborative practice teams of physicians, nurses, and allied health professionals) treating mostly patients with prevalent

chronic diseases resulted in improved patient outcomes. Integrated care services (e.g., disease management and case management) resulted in improved patient outcomes and cost savings. Interventions aimed at knowledge management (principally via use of technology to support patient care) resulted in improved adherence to EBPs and patient outcomes. The last aspect, quality management, had the fewest reviews available, with the results uncertain. A number of organizational interventions were not included in this review (e.g., leadership, process redesign, organizational learning), and the authors note that the lack of a widely accepted taxonomy of organizational interventions is a problem in examining effectiveness across studies.[82]

An organizational intervention that is receiving increasing attention is tailored interventions to overcome barriers to change.[162, 175, 185] This type of intervention focuses on first assessing needs in terms of what is causing the gap between current practice and EBP for a specified topic, what behaviors and/or mechanism need to change, what organizational units and persons should be involved, and identification of ways to facilitate the changes. This information is then used in tailoring an intervention for the setting that will promote use of the specified EBP. Based on a recent systematic review, effectiveness of tailored implementation interventions remains uncertain.[185]

In summary, making an evidence-based change in practice involves a series of action steps and a complex, nonlinear process. Implementing the change will take several weeks to months, depending on the nature of the practice change. Increasing staff knowledge about a specific EBP and passive dissemination strategies are not likely to work, particularly in complex health care settings. Strategies that seem to have a positive effect on promoting use of EBPs include audit and feedback, use of clinical reminders and practice prompts, opinion leaders, change champions, interactive education, mass media, educational outreach/academic detailing, and characteristics of the context of care delivery (e.g., leadership, learning, questioning). It is important that senior leadership and those leading EBP improvements are aware of change as a process and continue to encourage and teach peers about the change in practice. The new practice must be continually reinforced and sustained or the practice change will be intermittent and soon fade, allowing more traditional methods of care to return.[15]

Practice Implications From Translation Science

Principles of Evidence-Based Practice for Patient Safety

Several translation science principles are informative for implementing patient safety initiatives:

- First, consider the context and engage health care personnel who are at the point of care in selecting and prioritizing patient safety initiatives, clearly communicating the evidence base (strength and type) for the patient safety practice topic(s) and the conditions or setting to which it applies. These communication messages need to be carefully designed and targeted to each stakeholder user group.
- Second, illustrate, through qualitative or quantitative data (e.g., near misses, sentinel events, adverse events, injuries from adverse events), the reason the organization and individuals within the organization should commit to an evidence-based safety practice topic. Clinicians tend to be more engaged in adopting patient safety initiatives when they understand the evidence base of the practice, in contrast to administrators saying, “We must do this because it is an external regulatory requirement.” For example, it is critical

to converse with busy clinicians about the evidence-based rationale for doing fall-risk assessment, and to help them understand that fall-risk assessment is an external regulatory agency expectation because the strength of the evidence supports this patient safety practice.

- Third, didactic education alone is never enough to change practice; one-time education on a specific safety initiative is not enough. Simply improving knowledge does not necessarily improve practice. Rather, organizations must invest in the tools and skills needed to create a culture of evidence-based patient safety practices where questions are encouraged and systems are created to make it easy to do the right thing.
- Fourth, the context of EBP improvements in patient safety need to be addressed at each step of the implementation process; piloting the change in practice is essential to determine the fit between the EBP patient safety information/innovation and the setting of care delivery. There is no one way to implement, and what works in one agency may need modification to fit the organizational culture of another context.
- Finally, it is important to evaluate the processes and outcomes of implementation. Users and stakeholders need to know that the efforts to improve patient safety have a positive impact on quality of care. For example, if a new barcoding system is being used to administer blood products, it is imperative to know that the steps in the process are being followed (process indicators) and that the change in practice is resulting in fewer blood product transfusion errors (outcome indicators).

Research Implications

Translation science is young, and although there is a growing body of knowledge in this area, we have, to date, many unanswered questions. These include the type of audit and feedback (e.g., frequency, content, format) strategies that are most effective, the characteristics of opinion leaders that are critical for success, the role of specific context variables, and the combination of strategies that are most effective. We also know very little about use of tailored implementation interventions, or the key context attributes to assess and use in developing and testing tailored interventions. The types of clinical reminders that are most effective for making EBP knowledge available at the point of care require further empirical explanation. We also know very little about the intensity and intervention dose of single and multifaceted strategies that are effective for promoting and sustaining use of EBPs or how the effectiveness differs by type of topic (e.g., simple versus complex). Only recently has the context of care delivery been acknowledged as affecting use of evidence, and further empirical work is needed in this area to understand how complex adaptive systems of practice incorporate knowledge acquisition and use. Lastly, we do not know what strategies or combination of strategies work for whom, in what context, why they work in some settings or cases and not others, and what is the mechanism by which these strategies or combination of strategies work.

This is an exciting area of investigation that has a direct impact on implementing patient safety practices. In planning investigations, researchers must use a conceptual model to guide the research and add to the empirical and theoretical understanding of this field of inquiry. Additionally, funding is needed for implementation studies that focus on evidence-based patient safety practices as the topic of concern. To generalize empirical findings from patient safety implementation studies, we must have a better understanding of what implementation strategies work, with whom, and in what types of settings, and we must investigate the underlying

mechanisms of these strategies. This is likely to require mixed methods, a better understanding of complexity science, and greater appreciation for nontraditional methods and realistic inquiry.[87]

Conclusion

Although the science of translating research into practice is fairly new, there is some guiding evidence of what implementation interventions to use in promoting patient safety practices. However, there is no magic bullet for translating what is known from research into practice. To move evidence-based interventions into practice, several strategies may be needed. Additionally, what works in one context of care may or may not work in another setting, thereby suggesting that context variables matter in implementation.[80]

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Search Strategy

Several electronic databases were searched (MEDLINE®, CINAHL®, PubMed®) using terms of evidence-based practice research, implementation research, and patient safety. (The terms "quality improvement" or "quality improvement intervention research" were not used.) The Cochrane Collaboration–Cochrane Reviews was also searched to look for systematic reviews of specific implementation strategies, and the *Journal of Implementation Science* was also reviewed. I also requested the final reports of the TRIP I and TRIP II studies funded by AHRQ. Classic articles known to the author were also included in this chapter (e.g., Locock et al.[123]).

