How Can We Increase Translation of Research into Practice? Types of Evidence Needed

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Abstract

This review summarizes key factors that have interfered with translation of research to practice and what public health researchers can do to hasten such transfer, focusing on characteristics of interventions, target settings, and research designs. The need to address context and to utilize research, review, and reporting practices that address external validity issues—such as designs that focus on replication, and practical clinical and behavioral trials—are emphasized.

Although there has been increased emphasis on social-ecological interventions that go beyond the individual level, interventions often address each component as if it were an independent intervention. Greater attention is needed to connectedness across program levels and components. Finally, examples are provided of evaluation models and current programs that can help accelerate translation of research to practice and policy.

INTRODUCTION

The gap between research and practice in many areas of health care and public health is large, well documented, and troubling (67). Discrepancies between evidence-based, efficacious interventions and what actually occurs in practice are frequently so large as to be labeled a "chasm" by the Institute of Medicine (55). These gaps occur across prevention and disease management behaviors, and across settings, conditions, and population groups (72). Well-publicized reports by RAND researchers have documented that on average just over half of recommended health care practices are implemented, and the situation may be even worse for prevention and health behavior change interventions (39, 72). Many practices have met the rigorous review standards of the U.S. Preventive Services Task Force and the Community Guide to Prevention Services, but few have been broadly or consistently implemented (39, 71).

BARRIERS TO TRANSLATION AND THE IMPORTANCE OF CONTEXT

Multiple, interacting reasons can be given for the general failure of health research findings to translate into practice (8, 51), including historical, political, social, economic, scientific, cultural, and organization factors that slow or impede transfer of research into practice (7, 51). Given space limitations, we focus on four categories of barriers to dissemination that are proximal to, and potentially able to be at least partially addressed by, public health researchers. These include characteristics of (*a*) the intervention, (*b*) the target settings, (*c*) the research or evaluation design, and (*d*) interactions among the first three categories. **Figure 1** provides examples of key issues within each category.

The first set of barriers under the control of program developers and researchers concerns the characteristics of interventions. In general, health education and health promotion programs that have proven efficacious have tended to be intensive and demanding of both staff and participants (23, 63, 105). Some threshold level of intensity of intervention is likely necessary, but program designers should be developing programs of the "minimal intensity needed for change" (R. Croyle, personal communication, 2003) rather than of maximum intensity. Otherwise, few practice settings will have the resources or staff expertise required, and a relatively small and unrepresentative proportion of patients are likely to volunteer. Health policies are a good example of interventions that are often of low intensity but can have broad reach and impact. For example, workplace smoking policies have been associated with higher rates of smoking cessation attempts, lower rates of relapse among those who do attempt to quit, and lower rates of smoking among those who continue to smoke (21). In addition, household smoking policies have been associated with less smoking initiation among adolescents, and working in a smoke-free workplace has been associated with substantially higher quit rates among adolescent smokers (22). The few reviews that have evaluated the relationship between program reach and efficacy have unfortunately tended to find inverse relationships between participation rates and magnitude of change among participants (37). One possible solution is to replace intensive intervention strategies with more extensive approaches that involve multiple contacts over time through use of lower cost strategies, such as mail, phone, or computer-based approaches. To our knowledge no one has directly compared these two approaches.

Some minimal level of intensity is likely required to produce a meaningful change, and going below this level may not be worthwhile in terms of resources expended. However, at this point there is no empirical evidence available to identify what that level is. While acknowledging the validity of Rose's theorem, which highlights the potentially greater impact of smaller change at the population level versus greater change among the highest risk

