

RE-AIM: Evidence-Based Standards and a Web Resource to Improve Translation of Research Into Practice

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ABSTRACT

Background: Health services data indicate that under present conditions evidence-based medical and preventive practices are not consistently implemented in clinical practice and affect the quality of care provided to patients. Operating with similar conditions and resources, it is unlikely that evidence-based behavioral medicine (EBBM) practices will be more successfully implemented. **Purpose:** In this article we propose ways to help improve the implementation of EBBM practice. **Methods:** This article describes the RE-AIM (Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance) framework that is available on a free-use Web site (<http://www.re-aim.org>), which offers practical research translation tools, resources, and support for program planners, community leaders, and researchers. The material located at www.re-aim.org can be used to help anticipate and overcome likely barriers to dissemination and to estimate eventual public health impact. **Results:** Data on Web site utilization and lessons learned thus far in its implementation are presented. **Conclusions:** Scientists and public health leaders should devote greater attention to reporting practice-oriented issues such as generalizability, breadth of application, and pragmatic and setting or contextual issues in addition to the current focus on internal validity issues. We hope that this and similar efforts will assist EBBM interventions to have broader applications, be consistently implemented, and be sustained.

(Ann Behav Med 2004, 28(2):75–80)

We have been supported for this work and the development of <http://www.re-aim.org> by a grant from the Robert Wood Johnson Foundation.

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INTRODUCTION

Behavioral risk factors have been recognized as predictors of cardiovascular disease since the Framingham Heart Study in the early 1960s (1). However, despite 4 decades of behavioral research on “what works” to change lifestyle practices that create risk and protection for disease (2,3), we are faced with a lack of generalizable, effective, and sustainable interventions that have been translated into health promotion practice (4,5). Methods to improve the translation and dissemination of interventions into practice would greatly improve the public health burden related to behavioral risk factors.

The Committee on the Quality of Health Care in America, Institute of Medicine has reported that a similarly large gap between research and practice exists within all of health care (6). In their report titled, “Crossing the Quality Chasm,” they concluded that “critical steps must be taken to support evidence-based practice, including making evidence more useful and accessible to support the clinical decisions of clinicians and patients, and constructing quality measures for improvement and accountability” (p. 35). A recent report by McGlynn et al. (7) documented in a nationally representative sample that, on average, patients in the United States receive only approximately one half of recommended “best practices” and that this is true across acute and chronic care and preventive services, with only one exception: Education and counseling (also known as behavioral interventions) on health recommendations and guidelines were implemented only approximately 10% of the time—far less than for guidelines on any other service or condition (7). Similar to the challenges for evidence-based medicine (EBM), evidence-based behavioral medicine (EBBM) has the challenge to come to consensus on the criteria and standards by which to evaluate behavioral medicine intervention program research results to increase their adoption and impact in the practice arena. Consensus statements evaluating programs based on these criteria then need to be dispersed and promoted to practitioners, scientists,

journal editors, and policymakers to implement change. In this article, we (a) argue that EBBM can best move forward by demonstrating an equal emphasis on internal and external validity, (b) propose RE-AIM as a planning and reporting framework that balances internal and external validity, and (c) overview a related Web site (<http://www.re-aim.org>) designed to help clinicians and researchers select and evaluate interventions that have strong potential for translation to have public health impact (8).

Within behavioral medicine research, inconsistent reporting of key elements for translation and dissemination was found (9–12). A systematic review of published studies of behavioral interventions for smoking cessation, dietary change, or physical activity conducted in health care settings, workplaces, schools, and communities was recently reported by our group (5). Although internal validity information was reported very consistently, studies did not consistently report the representativeness of participants versus nonparticipants: Only 16% of the studies reported any information on the rate of program adoption at the setting level (in contrast to 76% reporting program participation at the individual level), and only 2% reported any information on the representativeness of these settings; these findings were consistent across settings and target behaviors. Based on these data, we concluded that (a) there were few data on the application of behavioral medicine approaches in representative real-world settings, and (b) research reports focus predominantly on internal validity issues to the neglect of external validity concerns. This review reached similar conclusions as others in the field (13). This body of work presents a compelling opportunity to behavioral medicine, namely, to address the disparity between the higher frequency and greater extent to which internal validity issues are reported and the lack of practice-oriented issues such as generalizability, breadth of application, and pragmatic and setting or contextual issues. Although increased reporting of external validity issues will not likely solve the lack of translation of research to practice by itself, including such data would be an important step forward.