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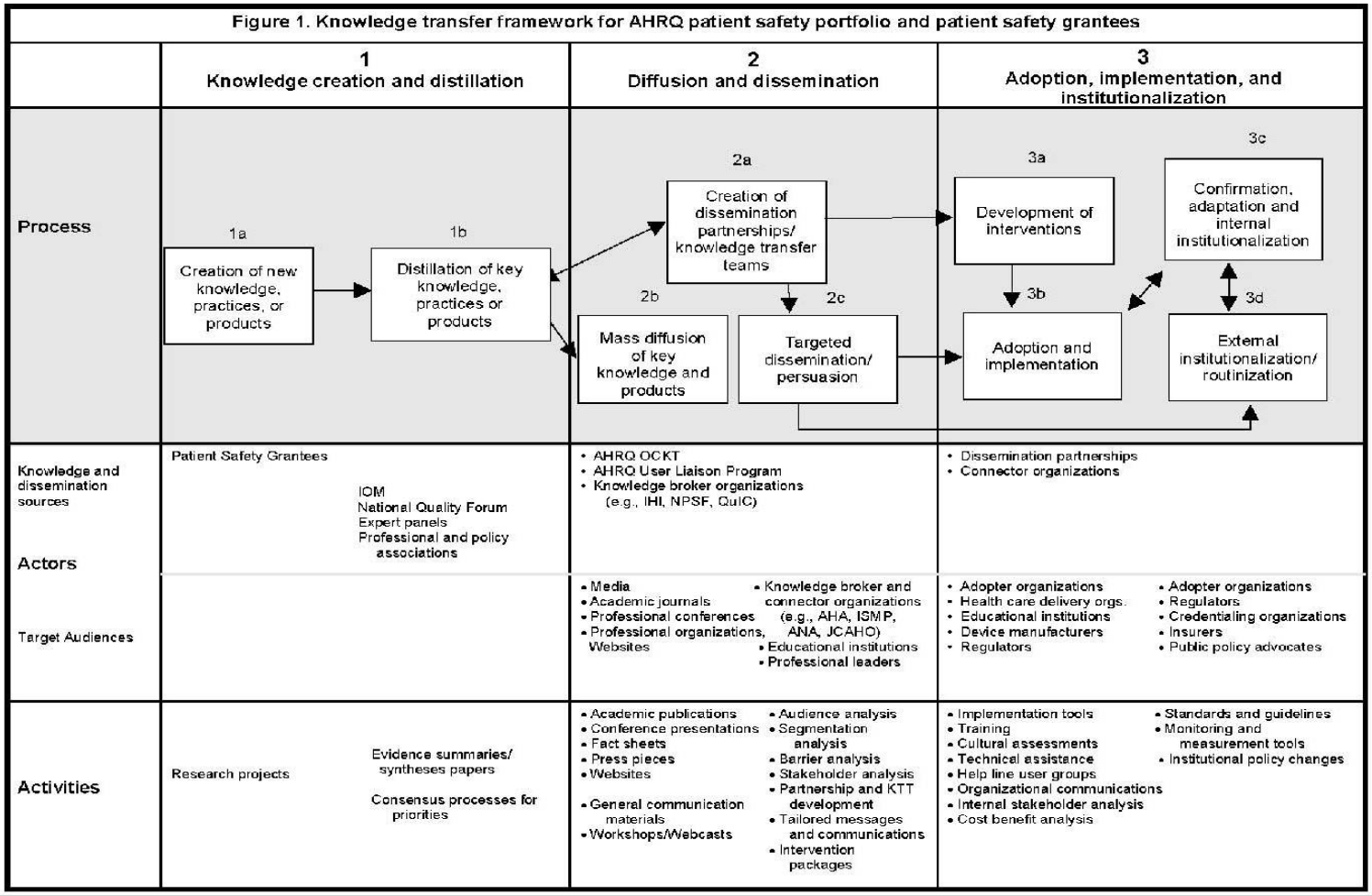
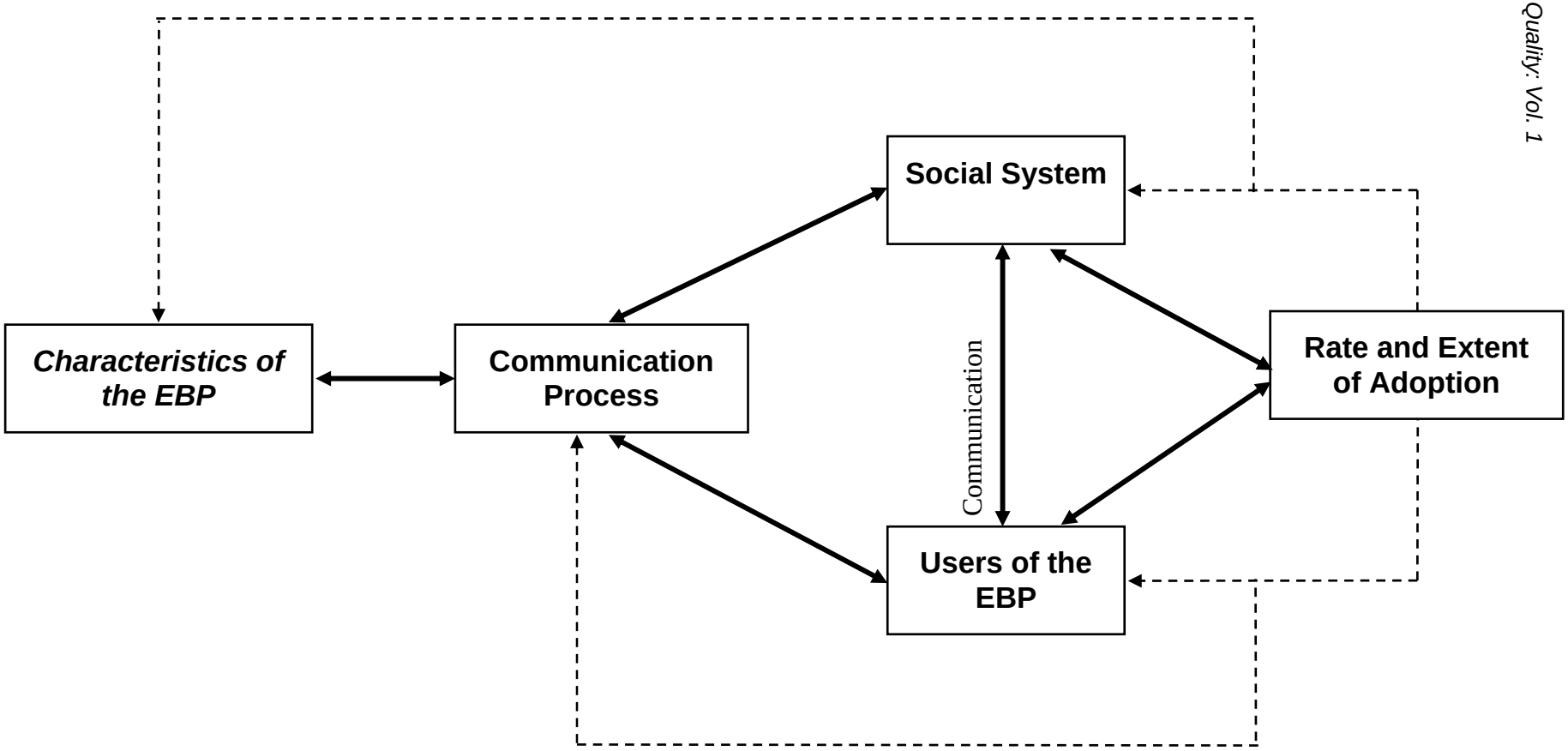
Figure 1. AHRQ Model of Knowledge Transfer