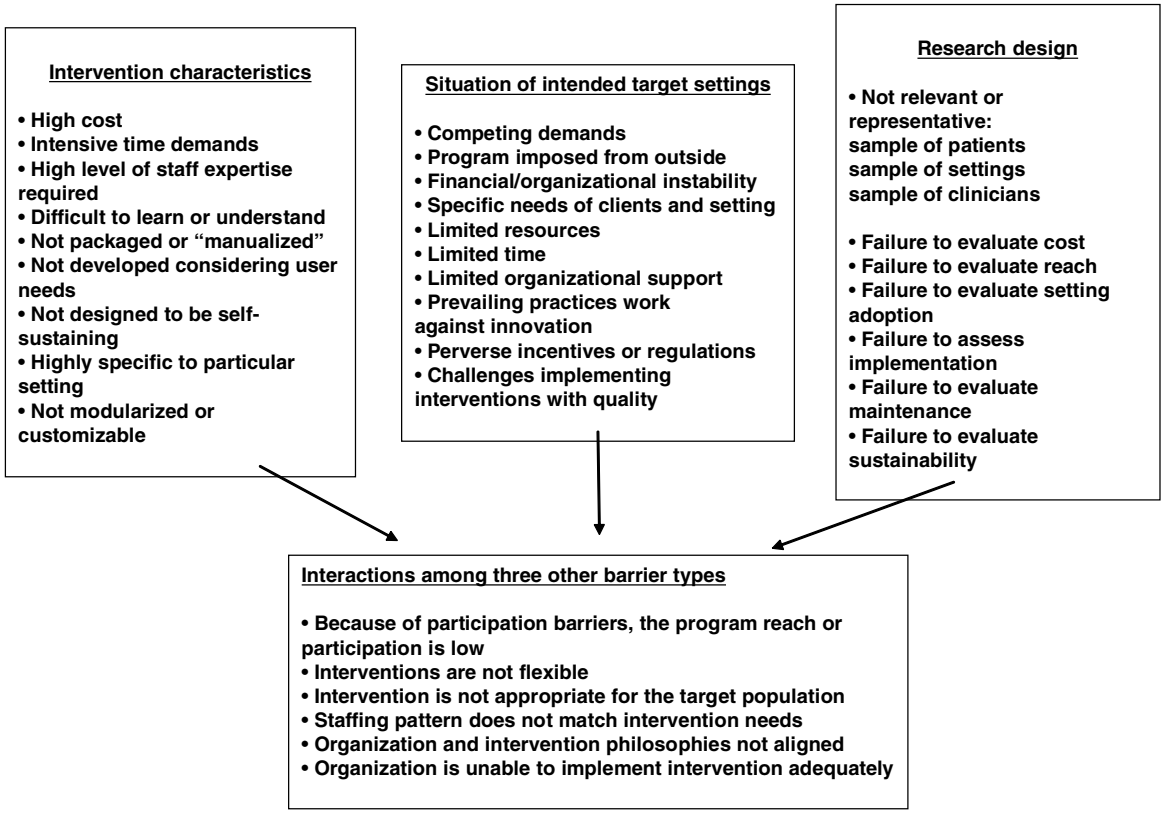

Figure 1

Factors that serve as barriers to dissemination of evidence-based interventions.

individuals (81), it is important to recognize that interventions that have broad reach but relatively low levels of success, such as physicians advising smokers to quit, can be discouraging for those delivering the intervention, even if at the population level those interventions have a public health impact. Funding agencies and grant reviewers must recognize the importance of funding research that investigates more efficient, generalizable interventions that have high potential for population-level impact. Intensive, costly interventions and highly selected participants are often required to produce large effect sizes, but they in turn reduce the generalizability of study findings and the likelihood of translation to nonresearch settings.

The top left section of **Figure 1** lists other issues related to program design. Two major and frequent barriers to translation are that (*a*) programs are not "packaged or manualized" so that they are straightforward to implement and (*b*) the implementation materials either do not permit any deviation from the original efficacy study protocol or do not describe what modifications are and are not permissible. We will likely never have head-to-head tests that will determine the impact of various modifications on outcomes, but process data can provide a valuable indication of the impact of different levels of implementation (95). Program designers should collect more process evaluation data that can be helpful in making recommendations about program modifications. For example, an effective intervention may have included group activities, but process evaluation data may reveal that only a very small percentage of participants ever attended

any sessions. Thus, in preparing the intervention for dissemination, it would be worth noting that the uptake of this particular component was minimal, and thus it would likely not hurt intervention outcomes if this component was dropped.

The top middle section of **Figure 1** lists characteristics of intended target settings (e.g., clinics, worksites, schools) that can provide barriers to adoption. Foremost among these are limited resources, staff time, or expertise. Many settings, and especially those that serve the most vulnerable and highest risk populations (e.g., community health centers), find themselves so strapped with competing demands that it is not even possible to find "one minute for prevention" (94, 106). For positive examples of how safety-net settings have been able to overcome these barriers to redesign care that addresses disease management and prevention issues, readers are referred to recent articles on the Bureau of Primary Care Health Disparities program (12). Also, numerous organizational and reimbursement issues create perverse incentives or do not reinforce or "make it easy to do the right thing." Because of these issues, target settings that could potentially adopt a program may not be able to implement the program properly (4).

The top right section of **Figure 1** lists characteristics of research designs that can limit translation. We stress two characteristics that pose major barriers. The first is when small and unrepresentative samples of patients, staff, or settings are included, such that results do not generalize to many other settings. Practitioners often fail to see the relevance of such research to their setting, and thus are unlikely to adopt programs evaluated under such conditions. The field has made major progress in recruiting more women and minority participants over the past two decades. However, many studies still include procedural demands and exclusion criteria (e.g., run-in periods and exclusion of patients with any comorbid conditions or those on medications other than the one being evaluated) that can greatly limit sample generalizability. Attention now needs to be focused on inclusion of more typical settings and intervention personnel (26). Second, studies often fail to address outcomes important to practitioners, patients, community leaders, or policy makers (28, 36, 100), such as intervention costs, cost-effectiveness, or other economic outcomes. Economic analyses are essential to make the business case to potential program adopters. Currently, only a minority of studies include cost-effectiveness analyses or report on bottom-line outcomes, such as impact on quality of life (34). However, the Food and Drug Administration (FDA) has recently announced that it will require drug treatment outcome studies to include quality-of-life assessment. Translation efforts would greatly benefit if nonpharmacologic studies follow suit. The lower section of **Figure 1** refers to interactions among the three categories already discussed. It is often the lack of "fit" between an intervention and a potential setting or a lack of congruence between information provided by a research design and information valued by decision makers that leads to low adoption and implementation levels. One major reason that programs efficacious in controlled studies do not transfer to real-world settings is that the intended target settings do not ever attempt the program because it is not seen as feasible or as having addressed issues crucial to local concerns. Among applied settings that do attempt to institute efficacy-based programs, the most common reason for failure is inadequate implementation of the program in question (4). This failure most often results from a mismatch between the characteristics and resources required by an intervention and those available in applied settings attempting implementation.

The barriers in **Figure 1** are not the only reasons that we do not see more frequent or rapid translation of research into practice, but they are most proximal to program developers and researchers. Other systems and political, economic, social, and value issues also contribute to limited translation of

evidence-based approaches. Foremost among these are inadequate training of practitioners (53); lack of funding for the types of practical trials recommended below; reviews that do not appreciate the difference between efficacy versus effectiveness, replication, and dissemination research (35); and failure to consider the community perspective in developing intervention strategies and study designs.