One way to balance both internal and external validity in the planning, design, and evaluation of health behavior promotion interventions is to use the RE-AIM framework (5). The RE-AIM acronym represents Reach, Efficacy/Effectiveness (depending on research goal), Adoption, Implementation, and Maintenance (8). Individual-level indicators within RE-AIM include reach and efficacy. Setting levels of impact include adoption and implementation. Maintenance is assessed at both an individual and setting level of impact. Each element of the RE-AIM framework provides valuable independent information that may facilitate the translation of research to practice (see Table 1).

A major shift in focus by balancing internal and external validity concerns could redirect the way that behavioral medicine research is currently conducted and reported (4,5,13) and may improve the potential evidence base available to disseminate quality interventions. EBBM has the opportunity to model exemplary methods and test approaches that respond to the ideal of EBM—that research informs practice. EBBM can take the best of what EBM approaches have offered and augment them with experience from health promotion and behavior change to focus our efforts on the potential for translation.

RE-AIM ONLINE TO SUPPORT EBBM

To address these goals, the remainder of this article discusses the purpose, design, tools, and resources available on a Web site (<http://www.re-aim.org>) created to further EBBM and translation research. The Web site is designed around the RE-AIM framework and is intended to help researchers and practitioners develop, evaluate, and select interventions that have a high likelihood of being successfully adopted, implemented, and sustained in real-world settings.

The following fictitious example illustrates how the RE-AIM Web site can be used in the planning and reporting of a health behavior intervention study. A funding agency released a request for applications (RFA) that sought studies testing the ef-

TABLE 1
Definition of RE-AIM Dimensions

<i>Dimension</i>	<i>Definition</i>
Reach (individual level)	What percentage of potentially eligible participants (a) were excluded, (b) took part, and (c) how representative were they?
Efficacy/Effectiveness (individual level)	What impact did the intervention have on (a) all participants who began the program, (b) on process intermediate and primary outcomes, and (c) on both positive and negative (unintended), outcomes including quality of life?
Adoption (setting/agent level)	What percentage of settings and intervention agents within these settings (e.g., schools/educators, medical offices/physicians) (a) were excluded, (b) participated, and (c) how representative were they?
Implementation (setting/agent level)	To what extent were the various intervention components delivered as intended (in the protocol), especially when conducted by different (nonresearch) staff members in applied settings?
Maintenance	
Setting	The extent to which a program or policy becomes institutionalized or part of the routine organizational practices and policies.
Individual	The long-term effects of a program on outcomes after 6 or more months after the most recent intervention contact.

fectiveness of an intervention that promoted nutrition and physical activity to prevent obesity among adults. The evaluation criteria for the quality of applications included an assessment of the likelihood that the intervention could be translated into hospital-based wellness center practice. The investigator team immediately turned to a statistician who determined that 400 participants were necessary to have enough statistical power to conduct the study. Because the RFA's criteria included the importance of translation, the team accessed www.re-aim.org to plan their study.

The team was very determined to evaluate the intervention's reach in addition to efficacy. The team accessed the reach Web page, which directed them to identify a representative target audience from which to recruit. Because the team worked in a medical center that had a fitness center offering prevention services, they decided to define their population according to a geographic catchment area—all adults living within four census tracts near the hospital. They used the Web site www.census.gov to determine that their target population was 16,000 individuals living in this geographic area.

Because the RFA offered significant resources to complete the project, they estimated that they could afford to conduct a representative recruitment strategy where they contacted 4,000 of these individuals through random digit-dial telephone recruitment. Of the 4,000 exposed to recruitment, they were confident that 700 would respond with enough interest to determine eligibility. Based on their exclusion criteria, they were very confident that 500 would be eligible and 400 would participate (given the incentives they would provide, such as free day care and a free fitness center membership).

The team was initially very excited: "We can do it," they exclaimed. "We can propose to recruit 500 participants and we will be able to report that 80% who were eligible participated in the study." The investigator accessing www.re-aim.org paused. "But the reach calculator says that we only REACHED 2.5% of our target population." The fitness center's registered dietician finally made a comment after listening intently to this discussion. "Reaching only 2.5% doesn't seem to me to be a cost-effective way to have public health impact, even if we were actually successful in implementing the program and attaining behavior change in more than half of these individuals." The point of this fictitious exercise is not to induce pessimism but (a) to illustrate the need to attend to the reach dimension—not just to effectiveness of change or to effect size—when selecting interventions for translation, and (b) to demonstrate that if researchers were able to improve the reach of interventions, the resultant public health benefits could be dramatically increased. To date, the vast majority of health behavior research has focused on efficacy, largely ignoring reach and the other RE-AIM dimensions.