Adapted from Nieva, V., Murphy, R., Ridley, N., et al.[37] Used with permission. http://www.ahrq.gov/qual/advances/

Figure 2.* Implementation Model

Redrawn from Rogers EM. Diffusion of innovations. 5th ed. New York: The Free Press; 2003; Titler MG, Everett LQ. Translating research into practice: considerations for critical care investigators. Crit Care Nurs Clin North Am 2001a;13(4):587-604. (Copyright of this model retained by Marita Titler.)



Evidence Table. Evidence-Based Practice in Nursing

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Berner 2003[121]	Local opinion leaders.	Group randomized controlled trial (RCT). Evidence level 2.	RCT 3 study arms: no intervention, traditional health care QI; opinion leader (OL) plus QI (level 2). Outcomes = 6 evidence-based quality indicators for 1994 unstable angina guidelines (level 2).	Hospitals in Alabama. Patients admitted to an Alabama hospital during 1997–98 (baseline) and 1999–2000 (followup) with ICD-9 CM codes of unstable angina, angina pectoris, coronary artery disease, and chest pain unspecified. Mean age of patients was >70 years of age.	Peer nominated opinion leader added to a Centers for Medicare and Medicaid Services (CMS) QI intervention.	OL treatment effects (over QI group) found for antiplatelet medication within 24 hours and heparin use (2 of 5 indicators).

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Bootsmiller 2004[103]	Assess the implementation methods for 4 clinical practice guidelines (CPGs) in the VA health care system.	Retrospective cohort study. Evidence level 5.	Survey methods with questionnaire sent to 416 quality managers, primary care administrators, or others involved with guideline implementation in primary care at 143 VA medical centers with primary care clinics (level 9). Modified Dillman method was used. Outcomes: methods used to implement guidelines (level 4).	Primary care clinics of VA medical centers. Study population is individual responsible for guideline implementation. 242 surveys returned from 130 hospitals. CPGs were chronic obstructive pulmonary disease (COPD), diabetes, heart failure, and major depressive disorder.	Total number of interventions used were counted and type of interventions used to implement CPGs were categorized as consistently effective, variably effective, and minimally effective, based on Bero's categories: Consistently effective: - Forms created/revised - Computer interactive education - Internet discussion groups - Responsibilities of nonphysicians changed academic detailing Variably effective: - CPG workgroup - Clinical meetings to discuss CPG Minimally effective: - Providers receive brief summary - Providers receive CPG - Providers receive pocket guide - Storyboards - Instructional tape of CPG - Grand rounds	Commonly used approaches were clinical meetings to discuss guidelines (variably effective/Bero's classification), provider receipt of brief summary (minimally effective classification), forms created or revised (consistently effective classification), responsibilities of nonphysicians revised (consistently effective classification). Most facilities used 4–7 approaches. Consistently and minimally effective approaches were used most frequently. Strategies used together almost always included one consistently effective approach.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Bradley 2004[60]	Describe the implementation process for the Hospital Elder Life Program (HELP)—an evidence-based program for improving care of older patients.	Descriptive prospective study.	Qualitative analyses of implementation process at the beginning of implementation and every 6 months for up to 18 months.	8 hospitals implementing HELP. In-depth, open-ended interviews were conducted by telephone with physicians, nurses, volunteers, and administrative staff involved in the HELP implementation.		Major themes in implementing the HELP program were (1) gain internal support for the program, recognizing diverse requirements and goals; (2) ensure effective clinical leadership in multiple roles; (3) integrate with existing geriatric programs to foster coordination rather than competition; (4) balance program fidelity with hospital-specific circumstances; (5) document and publicize positive outcomes; (6) maintain momentum while changing practice and shifting organizational culture.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Bradley 2004[177]	Identify key themes about effective approaches for data feedback as well as pitfalls to avoid in using data feedback to support performance improvement efforts.	Retrospective cohort study. Evidence level 5.	Qualitative study with open-ended interviews of clinical and administrative staff at 8 hospitals representing a range of sizes, geographical regions, and beta-blocker use rate after AMI (level 9). Outcomes = key themes in use of data feedback.	8 hospitals. Interviewed physicians (n = 14), nurses (n = 15), quality management (n = 11), and administrative (n = 5) staff who were identified as key in improving care of patients with AMI.	Data feedback for improving performance of beta-blocker use after AMI.	7 major themes: Data must be perceived by physicians as valid to motivate change. It takes time to develop credibility of data within a hospital. The source and timeliness of the data are critical to perceived validity. Benchmarking improves the validity of the data feedback. Physician leaders can enhance the effectiveness of data feedback. Data feedback that profiles an individual physician's practices can be effective but may be perceived as punitive. Data feedback must persist to sustain improved performance. Effectiveness of data feedback might be intertwined with the organizational context, including physician leadership and organizational culture.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Carter 2005[61]	Evaluation of the relationship between physicians' knowledge of hypertension guidelines and blood pressure (BP) control in their patients.	Cross-sectional study	Cross-sectional study of physicians' knowledge about Joint National Committee (JNC) 7 hypertension guidelines (level 4). Outcomes were BP values of patients each physician treated.	Study setting was two academic primary care clinics located in the same academic medical center. The sample was 32 primary care physicians and 613 patients they treated. Mean age of physicians was 41 years (Standard Deviation [SD]. = 10.9), majority were men (66%).	Association between physician knowledge and BP control. Covariates of presence of diabetes, patient age.	There was a strong inverse relationship between BP control rates and correct responses by physicians on the knowledge test (r = -0.524; *p* = .002). Strong correlation was also found between correct responses on the knowledge survey and a higher mean systolic BP (r = 0.453; *p* = .009). When the covariates of patient age and diabetes were added to the model, there was no longer a significant association between physician knowledge and BP control. However, the correlation (in the multivariate model) was still in the same direction; for every 5 points better on the knowledge test, there was a 16% decrease in the rate of BP control (*p* = .13), and for every 10 years increase in patient age, there was a 16% decrease in BP control (*p* = .04).