Community-based participatory research (CBPR) methods offer a means of enhancing the relevance and effectiveness of public health interventions (50, 56, 73). CBPR relies on a collaborative partnership that equitably and actively involves community partners in all aspects of the research process (13, 57, 64, 66). Ideally, the "community" (or work place, school, medical clinic) shares with study investigators a common interest in the selected health or behavioral outcomes, and thus one goal is to engage community partners in an iterative process of data collection, intervention development, and evaluation. The principles of CBPR, as outlined by Israel and colleagues (57), include the following: (*a*) build on strengths and resources within the community; (*b*) integrate knowledge and action for mutual benefit of all partners, which draws attention to local social, cultural, and political issues; (*c*) promote a colearning and empowering process between the research team and community collaborators, which can anticipate and bridge gaps between program design and eventual adoption settings/populations; (*d*) use a cyclical and iterative intervention development and evaluation process that allows integration of new knowledge; (*e*) address health from both positive and ecological perspectives, identifying factors across multiple levels that influence study outcomes; (*f*) disseminate findings and knowledge gained to all partners, so that no one member of the team has "ownership" of the outcome data or its interpretation; and (*g*) facilitate collaborative, equitable involvement of all partners in all phases of the research. Effective CBPR partnerships build expertise and capacity in the community for research and prevention, and thus have significant potential to make a lasting impact, even beyond the particular program at hand.

CONTEXT AND EVIDENCE

To summarize our points thus far, much research fails to translate into practice because the programs and methods used fail to address contextual factors. Second, much research employs a limited and researcher-centric perspective as to what constitutes "evidence." We address contextual factors in more detail below, but note the important observation of L. W. Green (48):

> Where did the field get the idea that evidence of an intervention's efficacy from carefully controlled trials could be generalized as THE best practice for widely varied populations and settings?" (48)

Concepts of Evidence

A challenging and presently unresolved issue concerns the fundamental question of "*what* constitutes evidence and when do we have enough evidence to translate?" Like many public health researchers (9, 10), we think that conceptualizations of evidence need to include, but also go beyond, evidence from tightly controlled randomized clinical trials (11, 15). As the Institute of Medicine (IOM) has concluded, in many areas, such as the childhood obesity crisis, we need to "recommend strategies based on the best available evidence as opposed to waiting for the best possible evidence" (54). In particular, local evidence—including historical and contextual evidence—is also important to consider.

As summarized in **Table 1**, there are many types of evidence, each having its own strengths and limitations, and we recommend evaluations that address the congruence among and integration of different types of evidence. Methods are needed to integrate and synthesize these different types of evidence, including tacit and explicit, quantitative and

Table 1 Types of evidence and associated strengths and weaknesses

Evidence type	General strength	Frequent weakness
Theoretical or mechanism data	Helps to understand how and why treatment works	Are concerns about length of assessments
Feasibility/implementation evidence	Helps to understand delivery issues and adaptations	Requires detailed monitoring and tracking information
Contextual information—e.g., constraints, history, resource availability	Helps in judging applicability and interpretation of other results	Is not clear exactly what is relevant
Intended primary outcome evidence	Is optimal for evaluations of a priori hypotheses	Can be limiting and researcher centric
Unintended or unanticipated outcome results	Is important from systems perspective	May be retrospective and anecdotal
Process or quality-of-care results	Is key concern of policy makers and useful for quality improvement	May not translate to outcomes
"Outcome" or clinical data	Is often important goal of programs	Is only part of the picture
Quality-of-life data and adverse consequences data	Addresses bottom line issues and participant perspective	Requires more questions of participants
Quality improvement data	Encourages refinement and adaptation	Is seen by some as "low quality" or uncontrolled
Marketing and opinion poll data	Is helpful for program design	Can be costly
Surveillance data on trends over time	Presents bottom line, population-based data	Are many potential confounders
Cost and economic data	Is key for decision makers	Can be complex and costly to collect and interpret
Qualitative data	Helps to understand how and why programs work (or do not work)	Are subjectivity, and in some cases, reliability issues
Local data	Assesses applicability	May not be generalizable
Systematic review data	Synthesizes and evaluates "quality" of evidence	Can be overly narrow or restrictive about what is included
Simulation data on project impact	Saves time and can identify important, nonintuitive factors	Can be expensive
Internal validity evidence	Helps determine causality and rule out confounding factors	Can lack relevance, if "decontextualized"
External validity evidence	Is important for translation, decision makers, and practitioners	Can be challenging to collect

qualitative, process and outcome, biological and patient centered, quality improvement and controlled trial, intended and unintended consequences data, internal and external validity, efficacy and feasibility, cost and implementation, and adoption and sustainability evidence. To date, discussion of these issues has tended to degrade into debates of black versus white, one type versus the other, and my evidence is superior to your evidence.

Researchers should utilize mixed methods that combine the strengths of both qualitative and quantitative methods to offset the limitations of each method. For example, Goldman et al. (46) used life history interviewing to elucidate the impact of social, cultural, economic, institutional, and political elements on the lives of working class, diverse adults. The qualitative methods informed both the development of a survey and an intervention

that was designed to address social contextual factors that could impact behavior change. The salient themes that emerged centered on six construct domains: immigration and social status, social support, stress, food, physical activity, and occupational health. Insights gained from thematic analysis of the interviews were integrated throughout intervention, materials development, and evaluation processes. The interventions led to significant changes in health behaviors in working class, multiethnic populations (19, 86). Linnan et al. (68) used a CBPR approach and a detailed process evaluation to determine the feasibility of training cosmetologists to deliver health promotion messages to their customers. Qualitative and quantitative methods assessed satisfaction, readiness to change, and self-reported health behavior changes in customers immediately postintervention and at 12 months. Trained stylists reported they would continue delivering health messages after the 7-week pilot was completed; 81% of customers reported having read educational displays, and 86% of customers talked with their cosmetologist about the target health messages. At 12 months, 55% of customers reported making changes in their health because of the conversations they had with their cosmetologist. Customers who spoke more often with their cosmetologists about health also reported a higher percentage of self-reported behavior changes.