The purposes of the RE-AIM Web site (www.re-aim.org) are (a) to develop a network of, and provide resources for, research scientists and community leaders who collaborate on the development and communication of evidence-based best practice guidelines, and (b) to promote evaluation methods for behavioral medicine interventions that are intended for dissemina-

tion and broad application—important goals of EBBM intervention research. The Web site also provides tools and resources to understand, use, and communicate the RE-AIM criteria that can support EBBM efforts. The Web site provides a publication and presentation library of references, abstracts, and PowerPoint® talks that provide examples of using RE-AIM program evaluation and reporting standards. The intent is that the Web site will evolve into a forum for sharing behavioral change translational research and program evaluation designs and reports that contain information on external validity, and to serve as a repository for such documents.

Central to the Web site's objective is that both research scientists and community leaders consider the RE-AIM dimensions (see Table 1) in the design, reporting, and communication of health behavior interventions outcomes. To meet this objective, a welcome page provides an introductory home for all users of the RE-AIM site. The welcome page links directly to a message board. This page also links to the publication repository that includes references, abstracts of available publications, and downloadable Power Point™ presentations. Although at this time the publication library currently includes work primarily by the development team, the intent is for the publication page to increasingly include materials submitted by diverse users.

To ease navigation through the site, every page includes a link to the site map (see Figure 1), "what's new," and a search engine page. Following a social marketing approach, the issues relevant to two target user audiences organize the paths through the site: people conducting research (researchers) or people delivering health behavior interventions in community and health care settings (clinicians and community leaders). On the welcome page, the user is directed to choose one of these two paths through the site.

The researcher path introductory page includes a definition of the RE-AIM framework and links to information on and examples of each of the model's components: Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance. We are developing interactive calculators for each dimension; for example, a calculator (www.re-aim.org/2003/calculate-reach.html) to determine the reach of an intervention that allows the user to input values for the target population—the recruited population and potential participants excluded by the investigator; the eligible population, those who participate, is currently available. The calculator can be used to teach the reach concept, set recruiting goals, and aid in calculating reach values for reports. In the initial release of the site, the inputs and outputs for the calculator cannot be saved. However, we intend to further develop the calculators so they will collect data, provide feedback, and allow users to share process evaluation data and compare their results to others.

In addition to providing resources and tools for each RE-AIM dimension, the researcher path also links to a "tools and resources" page that includes checklists, measures, calculations, figures and tables, and links. The researcher page also links to a frequently asked questions page that includes basic questions, breadth of application questions, support and evidence questions, and implementing RE-AIM questions.