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Chin 2004[62, 186]	To determine the additive effect of additional support for organizational change techniques and chronic care management as they are added to the Health Disparities Collaborative initiatives to improve diabetes care in community health centers.	RCT	34 centers were randomized to a standardized intensity arm (Health Disparities Collaborative initiatives) or high intensity arm. (level 2). Outcomes included process of care measures; laboratory values based on American Diabetes Association (ADA) recommendations; and patient surveys of satisfaction with provider's communication style and overall care, attitudes about interacting with providers, knowledge of ADA recommendations, and provider performance of key processes of care (levels 1 and 2).	34 community health centers from the Midwest or West Central clusters that participated in the 1998–99 or 1999–2000 Diabetes Collaborative of the Bureau of Primary Health Care in Improving Diabetes Care Collaboratively in the Community. These centers care for the medically underserved. In the standard arm, there were 843 patients at baseline and 665 in the followup standard intensity group. 993 patients were in the high intensity arm at baseline and 818 postinterventions high intensity group. Mean age of subjects ranged from 56 to 58, a majority were female, and white.	All 34 centers were community health centers that are overseen by the Bureau of Primary Health Care and had participated in the Health Disparities Collaborative to improve diabetes care. Interventions included forming a QI team, adoption of the Plan-Do-Study-Act (PDSA) cycle for QI, learning sessions, data feedback, monthly teleconferences, and regional meetings over a year. The centers randomized to the standard intensity arm continued to receive quarterly data-feedback reports, conference calls with other centers, and a yearly in-person meeting with other health centers. The high intensity sites received the standard intensity interventions plus additional support in organizational change strategies, chronic care management, and strategies to engage patients in behavioral change designed to get them to be more active in their care.	Centers in the high intensity arm showed higher rates of Hgb A1c and urine microalbumin assessment, eye exam, foot exam, dental referral, and increased prescription of home glucose monitoring postintervention as compared to the standard intensity arm. No significant differences by treatment arm were noted for patient survey data.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Davey 2005[187]	To estimate the effectiveness of persuasive interventions, restrictive interventions, and structural interventions (alone or in combination) in promoting prudent antibiotic prescribing to hospital inpatients.	Systematic literature review. Evidence level 1. (Table 3.1)	RCTs, quasi-randomized controlled trials, controlled before and after studies, and interrupted time series studies (levels 2 and 3). Outcomes were appropriate antibiotic prescribing and patient outcomes, including length of stay, inpatient mortality, and 28-day mortality (levels 1 and 2).	66 studies (43 interrupted time series studies, 13 RCTs, 6 controlled before/after studies, 2 controlled clinical trials, 1 cluster clinical trial, 1 cluster randomized trial. The majority of studies (42) were from the United States. Study participants were health care professionals who prescribe antibiotics to hospitalized inpatients receiving acute care.	Interventions were categorized as persuasive interventions (distribution of educational materials; local consensus process; educational outreach visits; local opinion leaders; reminders provided verbally, on paper, or via the computer; audit and feedback), restrictive interventions (formulary restrictions, prior authorization requirements, therapeutic substations, automatic stop orders and antibiotic policy changes), and structural (changing from paper to computerized records, introduction of quality monitoring mechanisms).	A wide variety of interventions has been shown to be effective in changing antibiotic prescribing for hospitalized patients. Restrictive interventions have a greater immediate impact than persuasive interventions, although their impact on clinical outcomes and long-term effects are uncertain.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Estabrooks 2004[20]	To map research utilization as a field of study in nursing and identify the structure of this scientific community, including the current network of researchers.	Systematic literature review.	Bibliometric analysis to map the development and structure of the field. Outcomes were journal patterns of publication, country patterns of publication, author patterns of publication, references per article, co-occurrence of words, citation patterns, interdisciplinary flow of information, within field diffusion of information.	630 articles (350 opinion articles, 65 conceptual articles, 112 research utilization studies, 103 research articles) published in 194 different journals.	Article location and data abstraction up to 2001/2002.	On the basis of co-citation, scholars at the core of the field are Horsley, Stetler, Fun, Titler, and Goode. The field has attained a critical mass of nurse scholars and scholarly works as demonstrated by more than 60% of the references in articles are to research by nurses. Emergence of interdisciplinary collaborative groups in this field is yet evolving.
Feldman 2005[64] Murtaugh 2005[77]	Tested a basic and an augmented e-mail reminder to improve evidence-based care of individuals with heart failure (HF) in home health care settings.	RCT. Evidence level 2 (Table 3.1)	Prospective randomized trail with 3 groups (control, basic e-mail reminder, augmented e-mail reminder). Outcome measures were nursing practices and patient outcomes. Level 1 outcomes.	Older adults with heart failure (n = 628; $\bar{x}$ age = 72) and nurses (n = 354; $\bar{x}$ age = 43.6; 93% female) caring for those patients. Home health care agency in a large urban setting.	Basic e-mail reminder upon patient admission to the nurses' care that highlighted 6 HF-specific clinical practices for improving patient outcomes. Augmented intervention included basic e-mail reminder plus package of material for care of HF patient (medication management, prompter card for improving communication with physicians, self-care guide for patients) and followup outreach by a clinical nurse specialist (CNS) who served as an expert peer.	Basic and augmented intervention significantly improved delivery of evidence-based care over control group; augmented intervention improved care more than basic intervention.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Foxcroft and Cole 2000[188]	Organizational infrastructures to promote evidence-based nursing practice.	Systematic literature review.	RCT, controlled clinical trial, and interrupted time series (levels 2, 3, 7). Unit of intervention was organizational, comprising nurses or groups of professionals including nurses. Outcomes = objective measures of evidence-based practice (levels 1 and 2).	121 papers were identified as potentially relevant, but no studies met the inclusion criteria. After relaxing the criteria, 7 studies were included and all used a retrospective case study design (15).	Entire or identified component of an organizational infrastructure to promote effective nursing interventions.	No high-quality studies that reported the effectiveness of organizational infrastructure interventions to promote evidence-based nursing practice were identified. Conceptual models that were assessed positively against criteria are briefly included in this review.
Greenhalgh 2005[22]	Diffusion, spread, and sustainability of innovations in the organization and delivery of health services.	Systematic literature review. Evidence level 1 (Table 3.1).	Metanarrative review.	Comprehensive report of factors and strategies to promote use of innovations in health care services.	7 key topic areas addressed: characteristics of the innovation, adoption by individuals, assimilation by organizations, diffusion and dissemination, the inner context, the outer context, implementation and routinization.	Complex process requiring multiple strategies. Excellent resource of scholarly work in knowledge transfer and innovation adoption.