Another exemplary use of mixed methods is the CDC's WISEWOMAN project (103) that first derived quantitative estimates of the factors in the RE-AIM (reach, effectiveness, adoption, implementation, maintenance) model (**http://www.re-aim.org**) to identify sites that were high versus low performing on these factors. Then qualitative interviews were conducted of sites that were strong or weak on these RE-AIM dimensions to understand how and why these results occurred.

Evidence on cost and other economic outcomes would greatly help decision-makers considering adoption of evidence-based interventions, as noted above. Few interventions utilize careful process evaluations that are needed to develop informed cost analyses (95) or to conduct cost-effectiveness analyses (34). A good example in this area is the analysis by Javitz et al. (58) of the return on investment associated with different behavioral and pharmacologic interventions for smoking cessation; this analysis was conducted to provide an employer's perspective on decisions related to coverage of smoking cessation treatment. Sensitivity analyses using different assumptions were used to create a series of pessimistic and optimistic scenarios. The results suggested that employers can receive competitive returns on investment from sponsoring smoking cessation programs and outlined conditions under which different approaches should be considered. Such analyses demonstrate the value of interventions to decision-makers in a metric that they understand and routinely utilize.

Context and External Validity

As there are no set answers to the issue of which evidence is essential, there are no simple answers to the question of when do we have enough evidence to translate. Factors relevant to this decision include contextual issues such as the magnitude and time course of the health issue; the personal, social, and economic costs of the problem; the political will and resources to tackle the issue (59); the robustness, replicability, relevance, and representativeness of the data; the quality and consistency of the evidence; and the cost of inaction despite limited evidence (17).

Public health researchers can do much more to present contextual and external validity evidence that can aid both local decision makers (e.g., individual clinicians, organizations, and patients) and policy-making bodies (e.g., city, state, and federal government; health plans). The decisions these two groups need to make about program adoption are quite different: Local decision makers are interested in whether evidence is relevant and

Table 2 Recommended external validity criteria and questions. Adapted from Green & Glasgow (49)

1. Program reach and sample representativeness
   - A. Target audience: Are the intended end users stated for: (*a*) adoption (e.g., the intended settings such as work sites, medical offices) and (*b*) application (at the individual level)?
   - B. Inclusion and exclusion criteria: Are both (*a*) inclusion criteria and (*b*) exclusion criteria (e.g., run-in period, language, comorbid conditions, other treatments, language, demographic characteristics) reported?
   - C. Participation: Are there analyses of the participation rate among potential (*a*) settings, (*b*) delivery staff, and (*c*) patients (consumers)?
   - D. Representativeness—settings: Are comparisons reported on the similarity of settings participating to the intended target audience of program settings—or to those settings that decline to participate?
   - E. Representativeness—individuals: Are analyses reported on the similarity and differences between patients, consumers, or individuals who participate versus either those who decline or the intended target audience?
2. Program or policy implementation and adaptation
   - A. Consistent implementation ("Fidelity" or well-delineated scope of adaptations): Are data presented on the range of implementation variations of different program components during the evaluation?
   - B. Staff expertise: Are data presented on (*a*) the level of training or experience required to deliver the program and (*b*) quality of implementation by different staff?
   - C. Program customization or adaptation: Is information reported on the ways different settings modified or customized the program to fit their setting (or that no variation was observed)?
3. Outcomes for decision making
   - A. Significance: Are the outcomes compared with either clinical guidelines (and their intended outcomes) or community preventive services guidelines for best practices and their associated public health goals?
   - B. Adverse consequences: Do the outcomes reported include quality of life or potential negative outcomes?
   - C. Moderators: Are there analyses of moderator effects—including (*a*) of different subgroups of participants and (*b*) types of intervention staff or settings—to assess robustness versus specificity of effects?
   - D. Program intensity: Are data reported on either the total amount of staff time or patient contact time required?
   - E. Costs: (*a*) Are data on the costs presented? If so, (*b*) are the assumptions made and perspective adopted (e.g., societal, health care payer, patient) reported?
4. Maintenance and institutionalization
   - A. Long-term effects: Are data reported on longer-term effects, at least 12 months following treatment?
   - B. Institutionalization: Are data reported on the sustainability (or reinvention or evolution) of program implementation at least 12 months after the formal evaluation?
   - C. Attrition: Are data on (*a*) attrition by condition reported, and (*b*) are analyses conducted of the representativeness of those who drop-out or imputation analyses conducted?

will fit their situation. In contrast, policy makers are concerned with the generalizability of evidence—that is, the breadth of conditions across which this evidence will apply.

Despite these different purposes, the types of information needed for these two types of decisions are similar. In particular, better evidence is needed on external validity (33, 49). External validity refers to "inferences about the extent to which a causal relationship holds over variations in persons, settings, treatments, and outcomes" (84). Several reviews have consistently concluded that data are reported far less often on external validity than on internal validity issues (34, 60, 77). **Table 2** summarizes the types of external validity information needed to enhance research translation. Information on the four categories of program reach and representativeness, program or policy implementation and adaptation, outcomes for decision making, and maintenance and institutionalization can and should be integrated into research reports in the same way that CONSORT criteria are now reported routinely (49, 74). For example, Glasgow et al. (40) provide evidence of the effectiveness of a primary care–based diabetes self-management program in the

context of different health care systems, clinicians, delivery procedures, and patient characteristics. In general, they found that the program they evaluated was robust across variations in these factors, possibly because much of the program was automated.