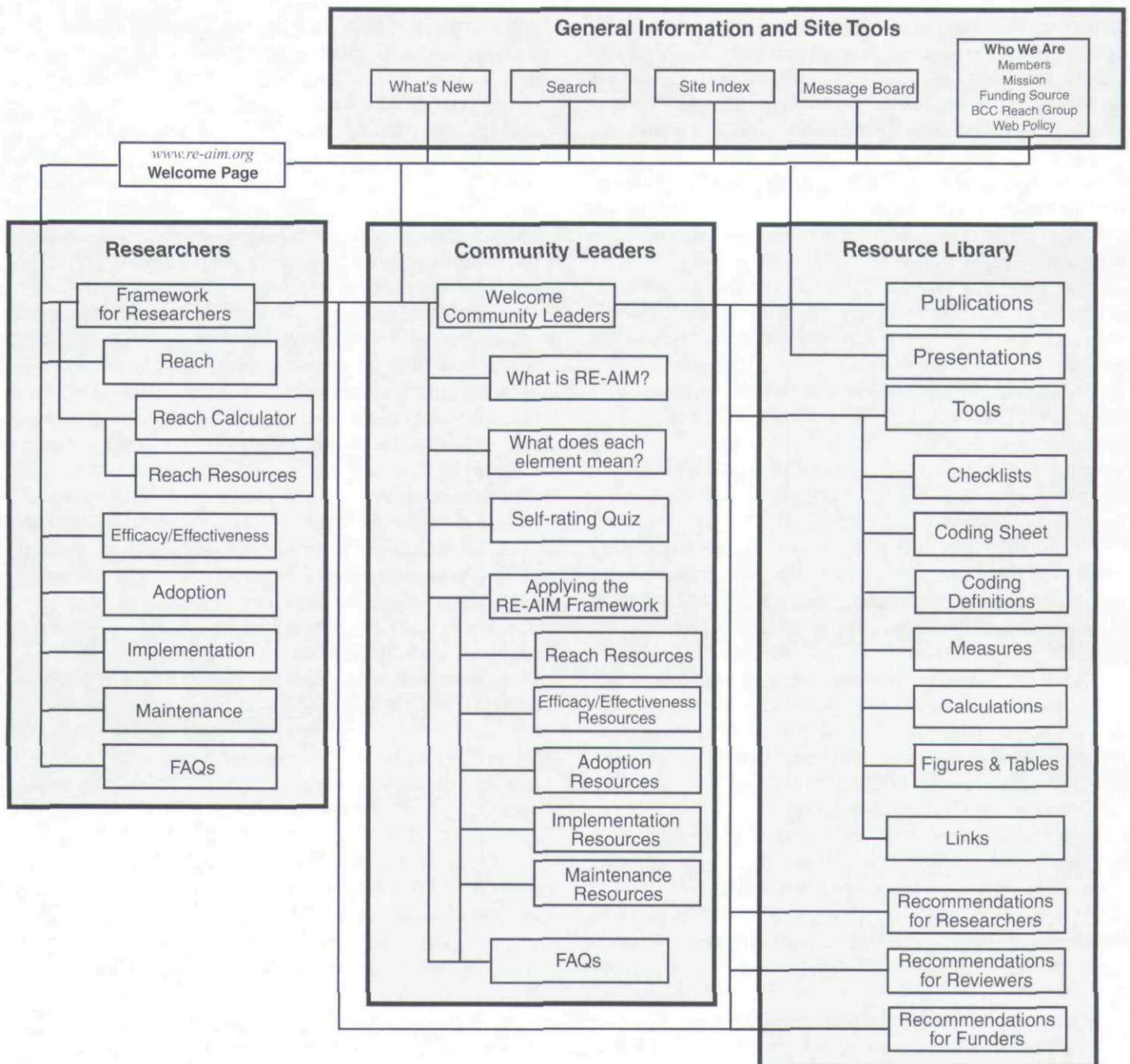


FIGURE 1 Site map of www.re-aim.org.

Users that choose the community leader path go from the welcome page to a page that describes why planning, design, and evaluation using the RE-AIM framework are important in EBBM. To stimulate interest, the community leader introductory page has a RE-AIM self-rating quiz that assesses the leader's confidence to implement evidence-based health behavior interventions (www.re-aim.org/2003/quiz.html). The goal of the interactive quiz is to have community leaders begin thinking about each of the dimensions in their planning and reporting. Then, users are directed to attend to the dimensions for which they need assistance to improve program implementation; users are referred to relevant pages that define the dimensions and

provide further developmental resources and a menu of suggestions. In contrast to the researcher path, there is less emphasis on research and evaluation of studies and more emphasis on practical issues of implementation.

Web Site Use

Since the initial release of www.re-aim.org, in the 1st year the site has had over 250,000 hits. Descriptive data on the hit use of the Web site was tracked using WebTrends® software (NetIQ Corp., San Jose, CA). Over the initial developmental period, use of the Web site has gradually increased. Figure 2 illustrates that

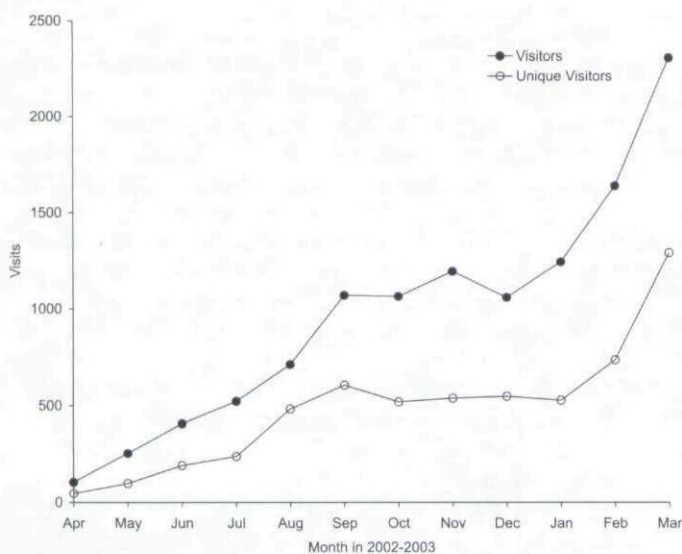


FIGURE 2 Number of visitors each month to www.re-aim.org for 12 months from 2002 to 2003.

visits to the site increased from approximately 100 in the 1st month to more than 2,300 in the 12th month (March 2003). The number of unique visitors also increased from approximately 50 during the 1st month to almost 1,300 in the 12th month. The WebTrends report identifies the IP address and domain name of each visitor, and it identifies the visitor's relative activity level on the site. Because we did not use cookies to track visits, this measure of site use cannot differentiate between hits from different visitors with the same IP address. There have been visitors from more than 20 countries and more than 20 states in the United States. The most frequently visited pages on the Web site in the first 3 months of 2003 have been the welcome page (www.re-aim.org), the community leader page (www.re-aim.org/2003/commleader.html), the message board (<http://www.re-aim.org/bbs.html>), who we are (<http://www.re-aim.org/2003/whoware.html>), and RE-AIM: Publications and Presentations (<http://www.re-aim.org/2003/publications1.html>).