Source	**Issue Related to EBP**	**Design Type***	**Study Design & Study Outcome Measure(s)**	**Study Setting & Study Population**	**Study Intervention**	**Key Findings**
Grilli 2002[120]	Assess the effect of mass media on use of health services.	Systematic literature review. Evidence level 1 (Table 3.1).	RCTs, controlled clinical trials, controlled before-and-after studies, and interrupted time series analysis (levels 2, 3, 4). Outcomes were objective measures of health services (drugs, medical or surgical procedures, diagnostic tests) by professionals, patients, or the public.	26 papers reporting 20 time series and on controlled before-and-after study met the inclusion criteria.	All studies relied on a variety of media, including radio, TV, newspapers, posters, and leaflets. To meet inclusion criteria, studies had to use mass media, be targeted at the population level, and aimed to promote/discourage use of evidence-based health care interventions or change public lifestyle.	Mass media campaigns have a positive influence upon the manner in which health services are used. Mass media have an important role in influencing use of health care interventions. Mass media campaign is one of the tools that may encourage use of effective services and discourage those of unproven effectiveness.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Grimshaw 2004[144] Grimshaw 2006[65]	Assessment of the effectiveness of guideline dissemination and implementation strategies.	Systematic literature review. Evidence level 1 (Table 3.1).	RCTs, controlled clinical trials, controlled before-and-after studies, interrupted time series from 1966 to 1998 (levels 2, 3, 4). Outcomes were objective measures of provider behavior and/or patient outcomes (levels 1, 2).	Studies of guidelines aimed at medically qualified professionals. (Studies on guidelines aimed at multiple professionals were included only if results for medical professionals were reported separately or if medical professionals represented more than 50% of the targeted population.) The review included 110 clustered RCTs, 29 patient RCTs, 7 clustered controlled clinical trials, 10 patient controlled clinical trials, 40 controlled before-and-after studies, and 39 interrupted time series designs. The most common setting was primary care (39%) followed by inpatient settings (19%) and generalist ambulatory settings (19%). Other studies addressed settings across sites of care or were in a variety of other types of settings (e.g., nursing homes).	Interventions were educational materials, educational meetings, educational outreach, consensus, opinion leaders, patient-directed interventions, audit and feedback, reminders, other professional (marketing, mass media), financial interventions, organizational interventions, structural interventions, and regulatory interventions. Studies compared single interventions to no intervention, multifaceted interventions to no intervention, or a control receiving one or more single intervention. This systematic review compared findings from studies with a single intervention against a "no-intervention" control group; single interventions against an "intervention" control group; multifaceted interventions against "no-intervention" control group (7 different types of comparisons); multifaceted interventions against intervention controls (4 different types of comparisons). A total of 309 comparisons were done. This systematic review also includes economic evaluations and cost analysis.	This is a comprehensive review of implementation strategies. The reader is referred to the technology report, as a comprehensive summary of findings is beyond the scope of this chapter. Overall findings include: the overall quality of studies were poor; the majority of comparisons (86.6%) observed improvements in care; reminders are a potentially effective intervention and are likely to result in moderate improvements in care processes; educational outreach may result in modest improvements in processes of care; educational materials and audit and feedback appeared to result in modest improvements in care; multifaceted interventions did not appear to be more effective than single interventions; multifaceted interventions did not appear to increase with the number of

Source	**Issue Related to EBP**	**Design Type***	**Study Design & Study Outcome Measure(s)**	**Study Setting & Study Population**	**Study Intervention**	**Key Findings**
Grimshaw 2006[124]	Examine the feasibility of identifying opinion leaders using a sociometric instrument (frequency of nomination of an individual as an OL by the responder) and a self-designating instrument (tendency for others to regard them as influential).	Cross-sectional study. Evidence level 5 (Table 3.1).	Survey. Mailed questionnaires of different professional groups. Outcomes = general and condition-specific opinion leader types classified as sociometric OLs and self-designated OLs (level 2 outcomes).	All general practitioners, practice nurses, and practice managers in two regions of Scotland. All physicians and surgeons and medical and surgical nursing staff in two district general hospitals and one teaching hospital in Scotland as well as Scottish obstetric and gynecology, and oncology consultants.	None	The self-designating instrument identified more OLs. OLs appear to be condition specific.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Horbar 2004[66]	To evaluate a coordinated, multifaceted implementation intervention designed to promote evidence-based surfactant therapy.	Clustered randomized trial.	Cluster randomized trial with randomization at the hospital level (level 2). Outcomes were proportion of infants receiving their first dose of surfactant in the delivery room, proportion of infants treated with surfactant who received their fist dose more than 2 hours after birth, and time after birth at which the first dose of surfactant was administered; proportion of all infants who developed a pneumothorax, and proportion of all infants who died prior to discharge (levels 1 and 2).	114 hospitals with membership in the Vermont Oxford Network, not participating in a formal quality improvement collaborative, with the majority of infants born in the hospital rather than transferred in and born in 1998 and 1999; received the first dose of surfactant within 15 minutes after birth. Subjects were high-risk preterm infants 23 to 29 weeks gestational age. The intervention group had 3,313 neonates and 2,726 in the comparison group.	The multifaceted 18-month intervention included quarterly audit and feedback of data, evidence reviews, an interactive 3-day training workshop, and ongoing support to participants via conference calls and e-mail discussion.	The proportion of infants 23 to 29 weeks gestational age receiving surfactant in the delivery room was significantly higher in the intervention than the control group for all infants (OR = 5.38). Those who received surfactant more than 2 hours after birth was significantly lower in the intervention than control group (OR = 0.35). There were no significant differences in rates of mortality or pneumothorax between groups. Infants in the intervention group received their first dose of surfactant significantly sooner after birth with a median time of 21 minutes as compared to 78 minutes in the control group ($p <$ .001).