Thus far, we have focused on measures and reporting criteria in discussing the need for greater attention to the context in which programs are delivered. Research design decisions can also either encourage or discourage attention to contextual factors (**Figure 1**) (84). Glasgow et al. (35) argued that the standard drug study model efficacy trial design, although strong on internal validity, is often weak on external validity (and on information concerning contextual factors). To address the imbalance between the large amount of data on efficacy and internal validity, and the miniscule amount of data on the external validity and contextual issues listed in **Table 2**, several authors have recently proposed the use of more practical clinical (36, 100) and behavioral trials (28).

Practical Trials

The purpose of practical trials is to provide information that will make health research more relevant and to aid decision makers at multiple levels to evaluate the applicability and generalizability of research. In contrast with efficacy trials, practical trials have several features that make them more contextual (28, 36, 100). As summarized in **Table 3**, their key characteristics include study of heterogeneous and representative patient samples; multiple and diverse settings; multiple measures relevant to decision makers (including cost and quality of life); and comparison conditions more relevant to real-world decisions (such as current standard of care or alternative programs), instead of no treatment or placebo controls. To enhance generalization and study of the context in which the intervention is being implemented, heterogeneity is encouraged and purposeful, rather than minimized, as is typical in efficacy research (26, 28).

Although practical trials are not necessarily more complex than efficacy trials, they do reflect more of the complexity and context of the real world, especially in terms of participants who may have multiple comorbid conditions and staff who have competing demands and varying levels of expertise. A defining feature of the practical trial is assessment of multiple and relevant outcomes. One of the complexities that can occur with inclusion of

Table 3 Key characteristics of practical clinical and behavioral trials

1. Answer questions of key stakeholders (e.g., clinicians, decision makers, and policy makers).
2. Assess multiple and relevant outcomes including cost, generalization, and quality of life (see **Table 2**).
   a. Behavior change at multiple levels relevant to program (i.e., patient, staff, organization).
   b. Quality of life or potential adverse consequences.
   c. Costs and other economic data (i.e., cost-effectiveness, return on investment).
   d. Implementation data, implementation and outcomes across different intervention staff, and lessons learned regarding delivery, including adaptations made.
   e. Data in metrics or forms related to public health goals (e.g., Healthy People 2010).
   f. Reach (patient level participation and representativeness) and adoption (setting level participation and representativeness).
3. Compare clinically meaningful treatment alternatives using research designs matched to state of knowledge.
4. Recruit a diverse, heterogeneous sample and evaluate robustness across key subgroups.
5. Include multiple, representative settings and interventionists.
6. Issues especially important in practical behavioral and public health trials:
   a. Training: Specify level of training/expertise necessary and amount of training provided.
   b. Address patient preferences.
   c. Provide algorithms for intervention tailoring or intervention manuals.

multiple measures is that differing results across the various measures can occur. Although use of only a single primary (usually biological or risk factor) outcome eliminates this possibility, it also greatly restricts the type and relevance of the outcome data. Measures of cost, implementation, quality of life, and potential adverse or iatrogenic outcomes (such as doing less well on preventive services or diseases not targeted) are especially recommended (26, 33, 49). In general, the most likely types of adverse consequences from health promotion and public health programs are those resulting from time and resource limitations. For example, offering a weight loss intervention may cause both participants and the sponsoring organization to focus less on other types of prevention (e.g., cancer screening, smoking cessation) that may also be important. To our knowledge, however, no evaluations exist that could demonstrate such deleterious impacts of health promotion program, and thus this is an area that should be considered in future work.

We encourage more practical trials (28, 36, 100) that address the context and external validity issues in **Table 2** and hypothesize that increased funding, conduct, and transparent reporting (33, 49) of such trials will greatly enhance translation. We note that such trials are not necessarily larger or more expensive than traditional efficacy studies (36). Through judicious and purposive selection of settings and participants, diversity and representativeness can be achieved. Many of the measures recommended can be completed without additional patient burden by careful tracking of project activities.

In addition to practical trials, both well-designed observational studies and alternative experimental and quasi-experimental designs (84) can contribute important information on external validity and the impact of contextual factors. The increased availability of electronic archival records provides the opportunity for time series–type analyses in real-world settings. Alternative designs such as interrupted time series or multiple baseline across setting designs (36, 84) that emphasize replication can contribute important information on robustness of intervention effects and potential moderating conditions.

CONNECTEDNESS OF INTERVENTION STRATEGIES ACROSS LEVELS OF INFLUENCE

The social-ecological model identifies the importance of addressing interventions to multiple levels of influence (96), although it is rare that the interventions effectively target more than one or two levels. Workplace interventions have perhaps been the exception in that interventions often target individual, interpersonal, organizational, and environmental factors (20, 88). Interest in the social-ecological model has resurged because it is increasingly being recognized that behavior change is complex, has multiple social-environmental determinants, and requires long-term emphasis on multiple levels (82, 85, 87). A recent example in the diabetes self-management area is the resources and supports for self-management model of Fisher and colleagues, which integrates primary care and community resources supports for diabetes self-care (24). We must begin to think more systematically about how to connect intervention efforts across levels and to link program activities to produce a more sustained, comprehensive approach. The discussion above related to shifting from an intensive approach to a more extensive strategy is one way to think about this and to reduce costs while still maintaining intervention effects.

With a particular focus on the health care environment, two intervention models have received considerable attention: the 5 A's model (**Figure 2**), which was developed to increase health care provider's involvement in behavior change counseling, and the chronic care model. These models provide a jumping-off point for thinking about how to increase connectedness among intervention levels and components.