The development plan for the RE-AIM Web site is following an iterative quality improvement cycle, whereby tools and resources are developed, piloted with each target audience, and then modified to meet their needs based on user experience and feedback. The researcher page has been developed based on feedback from the National Institutes of Health Behavior Change Consortium (14,15). The community leader path is being developed in collaboration with The Robert Wood Johnson Foundation, National Program Office of Active For Life™ (www.activeforlife.info) initiative and their community grantees. The Active for Life grantees are implementing behavioral-based lifestyle interventions in community settings that have been shown to improve the physical activity of older adults in efficacy trials. The Active for Life program is one example of how EBBM can be put into community practice by examining factors in the adoption, adaptation, sustainability, and replicability of evidence-based interventions.

DISCUSSION AND FUTURE DIRECTIONS

Discrepancy between EBM guidelines and the poor delivery of health care in practice for both chronic illness and preventive services has been labeled a "quality chasm" by the Institute of Medicine and other reviewers (6,7). We conclude that EBBM has the benefit of learning from these lessons and might attempt to avoid the current quality chasm in medical research and EBM. In particular, researchers and practitioners interacting much earlier in the research process might enhance the practicality of recommendations (16). Significant progress toward bridging the EBBM research-practice chasm could be made by alerting all constituents, including researchers, community leaders, clinicians, administrative decision makers, consumers, funders, and policymakers, to the idea of mutual responsibility for dissemination. This commitment would allow a focus on "end users" and dissemination at all phases of the research spectrum from initial discovery, refinement and further development of interventions, and their delivery into practice (4). An example of this strategy was the Designing for Dissemination Conference, where researchers, practitioners, and intermediaries were brought together to form recommendations on how to overcome the barriers to adoption of evidence-based interventions (17).

The goal of the RE-AIM Web-based resource is to provide helpful information to both researchers and practitioners who are interested in designing and evaluating practical and sustainable EBBM programs. As discussed in Glasgow, Lichtenstein, and Marcus (4), we recommend that the excellent set of methodological reporting criteria currently included in the widely used Consolidated Standards of Reporting Trials (CONSORT) criteria (18) include 7 additional items that focus on external validity (in addition to the 23 items that currently focus on internal validity). These items would include the following:

1. State the target population to which the study intends to generalize.
2. Report the rate of exclusions, the participation rate among those eligible, and the representativeness of participants.
3. Report on methods of recruiting study settings, including exclusion rate, participation rate among those approached, and representativeness of settings.
4. Describe the participation rate and characteristics of those delivering the intervention. State the population of *intervention agents* that one would see eventually implementing the program and how the study interventionists compare to those who will eventually deliver the intervention.
5. Report the extent to which different components of the intervention are delivered (by different intervention agents) as intended in the protocol.
6. Report specific amounts of time, costs, or both, required to deliver the intervention.
7. Report on organizational level of continuance, discontinuance, or adaptation in modified form of the intervention once the trial is completed, as well as individual-level maintenance of results.

Other Web-based resources address related issues, albeit with different foci, and can support EBBM efforts. In particular, the recently launched Web site (cancercontrolplanet.cancer.gov) hosted by the National Cancer Institute is a repository for evidence-based cancer prevention and control interventions. Given their missions to broadly disseminate cost-effective health care applications, several state health departments and the national Centers for Disease Control and Prevention (www.cdc.gov) also have useful information related to research translation on their Web sites. To our knowledge, however, www.re-aim.org is the only Web site focused on translation and dissemination issues that is based on a specific, comprehensive conceptual framework that attempts to target researchers, practitioners, and program developers and that provides interactive assessment tools.

Future directions for RE-AIM, which will be informed by Web site usage and feedback, will likely include partnering with other projects or organizations attempting to promote practical, community-based EBBM interventions and periodically evaluating the impact and helpfulness of www.re-aim.org. We also hope to interact with policymakers and other bodies such as those responsible for the CONSORT criteria (www.consort-statement.org [16]) and the Cochrane databases (www.cochrane.us) to develop a dialog concerning inclusion of more criteria related to external validity.

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