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Hysong 2006[67]	Exploratory study of how high-performing facilities and low-performing facilities differ in the way they use clinical data for feedback purposes.	Cross-sectional study.	Descriptive, qualitative, cross-sectional study. Subjects were interviewed using a semistructured interview format (level 4). Outcomes were participant responses to questions asking how CPGs were currently implemented at their facility, including strategies, barriers, and facilitators.	Study setting was 6 VA medical settings (from a pool of 15) ranked as high performing (n = 3) and low performing (n = 3) organizations with respect to 20 indicators for 6 chronic conditions treated in outpatient settings. 102 employees across 6 facilities were the subjects. Within each facility, facility leadership (n = 25), middle management (n = 34), and outpatient clinic personnel (n = 33) were interviewed.	No study intervention, but transcripts were analyzed using grounded theory, and passages that specifically addressed feedback of data were included in the analyses.	High-performing institutions provided timely, individualized, nonpunitive feedback to providers, whereas low performers were more variable in their timeliness and nonpunitiveness and relied more on standardized, facility-level reports. The concept of actionable feedback emerged as the core concept around which timeliness, individualization, nonpunitiveness, and customizability are important.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Irwin & Ozer 2004[68] Ozer 2005[189]	To determine if a systems intervention for primary care providers resulted in increased preventive screening and counseling of adolescent patients compared to usual care.	Controlled trial.	2 intervention outpatient pediatric clinics and 2 comparison outpatient pediatric clinics in the same health system were used to test the intervention. Level 3. Outcomes were adolescent reports of whether their provider screened and counseled them for risky behavior (tobacco, alcohol, drugs, sexual behavior, and safety—helmet and seatbelt use). Level 2.	4 outpatient pediatric clinics within Kaiser Permanente, Northern California. 76 clinicians were in the study (37 in each treatment arm). Adolescent reports of provider behavior—across all phases of the study, the intervention sample size was 1,717, and the comparison sample size was 911. Mean age of adolescents was 14.8 years (SD = 1.34). Data were collected from adolescents at baseline, following training, and following forms implementation.	The intervention was 2 phases. First phase was an 8-hour clinician training in adolescent preventative services based on social cognitive theory, including didactic education, discussions, demonstration role plays, and interactive role-plays at each intervention site (4 months). Second phase was implementation of screening and chart forms customized for this study (4 months). All clinicians participated in the training and the tools were implemented on a clinic-wide basis. Local opinion leaders were integrally involved in the intervention.	Average baseline screening rates in the intervention group ranged from 42% for helmet use to 71% for tobacco use. Following training, screening rates increased significantly across all 6 target areas, ranging from 70% for helmet use to 85% for tobacco use, and remained constant during the posttools implementation phase. Counseling rates followed a similar pattern. By comparison, screening and counseling rates in the comparison group tended to remain stable across all 3 data collection points. Screening and counseling rates were significantly higher in the intervention group than the comparison group after the full implementation of the intervention; screening and counseling rates were significantly higher in the intervention than the comparison group after the training component of the intervention; screening and counseling rates

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Jacobson 2005[69]	Assessment of the effectiveness of patient reminder and patient recall systems in improving immunization rates.	Systematic literature review. Evidence level 1 (Table 3.1).	RCTs, controlled before-and-after studies, and interrupted time series (levels 2 and 3). Outcomes were immunization rates or the proportion of the target population up to date on recommended immunizations.	43 studies. Approximately three-fourths of the studies were conducted in the United States. The majority of the studies were RCTs. Studies included children and adults and a variety of settings.	Reminder methods and recall systems included letters to patients, postcards, person-to-person telephone calls, autodialer, postcard and phone combination, and tracking and outreach.	Patients receiving patient reminder and recall interventions were more likely to have been immunized or up to date on immunizations (OR = 1.70). All types of reminders and recall were found to be effective, with increases in immunization rates on the order of 5%–20%. Person-to-person telephone reminders were the most effective single approach (OR = 1.92). Letter reminders were similar to phone reminders in effectiveness (OR = 1.89). Reminder and recall interventions were effective for children and adults in all types of settings.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Jamtvedt 2006[70]	Use of audit and feedback to improve professional practice.	Systematic literature review. Metaregression along with visual and qualitative analyses. Evidence level 1 (Table 3.1).	Randomized trails (level 2). Outcome measures = noncompliance with guideline recommendations (level 2).	85 studies. 53 trials in North America, 16 in Europe, 8 in Australia, 2 in Thailand, 1 in Uganda. In most trials, the professionals were physicians; in 2 studies the providers were nurses, and 5 involved mixed providers.	Audit and feedback defined as any summary of clinical performance of health care over a specified period of time, delivered in written, electronic, or verbal format.	Audit and feedback can be effective in improving professional practice with effects generally moderate. Absolute effects of audit and feedback are more likely to be larger when baseline adherence to recommended practice is low. Audit and feedback should be targeted where it is likely to effect change.
Jones 2004[71]	Improvement of pain practices in nursing homes.	Clustered RCT. Evidence level 2 (Table 3.1).	An intervention study to improve pain practices (RCT). The intervention was implemented in 6 nursing homes (level 2). Outcomes = pain knowledge and attitudes of staff; pain assessment and treatment decisions based on 2 short case studies; barriers to effective pain management. Outcomes measured from questionnaires distributed to nurses and nursing assistants (level 3).	12 long-term care sites in Colorado—6 in urban sites and 6 in rural sites. Nursing homes ranged in size from 65 to 150 beds.	Education for staff; resident educational video; designation of a 3-member internal pain team; pain vital sign; site visits with discussion of feedback reports; pain rounds and consultations. Implementation phase lasted 9 months.	No significant treatment effect for staff knowledge or staff attitudes; staff in the treatment group were 2.5 times more likely to chose an aggressive pain management strategy than those in the control group (p = .002); no significant treatment effect for decreasing barriers to pain management.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Katz 2004[72,98]	Testing an intervention to improve use of EBP smoking cessation guidelines.	RCT with randomization at the clinic level. Evidence level 2 (Table 3.1).	Prospective randomized trial of 8 primary care clinics in southern Wisconsin (level 2). Outcomes included staff performance and patient quit rates (levels 1 and 2).	8 community-based clinics (6 family practice, 2 internal medicine).	Multimodality intervention (5 components—didactic and interactive education of staff, modified vital signs stamp imprinted on each encounter form, offering nicotine patches and telephone counseling, group and confidential individual feedback to providers on whether clinicians had assessed smoking status and provided cessation counseling as needed) to implement AHRQ smoking cessation guideline.	Quit rates higher in experimental (E) sites at 2 and 6 months. Percentage of patients advised to quit smoking higher at E sites than control (C) sites.
Levine 2004[73]	Test a nurse-administered, protocol-driven model for comprehensive preventive services in a low-income outpatient setting. Focus was on preventive services as recommended by the U.S. Preventive Services Task Force (USPSTF).	Controlled trial.	Controlled comparison using a convenience sample of patients within a single practice (n = 987) and a usual care group (n = 666) obtained from a random sample of households from the postal zip codes served by the same practice (level 3). Outcomes were percentage of preventive services initiated in the treatment arm versus the comparison arm (level 1).	Primary care single practice with internal medicine, family medicine, and pediatric clinics. Patients receiving care in this clinic between January and September 2001. Children = 514 (about 170 in each of 3 age groups: 0–2, 3–7, 8–17; 63% African American). Adults = 473 (about 170 in each age group 18–49 and 50–64; 130 in 65 or older; 76% African American).	Offer all identified preventive services that are needed using a nursing model under the guidance of a protocol agreed upon by the medical staff.	Use of a nursing protocol for USPSTF recommendations was associated with a significantly higher percentage of preventive services initiated (99.6%) in the experimental arm as compared to usual care group (18.6%) ($p < .001$).