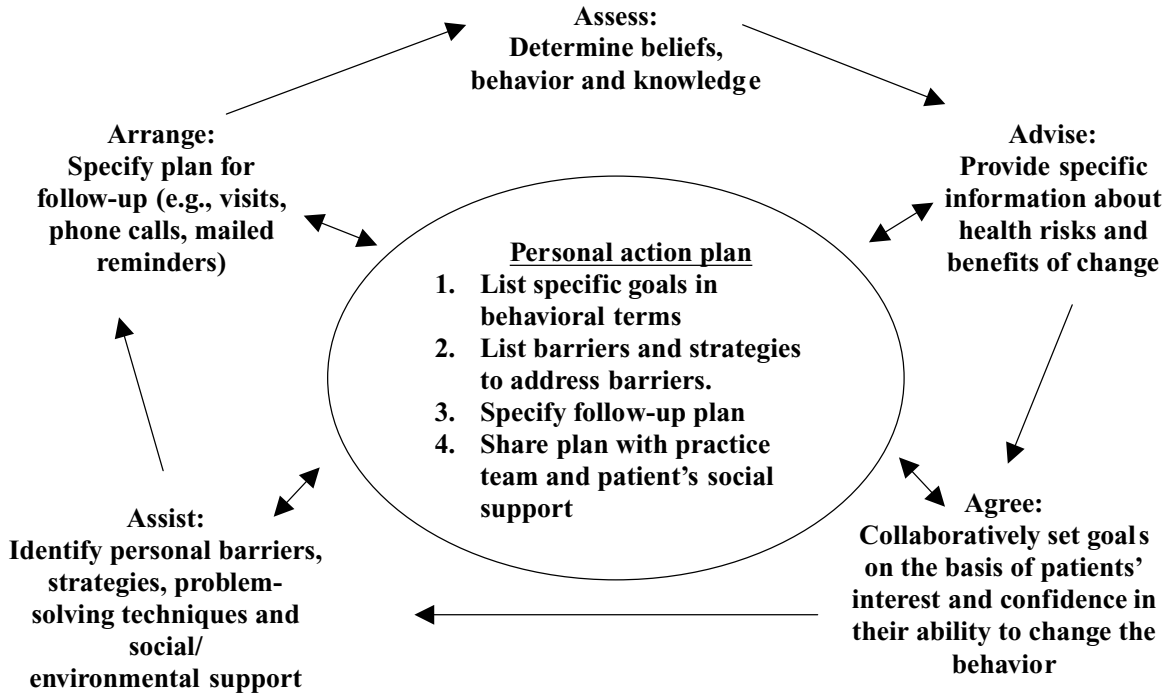

Figure 2

The 5 A's of behavior change counseling.

The 5 A's Model

To increase the adoption of smoking cessation counseling among practitioners, the 5 A's model was developed to guide physicians in counseling their patients to quit smoking (29, 45, 102). The 5 A's model guides clinicians through steps in behavior change counseling, with each "A" corresponding to a brief behavioral intervention strategy—assess, advise, agree, assist, arrange (31)—which together have been effective. This conceptualization of the 5 A's is slightly different from the original 5 A's smoking cessation model. Our model in **Figure 2** follows recommendations of Whitlock et al. (31, 102). This model has also been generalized to address multiple settings, behaviors, and behavior change levels (32, 47) and emphasizes the importance of collaborative goal setting (Agree). It can be integrated easily with self-management models and concepts of patient empowerment (1, 70) and motivational interviewing (18, 80), which promote collaborative goal setting (Agree) and identification of specific behaviors to be adopted or changed (Advise). Emphasis is placed on patient choice and the importance of individual relevance. In particular, successful behavior change programs encourage patients to identify barriers that may impede goal accomplishment and strategies or action plans (42, 69) for avoiding or overcoming these barriers (Assist). Follow-up support (Arrange) is also a key component of encouraging long-term maintenance of health behaviors.

Although substantial evidence demonstrates the utility of the 5 A's model, some evidence also indicates that most health care settings have difficulty finding the time to implement it routinely in the context of current 10–15-min, one-on-one patient-physician interactions (75, 97, 98). Because of the key

need to develop evidence-based, effective interventions that are sustainable, low cost, scalable, and consistently delivered, interactive computer technologies based on the 5 A's model may help to address barriers to adoption and implementation of behavior change programs in health care (and other) settings (27, 104). An Internet-driven self-management program can quickly perform assessments of a variety of domains (e.g., diet, smoking, and physical activity) and provide immediate feedback to both the patient and health care team. Such a program can ensure that a consistent, high-quality message is delivered to patients, inform patient-provider interactions, and maximize staffing efficiencies. Interactive technologies can also address a wide variety of health behavior domains simultaneously (27). Thus, interactive technology can provide a streamlined, consistent method for conducting many aspects of evidence-based behavior change counseling, including assessing current health behaviors, identifying barriers to change, allowing the patient to set goals and select relevant activities, and arranging follow-up support in a coordinated manner.

Studies of the 5 A's implementation across a variety of settings consistently show that the fourth and fifth "A"—assist and arrange—are implemented much less frequently and consistently than are the other A's (30). This provides an important opportunity to connect health care settings with public health services and community resources that are frequently better able to deliver these last two A's. For example, in Massachusetts providers can assist patients by referring them to QuitWorks, a state-sponsored smoking cessation quit line, but still follow up with the patient to offer support and track patient progress (arrange). As part of its recent legislated efforts on health care insurance reform, Massachusetts is also launching a smoking cessation pilot program that will provide free pharmacotherapy and extensive individual and group counseling to low-income smokers. In many cities, similar resources can be utilized across a range of health behaviors. For example, the Boston Public Health Commission sponsors Boston Steps, a CDC-funded community mobilization effort to increase physical activity. This program provides walking kits and sponsors physical activity events in communities throughout metro Boston. Neighbor Walk, a key component of STEPS, supports and evaluates community-based walking groups. There are nearly 50 active walking groups throughout the city, some of which are based at community health centers that provide easy opportunity for linkages with the health care system. The fifth "A" can be accomplished by arranging follow-up support through connecting patients with community resources of their preference that can provide ongoing support.