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Locock 2001[123]	Role of opinion leader in innovation and change.	Systematic literature review.	Case studies using principally qualitative methods. Outcomes = effectiveness of opinion leaders in promoting change/adoption of evidence-based practices (level 2.)	Variety of acute care and primary care settings. Evaluation of PACE project[100] and Welsh Clinical National Demonstration Project.	Local opinion leaders defined as those perceived as having particular influence on the beliefs and actions of their colleagues, either positive or negative.	Both expert and peer opinion leaders have important and distinct roles to play in promoting adoption of EBPs. Opinion leadership is part of a wider process that cannot be understood in isolation of other contextual variables with which it may interact. The value of the expert opinion leader is in the initial stages of getting an idea rolling, endorsing the evidence, and translating it into a form that is acceptable to practitioners and takes account of their local experience. Peer opinion leader influence seems to be important in mainstream implementation, providing a role model for fellow practitioners and building their confidence. The local context may modify or magnify the opinion leader influence.

Source	**Issue Related to EBP**	**Design Type**[*]	**Study Design & Study Outcome Measure(s)**	**Study Setting & Study Population**	**Study Intervention**	**Key Findings**
Loeb 2004[74]	To test the effect of a multifaceted implementation intervention for safely reducing antimicrobial prescriptions for suspected urinary tract infections in nursing home residents.	Cluster RCT.	The study design was randomization of 24 nursing homes to an intervention group or a usual care group (level 2). Main outcome measures were antimicrobials prescribed for urinary infections, total antimicrobials, hospitalizations, and deaths (level 1).	Free standing, community-based nursing homes with 100 or more beds in Hamilton, Ontario, region and Boise, Idaho, region were sites for the study. The numbers of residents were 2,156 in the intervention arm and 2,061 in the comparison arm.	Implementation of algorithms for diagnostic testing and antibiotic prescribing developed from research findings. Implementation strategies included interactive education with nurses, one-on-one meeting with physicians that see more than 80% of the patients, written materials, real-time paper reminders, and quarterly outreach visits targeted to nurses and physicians.	The rate of antimicrobial use for suspected urinary infections was significantly lower in the treatment arm (1.17 courses of antimicrobials per 1,000 resident days) as compared to the comparison arm (1.59 per 1,000 patient days) (P = .03). The proportion of antimicrobials prescribed for suspected urinary infections were lower in the intervention arm than the comparison arm (P = .02). There was no significant difference for total antimicrobial use, rate of urine cultures obtained, overall hospitalization, or mortality.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Lozano 2004[174]	To test the effectiveness of 2 implementation interventions in reducing asthma symptom days as compared to usual care.	Cluster RCT.	RTC. Outcomes were annualized asthma symptom days, asthma-specific functional health status, and frequency of brief oral steroid bursts (level 1).	42 primary care practices in 3 locales and targeted 3–17-year-old children with mild to moderate persistent asthma enrolled in practices affiliated with man-aged care organizations. Among the 638 patient subjects, the mean age was 9.4 years (SD = 3.5); the majority were white (66%) and boys (60%).	3 treatment arms were usual care, provider (MD, PA, NP) oriented strategy of targeted education through an on-site peer leader, and an organizational approach that combined the provider education with a nurse-run intervention (planned care arm) to better organize chronic asthma care in the primary care practice.	Children in the planned care arm had 13.3 fewer symptoms annually (P = .02) and 39% lower oral steroid burst rate per year relative to usual care (P = .01). Those in the peer leader arm showed a 36% decrease in annualized steroid bursts per year as compared to usual care (P = .008). Improvements in asthma-specific functional status were also found for both the peer leader and planned care arm as compared to usual care.
McDonald 2005[75]	Testing of 2 computer-based reminder interventions designed to promote evidence-based pain management practices among home care nurses.	RCT. Evidence level 2 (Table 3.1).	Nurses were randomly assigned to one of 3 treatment groups (control, basic e-mail reminder, augmented e-mail reminder). Outcomes = pain management practices of nurses and patient's pain (levels 1 and 2).	Home health care. Nurses were mostly female (> 90%) with an average age of 43.3 years.	Basic e-mail reminder that focused on 6 key practices (2 treatment arms) was sent to nurse every time an eligible cancer patient with pain was admitted to his/her care. Nurses in the augmented intervention group also received provider prompts, patient education material, and CNS outreach.	Nursing pain management practices did not differ significantly among the groups (P < .05), but pain levels were lower in the 2 treatment groups as compared to the control group. Patients treated by nurses in the augmented group had a 25% reduction in the probability of hospitalization.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
O'Brien 1997[119]	Assess the effect of outreach visits on improving professional practice or patient outcomes.	Systematic literature review. Evidence level 1 (Table 3.1).	Randomized trials (level 2). Outcomes of provider performance (level 2).	18 trials. Providers were mainly primary care physicians practicing in community settings. In 13 trials the behaviors were prescribing practices. 10 trials in North America, 4 in Europe, 2 in Indonesia, and 2 in Australia.	Outreach visits defined as use of a trained person who meets with providers in their practice settings to provide information with the intent of changing provider's performance. The information may include feedback about performance.	Positive effects on practice were observed in all studies. Only 1 study measured a patient outcome. Educational outreach visits, particularly when combined with social marketing, appear to be a promising approach to modifying health professional behavior, especially prescribing. Further research is needed to identify key characteristics of outreach visits important to success.
O'Brien 1999[116]	Assessment of the use of local opinion leaders on the practice of health professionals or patient outcomes.	Systematic literature review. Evidence level 1 (Table 3.1).	RCTs (level 2). Outcomes were objectively measured provider performance in a health care setting or health outcomes (levels 1 and 2).	Focus was on health care providers responsible for patient care.	Use of providers nominated by their colleagues as educationally influential. 8 studies met inclusion criteria. A variety of patient problems were targeted.	In 3 trials that measured patient outcomes, 1 achieved an impact on practice. Only 2 trials provided strong evidence for improving performance of health care providers. Local opinion leaders may be important change agents for some problems.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
O'Brien 2001[118]	Assess the effects of educational meetings on professional practice and health care outcomes.	Systematic literature review. Evidence level 1 (Table 3.1).	Randomized trials and well-designed quasi-experimental studies (levels 2 and 3). Outcomes were objectively measured health professional practice behaviors or patient outcomes in a setting where health care was provided (levels 1, 2, 3).	32 studies met inclusion criteria with 30 RCTs. 24 studies were in North America, 2 in the United Kingdom, and 1 each in Australia, Brazil, France, Indonesia, Sri Lanka, and Zambia. Most of the study participants were physicians; 4 included nurses, and 3 other health professionals.	The intervention was defined as continuing education: meetings, conferences, lectures, workshops, seminars, symposia, and courses that occurred off-site from the practice setting. Education was defined as didactic (predominately lectures with Q and A), or interactive (sessions that involved some type of interaction in small, moderate, or large groups). 7 studies were didactic and 25 were interactive. Duration and frequency of the intervention varied widely.	The few studies that compared didactic education to no intervention did not show an effect on professional practice. Studies that used interactive education were more likely to be effective in improving practice. Studies did not include information to determine what makes some interactive educational sessions more effective than others. Interactive workshops can result in moderately large changes in professional practice. Didactic education alone is unlikely to change professional practice.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Redfern 2003[79]	Evaluation of the South Thames Evidence-based Practice (STEP) project.	Pretest and posttest.	Each of the 9 projects followed a pretest/posttest design within a clinical audit framework over a period of 27 months (level 6). Outcomes = intermediate outcomes of uptake of change by staff and patient outcomes (levels 1 and 2).	9 projects that focused on improving evidence-based nursing practices. UK sites included acute care wards, community nursing services, and long-term care. Topics were leg ulcer management, breast-feeding, pressure ulcer care, nutrition in stroke patients (n = 2), Use of functional independence measure (FIM) assessment tool, assessment of continence, assessment and transfer of older adults on discharge from hospital, family therapy in schizophrenia.	A 2-week training program followed by 3 monthly seminars, staff training program, active support in the practice setting.	Intermediate outcomes improved in most projects; leaders' ratings of staff adherence were moderate or better in the majority of the projects; patient outcomes improved in most projects. Organizational factors were found to have a major impact on achieving successful change in practice. Having enough staff of the right skill mix, strong leadership, supportive managers and colleagues, and organizational stability are important to successful change. Project leaders and a credible change agent who works with practitioners face-to-face to encourage enthusiastic involvement are also important.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Shaw 2005[185]	Tailored interventions to address specific identified barriers to change in professional performance.	Systematic literature review with metaregression. Evidence level 1 (Table 3.1).	RCTs (level 2). Outcomes = professional performance, patient outcomes, or both (levels 1 and 2).	15 RCTs. 7 in primary care or community settings and health care professionals responsible for patient care. 10 in North America, 2 in the United Kingdom, 2 in Indonesia, and 1 in Norway.	An intervention was defined as tailored if it was chosen after identification of barriers and to overcome those barriers.	Results were mixed with variation in the direction and size of effect. The effectiveness of tailored interventions remains uncertain, and more rigorous trials including process evaluations are needed.
Titler 2006[81]	Testing a TRIP intervention for promoting adoption of evidence-based acute pain management practices for care of older adults hospitalized with hip fracture.	RCT with randomization at the clinic level. Evidence level 2 (Table 3.1).	Prospective randomized trial of 12 acute care hospitals in the Midwest United States (level 2). Outcomes included nurse and physician performance, patient pain levels, and cost effectiveness (levels 1 and 2).	12 large (n = 2), medium (n = 6), and small hospitals (n = 4) in the Midwest.	Multifaceted intervention that addressed the characteristics of the EBP, the users, the social context of care, and communication, based on Rogers' diffusion of innovation framework.	Acute pain management strategies improved more in the experimental than comparison group, and the TRIP intervention saved health care dollars.