The Chronic Care Model

Theory and experience with quality improvement in health care delivery settings demonstrate that providing effective behavior change counseling in this context requires innovative changes in the process of care delivery. Such changes must consider all the steps needed for delivery of preventive care and include the various participants involved in those steps (e.g., the medical receptionist who might ensure that follow-up visits are scheduled; physician and nonphysician team members involved in patient education, counseling, and support for change) (76). The chronic care model (CCM) from Wagner et al. (9, 101) is an integrative approach to care delivery developed to provide optimal care for adults with chronic conditions (79). This model identifies the essential elements of a health care system that delivers high-quality care of patients with chronic conditions (79): health system and organizational support, self-management support, delivery system design, decision support, clinical information systems, and integration with community resources (**Figure 3**). Evidence-based change concepts under each element foster productive interactions between informed, "activated"

patients (52) and families who collaborate in their care with providers who have resources and expertise. The CCM is appropriate for preventive as well as therapeutic interventions (38).

Implementation of the CCM requires connectedness across different levels within and often outside the health care system. It first requires delivery system design to support chronic disease management and prevention, which typically means changing the structure of practice to optimize behavioral and health outcomes. Practice teams might include secretaries, medical assistants, registered nurses, advanced practice clinicians, and physicians. The goal of practice restructuring is to improve the quality of management/prevention of chronic conditions while maintaining practice efficiency. This typically means redefining roles of team members so that physicians do more acute and same-day care of patients, freeing advanced practice clinicians and other staff to provide more chronic care, which is more cost-effective than having a physician providing such care. Other team members contribute by conducting assessments and follow-ups needed for chronic care delivery (e.g., blood pressure assessment and tracking; scheduling of follow-up visits). MDs are trained to give very brief endorsements of the importance of the intervention and the specific goals that the patient has set. Utilizing the MD in this way maximizes efficiency because it takes little time but capitalizes on the fact that patients value, and find highly credible advice coming from, the physician.

Delivery system design and decision support involve changing behaviors of practitioners, who can in turn support patient behavior change efforts. Efforts must be made to build providers' skills for assisting in behavior change management and to provide multiple and positive reinforcement of efforts, as well as reminders and feedback on results (14, 17, 89, 93). Promising results have been achieved in randomized trials of "academic detailing" (2, 83, 89). The principles of this method (91) include understanding clinician behavior; use of succinct, high-quality graphical materials; sponsorship by authoritative and credible organizations; and presentation and discussion of barriers and counterarguments (3, 6, 83). More recently, controlled trials have noted success with expanding from individual to small-group sessions (47, 101). Such "group detailing" has the advantage of encouraging discussions within a group of clinicians practicing together in a practice or network (92). Another delivery system design strategy for which there are increasingly strong data is conducting primary care in group medical visits for patients having similar chronic conditions (5, 99). Providing care in this way allows patients to learn from other peers as well as from health care professionals. Finally, support from information systems is critical in implementing the CCM because systems interventions are much more effective and efficient when technological systems, such as user-friendly electronic health records or patient registries, are in place to organize, inform, support, and manage them.

The CCM emphasizes the importance of providing self-management support to patients. This can occur through regular appointments, additional visits scheduled to support specific behavior change efforts, telephone support, and provision of written or interactive behavior change programs. Ideally, self-management approaches utilize evidence-based strategies, adapted for one's specific target population and setting. If self-management support is delivered outside the office setting, it needs to be linked back to and integrated with what the health care team is doing (29).

Finally, the CCM includes reinforcement of behavior change through coordination with community resources, such as those described above for use with the 5 A's model. Recent data indicate that although many interventions acknowledge the importance of community resources, such resources are rarely integrated into interventions based in health care settings (30, 44). Use of community activities partially

mediates intervention success for enhancing both dietary and physical activity behaviors (43). One effort to address the need to integrate community resources has focused on the identification and measurement of such support. The Chronic Illness Resources Survey (CIRS) (41, 43) identifies levels and types of social environmental resources currently used by individuals, and those resources that they feel would be the most helpful at the family, friend, neighborhood, work/school, and organizational levels. Through this kind of analysis, it is possible within an individual-level intervention that we can start to identify and integrate important multilevel resources that can support long-term behavior change. Riley et al. (78) found use of the CIRS to enhance both behavior change and utilization of community resources in a study of Latino patients in a community health center.

CONCLUSIONS, RECOMMENDATIONS, AND FUTURE DIRECTIONS

The individual components of the CCM and the 5 A's, although each important, are much more successful when integrated and delivered in coordinated ways that reinforce the other channels, as opposed to these activities happening in separate "silos" of unrelated activities, as often happens in large systems. The same is true of most other complex interventions and multifaceted programs, such as multilevel social ecological interventions, work site occupational health and health-promotion programs (88), and community-based and multiple–risk factor programs (47).

A simplified view of how of these concepts of context and connectedness can be combined and integrated into a coherent model for coordinating patient self-management,

Figure 4

Integrated self-management support.