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Wensing 2006[82]	Organizational strategies for improving professional performance, patient outcomes, and costs.	Systematic literature review. Evidence level 1.	A review of reviews that included RCTs, interrupted time series, controlled before/after studies, and prospective comparative observational studies (levels 2, 5, 6, 7). Outcomes = professional practice and patient outcomes (levels 1 and 2).	36 reviews were included. A taxonomy of organizational strategies to improve patient care was developed to organize findings.	Revision of professional roles, multidisciplinary teams, integrated care services, knowledge management, quality management.	Revision of professional roles can improve professional performance, while positive effects on patient outcomes remain uncertain. Multidisciplinary teams can improve patient outcomes but have primarily been tested in highly prevalent chronic diseases. Integrated care systems can improve patient outcomes and save costs; they have been extensively tested in highly prevalent chronic conditions. Professional performance and patient outcomes can be improved by implementation of computers in clinical practice settings (knowledge management). Effects of quality management on professional performance and patient outcomes remain uncertain. There is growing evidence of rigorous evaluations of organizational strategies, but the evidence underlying some strategies is limited; for no strategy can

Source	Issue Related to EBP	Design Type*	Study Design & Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Findings
Zwarenstein 2000[117]	Usefulness of interprofessional education (IPE) interventions on professional practice and health care outcomes.	Systematic literature review. Evidence level 1 (Table 3.1).	RCTs, controlled before-and-after studies, and interrupted time series studies (levels 2, 6, 7). Outcomes included health care outcomes (mortality rates, complication rates, readmission rates) and impact on professional practice (teamwork and cooperative practice) (levels 1 and 2).	89 studies were reviewed for possible inclusion, but none met the inclusion criteria.	An educational intervention during which members of more than one health and/or social care profession learn interactively together for the purpose of improving collaborative practice and/or the health of patients.	Despite finding a large body of literature on the evaluation of IPE, studies lacked the methodological rigor needed to understand the impact of IPE.

***Study design type:** Use the following numbers for categories to reference the specific type of evidence ("evidence level"):

1. Meta-analysis
2. Randomized controlled trials
3. Non-randomized trials
4. Cross-sectional studies
5. Case control studies
6. Pretest and post-test (before and after) studies
7. Time series studies
8. Noncomparative studies
9. Retrospective cohort studies
10. Prospective cohort studies
11. Systematic literature reviews
12. Literature reviews, nonsystematic/narrative
13. Quality improvement projects/research
14. Changing practice projects/research
15. Case series
16. Consensus reports
17. Published guidelines
18. Unpublished research, reviews, etc.