Table 4 Summary recommendations to enhance integration of research and practice

1. Anticipate and address likely barriers to dissemination.
2. Appreciate and integrate multiple types of evidence.
3. Adopt research designs, such as practical clinical and behavioral trials and multiple baseline across settings, that address concerns of clinicians and policy makers.
4. Conduct broader evaluations that include multiple outcomes, address generalizability, and report on contextual factors.
5. Design multilevel programs using systems and social/ecological models that attend to "connectedness" and integration across program components and levels.
6. Do not expect a program to work perfectly initially, but plan for adaptation and refinement to fit local conditions and emerging issues.

medical care support, and community resources to support healthy lifestyle options is shown in **Figure 4**. A key concept from systems thinking (A. Best, submitted manuscript) relevant here is that the input into any one part of the system also produces other, often unintended and "nonlinear" consequences in other parts of the system. Another key concept is that actions are specifically needed to connect the various program components so that they do in fact operate to support and reinforce each other. Space limitations preclude detailed discussions of the implications of systems models, but one important inference is that it is possible to overstructure or have protocols that are too rigid for practice change. Second, consistent with many quality improvement approaches (7, 65), successful program improvements are best achieved via a series of successive approximations, and trials, rather than expecting an initial protocol to be implemented without change. Interested readers are referred to key papers and texts such as Gharajedaghi (25), on using systems thinking to manage chaos and complexity, and the March 2006 issue of the *American Journal of Public Health*, devoted to systems approaches in public health. Best et al. (A. Best, submitted manuscript) presents a strong argument that such systems thinking is beginning to be used more widely and is currently necessary to help accelerate the translation of research to practice.

In conclusion, and as summarized in **Table 4**, to enhance integration of research and practice, we need to change how we perform research program development, evaluation, and reporting. If health researchers can develop and evaluate programs with greater attention to context and external validity (**Table 2**) and in partnership with relevant decision makers and target audiences, it will be much easier for both local practitioners and policy makers to judge program relevance (61, 62). This is only one of the many strategies needed to increase translation of evidence-based interventions, but it is a critical component and an excellent starting point.

In particular, we recommend greater use of practical trials (**Table 3**) and other designs that address the barriers to dissemination in **Figure 1**. Social-ecological and systems thinking offer important and promising conceptual models for translation research, and greater attention needs to be devoted to how various program components connect to each other. Attention to these issues of context and connectedness will help to create a more relevant and useful science of dissemination.

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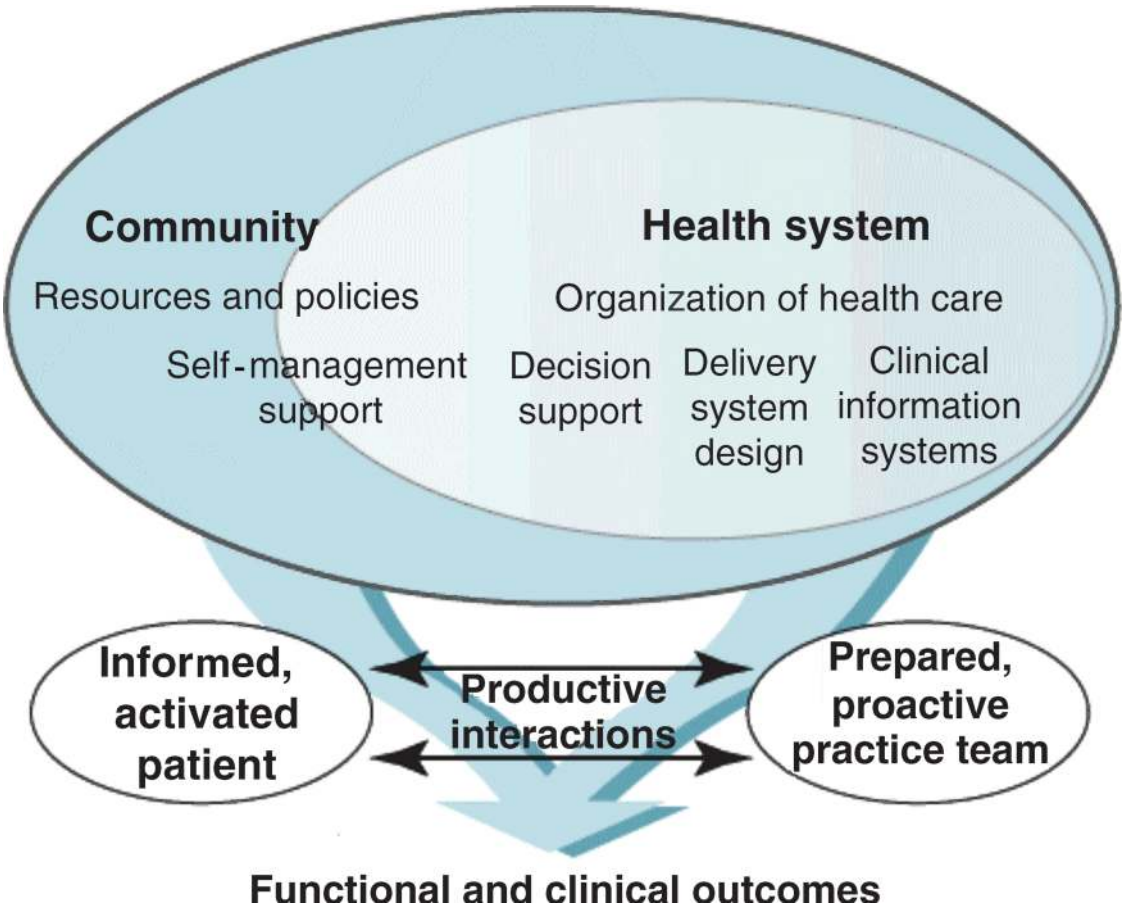

Figure 3

The chronic care model.

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